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User Manual

Denomination:

IR-NE-3

Gas Concentration Measuring

Infrared Transmitter

Gas monitoring system manufacture and sales

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CONTENTS

1. PURPOSE

Measurement of concentrations of carbon dioxide, carbon monoxide, nitrogen dioxide, nitrous oxide, sulfur dioxide, and low-carbon-number hydrocarbons (which are either gaseous or liquid at the given ambient temperature but easily vaporized) and transmission of measurement results to signal processing equipment.

2. MAIN FEATURES

→ *Robust design suitable for installation in industrial environments*

→ *Versions available for free air stream or piped sampling*

→ *Reliable infrared measurement principle*

→ *Selective measurement of detectable substances*

→ *Even concentrations significantly exceeding the measurement range do not cause damage*

→ *No oxygen required for operation*

→ *Not affected by toxic substances that would render other sensors insensitive*

→ *4…20 mA analog and RS485 digital MODBUS/RTU protocol outputs*

→ *Extended operating temperature range, temperature measurement and temperature-compensated operation*

→ *Can be configured and adjusted using a computer without disassembly*

→ *No frequent maintenance required, unlike transmitters with other measuring principles, under non-extreme operating conditions*

→ *Hungarian product, easily accessible service*

3. CONSTRUCTION AND OPERATION

The transmitter is a device with a simple mechanical structure built into a plastic casing. The casing is equipped with a gas inlet component and a cable inlet, and a mounting plate is also screwed onto it to aid installation.

The gaseous substance enters the transmitter through the two gas inlet component, where its concentration is measured. The gas inlet components also contains a filters that allows the gaseous substance to pass through but prevents contamination of the sensitive internal parts of the transmitter. There are two types of gas inlet components. Either the concentration of gases mixed into the air in the vicinity of the transmitter can be measured without any additional equipment, with free air flow, or the measurement can be performed on gaseous substance sampled elsewhere and fed to the transmitter through a pipe. In the sampling method, the gas inlet component is equipped with two-two connection stubs to which the pipes carrying the medium can be connected.

The cable required for the appropriate electrical connection can be fed into the transmitter through a cable gland; no other junction box is required. Inside, the wires are connected to spring-loaded terminal blocks.

With the help of the mounting plate, the transmitter can be easily mounted on a flat surface so that the gas inlet component is always in the correct position.

The transmitter belongs to the group of gas concentration measuring devices that operate on the principle of light absorption. Its operation is based on the fact that certain gaseous substances exhibit absorption properties in the infrared range. The degree of absorption is related to the concentration. It operates without chemical reactions, and the sensitive components required for measurement do not come into direct contact with the substance to be measured.

For measurement purposes, an infrared radiation source and a sensor are placed at a certain distance from each other in the transmitter. Absorption occurs between these two points. The concentration, i.e. the absorption, influences the intensity of the infrared radiation reaching the sensor. The sensor provides an electrical signal proportional to the intensity of the infrared radiation. From this signal, processor-controlled electronics calculate and transmit the measured gas concentration value to other signal processing devices. The measurement results are transmitted in the form of standard analog and digital signals.

Since different substances produce absorption in different bands, the transmitter is able to selectively measure the concentration of the substance to be measured by operating in the absorption band characteristic of that stubstances.

4. INSTALLATION

4.1. Conditions

The transmitter may only be installed in locations that fully comply with the requirements specified in the technical parameters of the device. The transmitter must not be exposed to ambient temperatures lower or higher than those permitted, radiant heat, or pressures that exceed the permitted limits. When selecting the installation location, avoid areas prone to water dripping or splashing, and if the transmitter is installed in a room that is cleaned with a water jet, the gas inlets opening of the transmitter must be protected against this effect. In addition, the installation location must be chosen so that the transmitter is accessible for commissioning and subsequent maintenance.

4.2. Placement

The appropriate placement of the transmitter within a given facility is usually specified in the design documentation, which takes into account the requirements of the facility, the physical properties of the material to be measured, and the technical characteristics of the transmitter. When preparing the design documentation or in the absence of design documentation, the following aspects must be taken into account:

The transmitter is suitable for mounting on a flat surface.

The transmitter works equally well when installed at any angle, but in the free airflow version (where the filters is also visible), the transmitter should only be installed so that the gas inlet components faces sideways or downwards. This reduces dust accumulation on the filter and prevents water from collecting on it. In the free airflow version, the transmitter must be placed where the material to be measured is most likely to accumulate (e.g., for carbon dioxide, which is significantly heavier than air, near the floor, approx. 30 cm above it).

The transmitter in the free airflow version belongs to the so-called point sensor transmitters. The size of the area that can be properly monitored with the transmitter therefore depends primarily on the geometric characteristics of the facility and the physical properties of the material to be measured. The transmitter is not able to measure the concentration of material that does not reach the transmitter, so extreme care must be taken when determining the installation points and the number of transmitters. The area covered by the transmitter is largest when it is installed not on the wall surface at the edge of the area, but, for example, on a column inside the area.

In the case of piped sampling, it is recommended to install the remote transmitter in such a way that the length of the sampling pipes is minimized. In this case, due to forced circulation and the closed system, the installation height and position are irrelevant, and of course the coverage area is also irrelevant.

The transmitter has no external control devices and can be adjusted without disassembly, so it is not necessary to provide a large free area around it. However, it may be necessary to disassemble it during commissioning and later during maintenance, so the space requirements for these otherwise infrequent tasks must be taken into account.

4.3. Cabling

Only shielded cables with the diameter and cross-section specified in the technical data may be used as transmitter cables. The transmitter cable must always be identified based on its transmitter location within the facility or, for example, its technological mark or the transmitter's serial number. When cutting the transmitter cable to size, sufficient length must be left for connection. The loop resistance of the transmitter cable, taking into account the electrical parameters of the signal processing equipment, must not exceed that specified in the technical data.

The transmitter must be wired differently depending on the requirements of the given application.

If only the 4...20 mA analog output of the transmitter is to be used, a simple 3-wire shielded cable is sufficient for connection. If only the RS485 digital communication output of the remote control is used, a shielded cable with at least 4 wires is required, but for longer cable lengths, a shielded cable type with twisted pairs must be selected.

Note: If only the RS485 digital communication output of the transmitter will be used, but the transmitter will operate under harsh conditions, or it is not possible to work with a laptop in its vicinity, it is still recommended to connect it with a 6-wire twisted pair cable, as this (provided that the other end of the cable is accessible) can significantly facilitate commissioning and maintenance work related to the transmitter.

If both the RS485 digital communication output and the 4...20 mA analog output of the transmitter are used, a 6-wire shielded cable must be used. For longer cable lengths, a shielded cable type with twisted pairs must also be selected.

If you wish to connect the transmitter to an existing RS485 bus system together with other devices, you must provide a separate branch connection, as the transmitter is not equipped with the two cable glands and additional connection points required for connection.

5. COMMISSIONING

The condition for commissioning is that the transmitter has been installed in accordance with Chapter 4 and that the signal processing equipment connected to the transmitter is in working order.

Commissioning involves connecting the transmitter, switching it on and checking its proper functioning on site using measuring gas. Commissioning is carried out by the manufacturer's technical service or by partner companies contracted by the manufacturer for a fee. If the manufacturer has delivered the transmitter together with gas concentration measuring apparatus as ordered, commissioning is carried out together with this (in this case a apparatus and the ransmitter essentially form a single device).

If the remote transmitter is connected to third-party signal processing equipment, commissioning does not include checking the correct operation of the third-party equipment. However, it is recommended that commissioning be scheduled so that the operation of all other equipment controlled by the transmitter's measurement results can be observed during commissioning in order to avoid any disputes that may arise later.

Commissioning is performed using a diagnostic program running on a computer. During commissioning, it is possible to change certain operating settings (e.g. if the transmitter needs to be connected to a MODBUS protocol query system and a communication speed or query address different from the factory settings needs to be set, or the measurement results need to be clarified).

During commissioning (and later during maintenance), the computer and the transmitter can be connected using a hardware key. This connection can also be established remotely if the 4...20 mA output of the transmitter is connected and the signal processing device end of the transmitter cable is accessible.

A commissioning report is prepared using the diagnostic program, which is certified by the signatures of the persons responsible for commissioning and the persons responsible for accepting the commissioning work on behalf of the customer or their representative. The commissioning report contains all the relevant settings of the device.

If the conditions for commissioning are not met by the customer at the agreed time, commissioning will fail due to the customer's fault. The costs of failed commissioning shall be borne by the customer.

Attention! Switching on the transmitter without using the computer diagnostic program required for commissioning and maintenance does not constitute commissioning, and therefore the manufacturer does not consider the technical conditions of the warranty to have been fulfilled.

6. OPERATING ISTRUCTION

6.1 Control devices

The transmitter has no external control devices. No operation is required for it to function properly.

However, there is a green LED (D4) inside the transmitter to indicate operation and a jumper (JP1) to enable wave impedance termination of the RS485 communication pair. These must be monitored and operated by the technician performing the installation.

6.2. Electrical connection points

CS1 connector

+Ut	*Supply voltage positive pole*
Iki	*4…20 mA analog output*
GND	*Supply voltage negative pole*

CS10 connector

A	*RS485 digital output „A” point*
B	*RS485 digital output „B” point*
GND	*GND, Cable shield connection point*

6.3. Connection to sampling system

In the case of the version for connection to a piped sampling system, the transmitter has 2 to 2 pipe connection points on the 2 gas inlet components. One of these should always be used as an input point and the other as an output point. The sampled gas shall be passed through both gas inlet components by connecting the outlet of one gas inlet component and the inlet of the other gas inlet component by a short pipe. The transmitter must not be used in such a way that the 2 connection points on one gas inlet component are only used for inflow and the 2 connection points on the other gas inlet component are only used for outflow, because the sampling system will then force the entire gas flow through the filters and the interior of the transmitter, which may lead to premature contamination and failure of the sensitive interior of the filters and the transmitter.

Attention! The sampling system must not cause the pressure range specified in the technical data to be exceeded!

6.4 Tasks during operation

If the transmitter is connected to a piped sampling system, it is essential to check and maintain the appropriate gas flow (10…30 l/h) for the transmitter to operate. Otherwise, the transmitter may only measure the concentration of gas trapped in the pipeline. If the medium being sampled may contain solid contaminants or moisture, a suitable filter system must also be installed in the pipeline supplying the sampled medium to the transmitter. The operator is responsible for checking and maintaining the efficiency of this system at reasonable intervals.

In the case of transmitters with free air flow, operating conditions may arise in which the transmitter cannot be adequately protected in any other way and, for example, water may enter the gas inlet during water jet cleaning of the facility. In this case, the transmitter (or at least the gas inlet) must be covered with a waterproof cover during cleaning and this additional protection must be removed after cleaning.

6.5. Cleaning

The transmitter housing can be cleaned if necessary, but care must be taken to ensure that no water or other cleaning agents get inside. Only neutral substances and cleaning agents that do not damage the transmitter, attack the housing material, or render the inscriptions illegible may be used for cleaning.

Care must be taken to ensure that nothing gets into the gas inlet component (where the filter is visible and where the pipes are connected) and that it is protected from water in particular.

Cleaning, repairing, or replacing a transmitter with a gas inlet that is contaminated to the extent that it impedes operation, or a transmitter with a gas inlet that is saturated with water, or a transmitter that has been submerged in water, is the responsibility of the maintenance technician.

7. CONDITIONS OF SAFE APPLICATION

The transmitter may only be connected to electrical equipment (i.e., signal processing equipment) that is necessary for the intended use of the transmitter, has reinforced insulation from the mains voltage or has a grounded output, and does not cause the limits specified in the technical data to be exceeded.

The transmitter may only be connected with a shielded cable, otherwise electromagnetic compatibility (EMC) problems may occur, which may cause malfunctions.

No modifications may be made to the transmitter without the manufacturer's permission!

8. ABBREVATIONS INDICATED ON TRANSMITTER

CE *European conformity marking;*

⚠ *When using the device for its intended purpose, the instructions in the user manual must be observed.*

9. TECHNICAL DATA

Type:	*IR-NE-3*
Sensing principle:	*Dual wavelength NDIR (Non-Dispersive Infrared)*
Detectable substances:	*According to table 1.*
Measuring ranges:	*According to table 1.*
Ambient temperature:	*-20...+65 °C*
Allowed humidity:	*0...95 RH%, non-condensing*
Allowed pressure:	*900...1100 hPa*
Supply voltage:	*9.5...28 V⎓*
Power consumption:	*P < 0.9 W (average value)*
Temperature measurement:	*Yes (the measured value is only displayed on the RS485 digital output)*
Temperature compensation:	*Have*
Protection:	*IP54*
Explosion protection:	*None*
Expected service life:	*> 40,000 operating hours without replacement of parts*
Connectable sampling tube:	*Ø 6/4 mm (only for sampling version)*
Dimensions:	*127 x 127.5 x 113/95 mm version dependent*
Weight:	*approx. 500 g*
RS485 digital output features	
Communication protocol:	*MODBUS / RTU*
Communication speed:	*9600…57600, configurable*
Logical address:	*1…247, configurable*
Data readout:	*Holding register*
Measured concentration address and format:	*40001, measured value without decimal point (resolution according to current configuration setting)*
Measured temperature address and format:	*40002, measured value without decimal point (resolution 0.1oC)*
Operation/self-fault indication address and format:	*40003 (0=operation, 1=self-fault)*

4…20 mA analog output characteristics	
Maximum load resistor:	*R = 140 Ω (if cable resistance is 0 Ω)*
Maximum output current:	*I = 25 mA*
Cable required for transmitter connection:	*3-wire shielded, only for 4…20 mA output,* *2 x 2-wire (twisted pair) shielded only for RS485 *, or* *3 x 2-wire (twisted pair) shielded for 4…20 mA and RS485 outputs*
Maximum cable loop resistance:	*Rl = 20 Ω / 24 V power supply* *Rl = 10 Ω / 12 V power supply*
Cable entry:	*3...8 mm*
Connectible wire cross-sections:	*0,25...1,5 mm^2*
Adjustment method:	*Controlled by a computer diagnostic program*

** Note: Installation and maintenance of the transmitter is greatly facilitated if the connection is made using a 3 x 2 (twisted pair) cable even when using the RS485 output, and the signal processing end of the cable is accessible.*

Table 1.

Detected substances	***Measuring range***	***t_{50} /t_{90}*****	***Inaccuracy***
Carbon Dioxide (CO_2)	*0…1.0 vol%*	*< 25 /50 s*	*< 3 %*
Carbon Monoxide (CO)	*0…10.0 vol%*	*< / s*	*< %*
Nitrogen Dioxide (NO_2)	*0… vol%*	*< / s*	*< %*
Dinitrogen Oxide	*0… vol%*	*< / s*	*< %*
Sulfur Dioxide	*0…0.2 vol%*	*< / s*	*< %*
Methane	*0…5 vol%*	*< / s*	*< %*

*** Measured at a flow rate of 10 l/h and with a specified measuring condition*

10. GUARANTEE

*When used as intended, the transmitter is covered by a **1 year** warranty from the date of installation, provided that the transmitter was installed by the manufacturer's technical service or one of the manufacturer's contracted partners. The warranty can be extended for an additional **2 years** if the operator or its representative enters into a regular maintenance contract with the manufacturer's service department for 3 years from the date of installation.*

The warranty is conditional upon full compliance with the regulations governing installation, commissioning, operation, safe use, and maintenance.

Attention! Switching on and operating the transmitter without using the diagnostic program does not constitute commissioning and may result in loss of warranty.

The warranty only covers manufacturing defects. It does not cover damage caused during transport, storage, installation or use, or malfunctions resulting from failure to comply with the user manual.

11. SERVICE, MAINTENANCE

*The transmitter is safety device must be regularly maintained in order to prevent any malfunctions that may occur during operation and to ensure reliable, long-term operation. Maintenance is performed by the manufacturer or its contracted partners for a fee, except for any warranty repairs. Even if the device is functioning properly, maintenance must be performed at **least once a year** from the date of installation, depending on usage.*

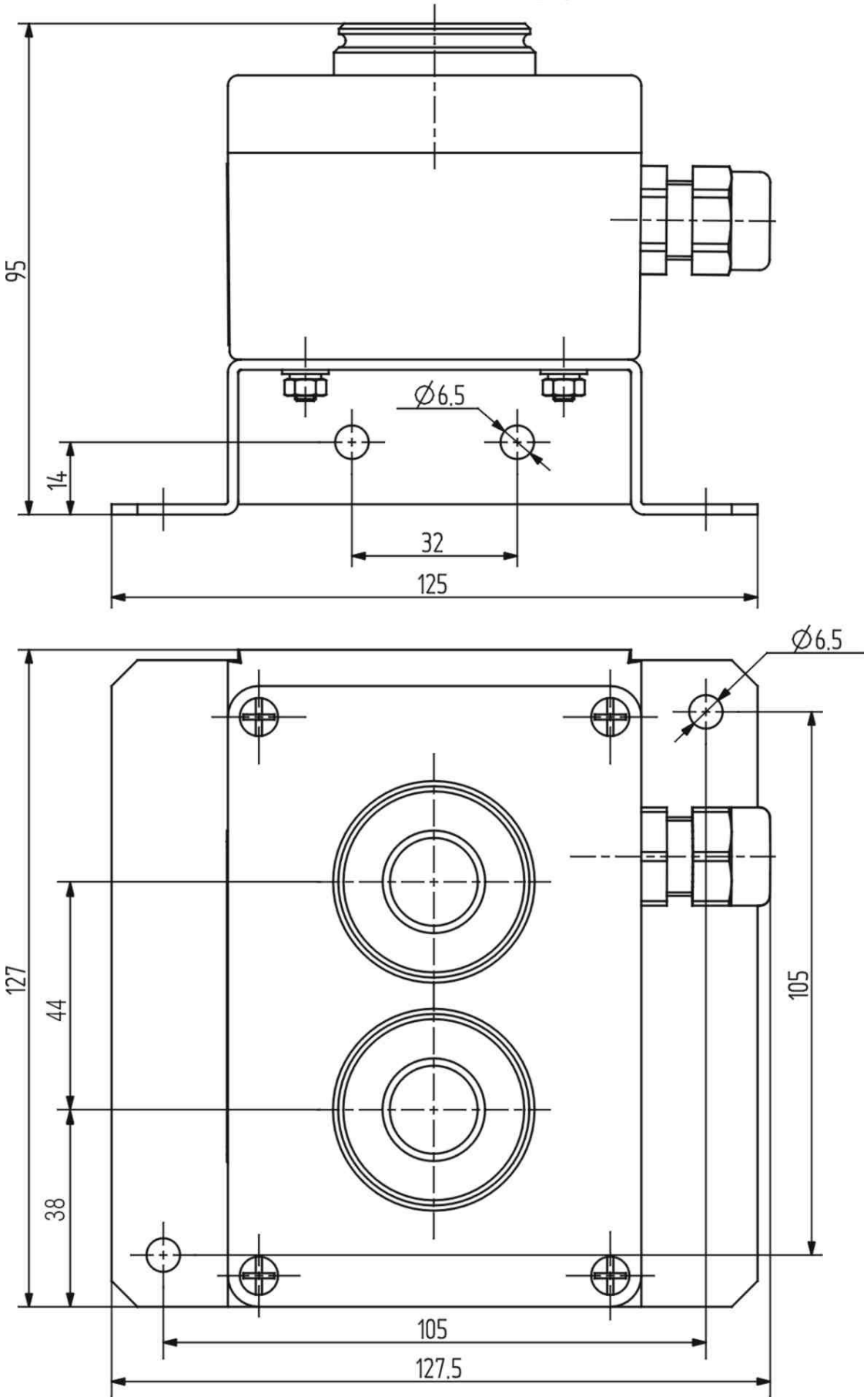
Maintenance is performed using a computer diagnostic program. Maintenance includes assessing the general technical condition, checking the proper functioning of the transmitter, adjusting the settings, and repairing any faults if necessary. During maintenance, it is also possible to change certain settings on request. A printed report is generated about the maintenance using the computer diagnostic program, which contains all the important settings of the transmitter.

Attention! The device cannot be maintained without using the computer diagnostic program required for commissioning and maintenance.

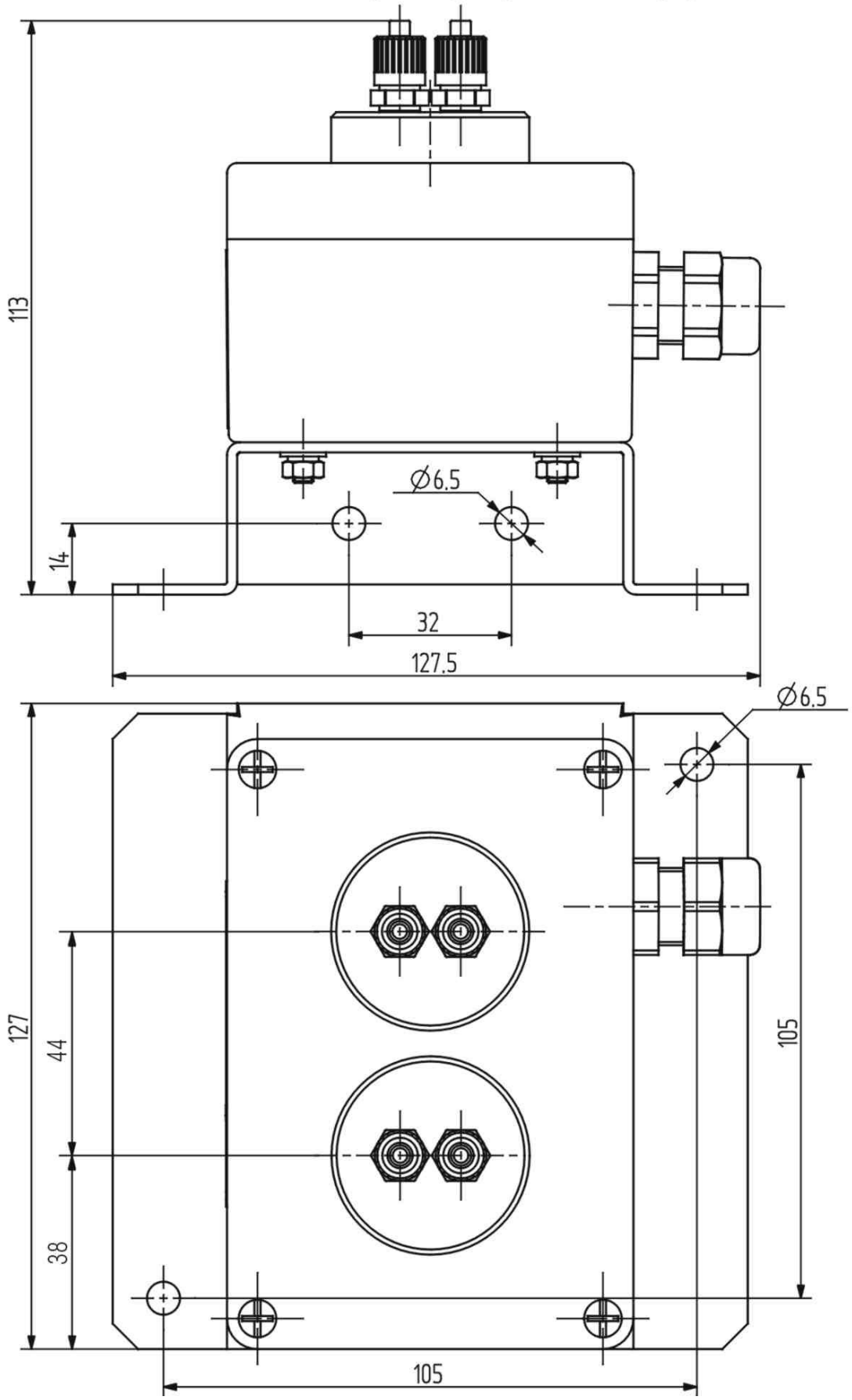
During the operation of the transmitter, it is also possible to remedy any malfunctions that may occur due to lack of maintenance or despite maintenance. Troubleshooting must be initiated with the manufacturer or its contracted partner. In such cases, the following information must be provided:

- *the name of the facility where the transmitter is located,*
- *the serial number,*
- *the exact installation location,*
- *a description of the fault as accurately as possible,*
- *the name and contact details of the contact person on behalf of the operator or the party initiating the repair.*

Dimensions of IR-NE-3 transmitter for free air stream applications



Dimensions of IR-NE-3 transmitter with pipeline connectors for sampling system applications



Internal layout and connection points of IR-NE-3 transmitter