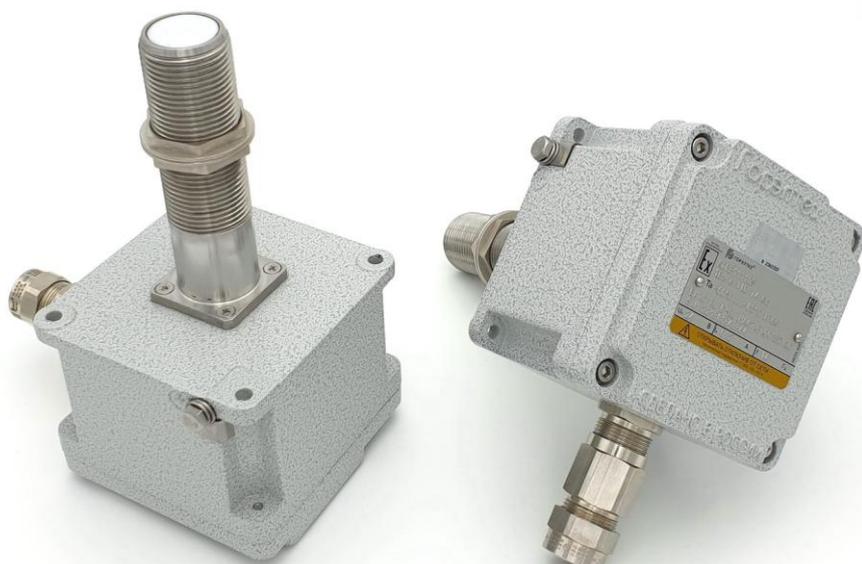


**Design Bureau Fizelektronpribor, Ltd.**

## **Barrier for Level SIUR-03V2**

Technical description and operation  
manual  
VIGT.407629.001-04 RE  
(Rev. 9.5)



**Samara, 2024**

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## 1. Introduction

1.1 This technical description and the operating manual are intended to familiarize the user with the device, its operating principle, rules of installation, preparation, inspection, adjustment and maintenance in operation of the Radiowave Barrier for Level SIUR-03V2 VIGT.407629.025 (hereinafter - the barrier).

1.2 Barriers for level SIUR-03V2 correspond to Class III of protection against electric shock according to GOST 12.2.007.0-75. Barriers are designed to operate at a safe ultra-low voltage (24V), have no internal electrical circuits operating at a higher voltage.

1.3 The manufacturer reserves the right to make modifications in the barrier design and circuit that do not affect its performance without adjusting the operating and maintenance documentation.

1.4 List of conventional designations:

- AN — antenna (emitter);
- RC — receiver unit (receiving module);
- TR — transmitter unit (transmitting module);
- BS — synchronization unit;
- SHF — super-high frequencies (microwave band);
- SPTA — spare parts and accessories.

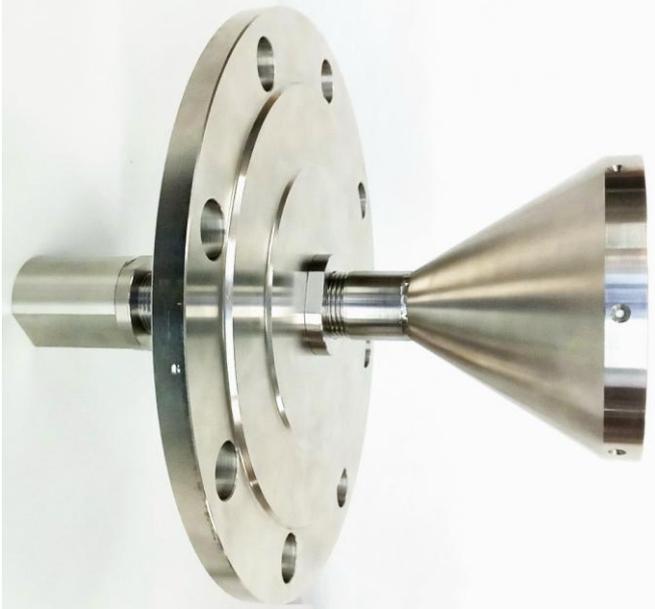
## 2. Purpose

2.1 The barrier is designed to control the maximum level of tank filling with bulk and liquid materials, and can also be used to control the level of burning fuel in boilers. The barrier can be used in the conditions of high temperature and high dustiness.

2.2 Design versions of the barrier are given in Table 1.

Table 1

Barrier designation	Permissible temperature of unit housings	Design features
<p><b>Barriers for level SIUR-03V2 VIGT.407629.025A</b></p> <p>SIUR-03V2.5</p>	-25...+85°C	 <p>The barrier consists of two units – TR and RC – mounted on hopper walls. Units are attached to emitters with G1 thread or using holes in the housings of units. Emitters are 120 mm long and made of AISI 321 steel. Unit housings are sealed, IP66. Cables are connected to units using KOVIM cable leads (for armored cables with an outer diameter of 9-17 mm).</p>
<p><b>Barriers for level SIUR-03V2 VIGT.407629.025-01</b></p> <p>SIUR-03V2.51</p>	-45...+85°C	

<p><b>Barrier for level SIUR-03V2 VIGT.407629.025</b></p> <p>(with an additional synchronization unit)</p> <p>SIUR-03V2.5M</p>	<p>-25...+85°C</p>	 <p>The barrier consists of two units – TR and RC – mounted on hopper walls, and an additional BS synchronization unit. TR and RC units are attached to emitters with G1 thread or using holes in the housings of units. Emitters are 120 mm long and made of AISI 321 steel. Unit housings are sealed, IP66. Cables are connected to units using the KOV1M cable leads (for an armored cable with an outer diameter of 9-17mm). The barrier features by increased sensitivity. The scope of supply includes cables for connecting TR and RC units with the BS unit.</p>
<p><b>Set of two horn antennas mounted on flanges VIGT.407629.101-02</b></p>	<p>Permissible antenna heating temperature is up to +400 °C</p>	 <p>Horn antennas, flanges (DN150, PN10), G1 couplings and G1 locking nuts are made of AISI 321 steel. Horn antennas are connected to the barrier emitters using a coupling (threaded fitting) with straight pipe thread 1" and are fixed using locking nuts (locknuts).</p>

<p><b>Set of two emitter pipes</b> <b>VIGT.407629.101-03</b></p>	<p>Permissible heating temperature of pipe ends is up to +400 °C</p>	<div data-bbox="683 168 1401 499" data-label="Image"> </div> <p>A set of two 370 mm long probe pipes made with a ceramic plug at the end. Pipes are connected to the barrier emitters using a coupling (threaded fitting) with straight pipe thread 1" (G1), the pipe material is AISI 321 steel. The peculiarity of this version: G1 thread is made on the 250 mm pipe section to enable pipe securing in the flange.</p>
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The SIUR-03V2 barrier for level consist of a receiving (TR) and a transmitting (RC) module, which are installed on the walls of a bin (tank) at a controlled level. The probing microwave signal is introduced into the bin through openings in its walls made at a specified level. The presence of material at a given level is determined by the attenuation of the signal during its propagation from the transmitting to the receiving module. The modules are equipped with antennas (emitters), which are made in the form of pipes with G1 threads (pipe cylindrical thread 1" according to GOST 6357-81), and the pipes are filled with fluoroplastic F4 (PTFE), which ensures the operation of the modules at pressures up to 1.0 MPa. The modules of the SIUR-03V2.7 version are provided for fastening using DN40, PN10 flanges. For reliable operation of the barrier when the bunker is filled, it is necessary that the probing signal in the monitored material be weakened in power by 3...5 times (or more). It has been experimentally established that in a layer of cement, ore, crushed stone, sand more than 30 cm thick, the power of the microwave signal is weakened by at least 10 times. At the same time, a layer of a small thickness of material, for example, up to 5 cm, weakens microwaves by less than 3 times. This peculiarity allows using barrier for level to monitor materials that can stick to the sensor and the walls of the bunker. It is important to note that high temperatures of the environment inside the tank and the presence of dust do not affect the propagation of microwaves. The design of the barrier for level is protected by patent RC 2631519.

The fastening of the barrier modules to the side walls of the bunker can be performed in two versions. If the temperature of the environment inside the bunker does not exceed 80°C, and the vibrations of the walls are not large, then the modules are fixed directly to the walls using steel bushings with G1 thread. Otherwise, the modules are fixed so that they do not touch the walls of the bunker, but the gap between the antenna and the plane of the hole does not exceed 1 cm. The holes are covered with plates made of ceramics, rubber, fluoroplastic and other dielectrics. Plates cut from a multilayer conveyor belt, which is resistant to abrasion, are also used. At very high temperatures, fireclay bricks are used. The receiving and transmitting modules of the barrier can be installed on the roof of the bunker. In this case, steel pipes with an internal diameter of 25 ... 35 mm should be used to transmit the probing signal to the controlled level. The length of the pipes, the grade of steel

and the quality of the surface treatment of the pipes are not important. The peculiarity of the SIUR-03V2.5M variant of the signaling device is that this variant is equipped with an additional synchronization unit (SU), providing increased selectivity of the received signal. Due to this feature, the sensitivity of the signaling device is increased by 30 dB (sensitivity is the maximum permissible attenuation of the microwave probing signal on the propagation path from the transmitting module to the receiving one) and is not less than 90 dB.

An example of recording the designation of the barrier when ordering and in the technical documentation of other products:

"Barrier for Level SIUR-03V2 VIGT.407629.025".

### 3. Specifications

Main specifications of SIUR-03V2 are given in Table 2.

Table 2

Serial No.	Parameter	Value
1.1	Maximum permissible distance between antennas, not less than, m, for design options: - options B2.4/ B2.5 / B2.6 / B2.7 - option B2.5M	16 100
1.1.1	Sensitivity (maximum permissible attenuation of the microwave probing signal along the propagation path from the transmitting module to the receiving module), dB, for design options: - options B2.4/ B2.5 / B2.6 / B2.7 - option B2.5M	60 90
1.2	Ambient temperature at the installation site of the RC, TR and BS units (permissible temperature of the unit housings during operation), °C, for design options: - general industrial design - with extended range of operating temperatures	-25 ... +85 -45 ... +85
1.3	Maximum permissible heating temperature of the outer (radiating) end of the antennas (Subject to fulfillment of clause 1.2), °C, for design options: - with a fluoroplastic plug - with a ceramic plug (see notes 1, 2)	+200 +400
1.4	Dimensions of openings in the tank walls, mm, not less than	Ø35
1.5	Operating range of wavelengths of the probing microwave signal, cm	3
1.6	Average power of the probing signal, no more than, mW, for design options: - options B2.4/B2.5 / B2.6 / B2.7 - option B2.5M	3 50
1.6.1	Maximum power flux density of the microwave signal emitted by the transmitter and its antenna at a distance of 0.5 m (averaged over the period), no more than, $\mu\text{W}/\text{cm}^2$	0,5
1.7	Output voltage, V - when the tank is not filled to the controlled level (microwave signal passes through the tank without attenuation), not less than - when the tank is filled to the controlled level, not more than (see notes 3)	$+U_{\text{пит}} - 1$ 1
1.8	Electrical load of the output transistor switch, not more than, mA	150
1.9	Supply voltage ( $U_{\text{sup}}$ ) of the barrier (DC source), V - nominal - maximum permissible - minimum permissible	+24 +27 +20

1.10	Current consumed by the signaling device via the power supply circuit (excluding the current consumed by the external load), no more than, mA, for design options: - options B2.4/B2.5 / B2.6 / B2.7 - option B2.5M	150 600
1.11	Overall dimensions of RC and TR units (without emitters and without sealed entries), mm - option SIUR-03V2.4 - option SIUR-03V2.5 / V2.5M / V2.6 / V2.7	120 x 120 x 100 110 x 110 x 90
1.12	Overall dimensions of the BS block (without cable glands), mm	180 x 110 x 90
1.13	Overall dimensions of emitters, mm - option SIUR-03V2.4 / V2.5 - option SIUR-03V2.5M - option SIUR-03V2.6 - option SIUR-03V2.7	Ø34, L=120 Ø34, L=280 Ø34, L=200..500 Ø145, L = 80
1.14	Degree of protection of the barrier unit shell from dust and moisture penetration according to GOST 14254-2015: - for the SIUR-03V2.4 option - for the SIUR-03V2.5 / V2.5M / V2.6 / V2.7 option	IP65 IP66
1.15	Weight of electronic units (excluding antenna weight), kg - TR unit - RC unit - BS unit	1,2 1,2 0,8
1.16	Warranty period, months.	24

### **Notes**

1. The permissible heating temperature of the end of antennas closed with fluoroplastic plugs is +200°C, provided that the temperature of the electronic units does not exceed +85°C.
2. The permissible heating temperature of the end of antennas closed with ceramic plugs (or without plugs) is +400°C, provided that the temperature of the electronic units does not exceed +85°C.
3. The output stage is implemented on a p-type field-effect transistor

## 4. Barrier design and operating principle

4.1 The barrier is a receiving and transmitting device for radio pulse microwave signals (microwave signals) and consists of the following units:

- transmitter unit (TR);
- receiver unit (RC).

The barrier of the SIUR-03V2.5 VIGT.407629.025 (SIUR-03V2.5M) variant is additionally equipped with a BS synchronization unit.

4.2 The operating principle of the barrier is as follows

The transmitting and receiving units with antennas are installed on opposite walls of the tank at the controlled level. The radiation and reception of radio waves (microwaves) by the antennas is carried out through openings in the walls of the tank.

The transmitter, through the antenna connected to it, emits a microwave signal into the tank, which is fed through the second antenna to the receiver, where it is converted into an information signal. The criterion for the presence or absence of bulk material at the controlled level in the tank is the degree of absorption of the energy of the emitted radio signal on the way from the transmitting antenna to the receiving one.

It is meant that when transmitted through bulk material, the energy of the microwave signal is weakened by at least 3 ... 5 times compared to passing through the free space of the tank. It has been experimentally established that the radio signal when passing through a layer of crushed stone, sawdust, shavings, coal or ash 10 cm or more thick is weakened by at least 10 times. In a cement layer 10 cm thick, the signal is weakened by about 2 times. Therefore, the sensitivity of the barrier for work in cement bunkers can be adjusted in such a way that the device will not sense cement sTRck to a thickness of up to 20 cm and the output signal will be switched only when the entire space between the antennas of the device is filled with cement.

4.3 Transmitter block unit contains a microwave generator, a modulator and a voltage stabilizer with an output voltage of +12V. The microwave generator, implemented on a Gunn diode, produces radio pulses with a pulse power of 100 mW with a carrier frequency in the 3-centimeter wavelength range (about 10 GHz).

The transmitter unit has two LEDs that allow you to monitor its operation. One LED is connected to the input power supply circuit +24V and lights up when the supply voltage is applied. The second LED allows you to monitor the operability of the microwave generator.

4.4 The receiver unit of RC barriers of all types is a detector receiver of a microwave signal, which includes a microwave detector, signal amplifier with a frequency of 60 - 80 kHz and a supply voltage stabilizer with an output voltage of +12V. In addition, the following devices are included in the RC units of the B2.4/B2.5/B2.6/B.2.7 variants of the barrier:

- a comparator;
- an integrator that provides a 3-second TR-on delay;
- an output transistor switch made on a p-type field-effect transistor, the source of which is connected to the +24V bus;

The gain of the amplifier can be adjusted using a trimmer resistor (installed on the board).

In the B2.5M variant of the barrier, the comparator and the output transistor switch are located in the BS synchronization unit, which also includes a synchronous detector that increases the sensitivity of the barrier.

4.4.1 The operating principle of the receiver is as follows.

In the absence of bulk material at the controlled microwave level, the signal passes from the transmitter to the receiver with little attenuation, while the output transistor switch of the RC unit is open and the voltage at its output is +24V.

When loading the material into the tank, it gradually blocks the microwave beam, the amplitude of the received signal and the output transistor key of the RC unit are locked.

The gain (i.e. the sensitivity of the receiver) is adjusted using a trimmer resistor, which is located on the lower board under the cover; for its adjustment, a hole for inserting a screwdriver is provided in the upper board. At the factory setting, the resistor is set to a position corresponding to confident reception of the microwave signal at distances of up to 6 m.

To eliminate false barriers, the receiver has a delay in switching on and off for about 3 seconds.

*Note.* It should be noted that this delay reduces the frequency of switching on the electric motor that controls the loading of the tank.

4.4.2 The receiver has three LEDs that allow monitoring the operation of the barrier.

One LED, connected to the +24V input power supply circuit, lights up when the supply voltage is applied. When a microwave signal appears at the receiver input, the green LED lights up. After a set delay time (3 sec), when the output stage is triggered, the third LED (red) turns on. When the microwave beam is blocked, the green LED turns off immediately, and the red LED turns off with a delay of 3 sec.

4.4.3 As experience of operating the barriers shows, when installing them on the tank, there is no need to change the settings made at the manufacturer. LEDs are quite sufficient to monitor the operation. However, the barrier has the ability to monitor the attenuation of the microwave signal using the output voltage of the amplifier, output to contact 4 of the RC unit connector.

Monitoring the amplitude of the received signal is performed using a voltmeter (for example, a multimeter of the MY-64 type).

The voltmeter must be set to measure direct voltage with a limit of 20 V (see Appendix 9).

In this case, when the tank is not filled, the device must show a signal level of more than 3 V, and when the tank is filled - less than 1 V.

4.5 The designs of the TR and RC units are identical in layout, overall and connection dimensions.

The supporting structure of each unit is a housing closed with a cover. The housing contains:

- microwave generator (in the TR unit);
- microwave detector (in the RC unit);
- printed circuit boards of low-frequency devices.

The unit cover is fastened to the housing with screws and is sealed with rubber gaskets.

4.6 The overall dimensions of the barrier units are shown in Appendices 1 - 4. The figure in Appendix 4 shows the placement of the SIUR-03V2.5M barrier on a reinforced concrete bunker. Appendices 7 and 9 show the connection diagrams of the barriers.

## **5. Labeling and sealing**

5.1 The following signs and inscriptions are applied on the receiver and transmitter covers: name and type of the device, type of the unit (RC, TR or BS), serial number according to the manufacturer numbering system, year of manufacture.

5.2 Seals may be installed inside the RC, TR and BS units to prevent unauthorized opening of the device.

## **6. Container and packaging**

6.1 Containers and packaging are intended for barrier storage and transportation and ensure its safety during transportation and storage.

6.2 Barrier units, parts and components included in the delivery set, spare parts and operating documentation shall be packed in containers.

6.3 Operating documentation is wrapped in plastic wrap.

6.4 Along with the delivery set, a packing list indicating the name and quantity of the delivered products must be included in the shipping container..

## **7. General operating instructions**

### **7.1 Unpacking rules.**

7.1.1 Upon receipt of the container with the barrier, its external inspection is carried out together with the person responsible for transportation. It is necessary to ensure that the container is completely intact.

In case of any damage to the container, a relevant report shall be drawn up and signed by persons responsible for acceptance and transportation, sealed and sent to the carrier.

7.1.2 In the cold season, unpacking of boxes should be done only after keeping them in a warm room with a temperature of at least +18 ... 20 °C.

7.1.3 After unpacking, the contents of packages shall be checked with the inventory in the packing lists. The name, designation, serial number and quantity of products shall match the entries made in the packing lists.

### **7.2 Inspection rules.**

7.2.1 During the external inspection of the products, check the integrity of the barrier unit housings, the safety and absence of their damage. The product must be free from any scratches, cracks, dents, traces of corrosion and other defects that can be detected during external inspection.

7.2.2 A complaint report is drawn up for all defects and discrepancies discovered during unpacking and external inspection and verification of completeness, which is signed by the persons responsible for accepting the barrier, approved by the head of the consumer enterprise and sent to the manufacturer.

### **7.3 Connection rules.**

7.3.1 The barrier must be powered from a stabilized general-purpose DC voltage source with an output voltage of 23...25V (maximum permissible supply voltage values are 20...27V).

7.3.2 Galvanic isolation of the output circuits of the power source from the 220V network must be at least 500V.

7.3.3 To prevent the signaling device housing from being exposed to mains voltage in an emergency (in the event of a power supply failure), it is recommended to connect the “-24V” output of the power supply directly in the control cabinet to the ground bus, and install the electronic unit housings on metal brackets connected to the ground bus.

7.3.4 The length of the cables supplying power to the TR and RC units and the cross-section of their conductors are selected so that at a maximum current of 200 mA the voltage drop on the conductors does not lead to a decrease in the operating voltage below the maximum level of 20 V. The barrier's own power consumption (excluding the power consumption of the actuator) does not exceed 2 W.

To power the TR unit, a cable with at least two cores and a cross-section of at least 0.75 mm<sup>2</sup>.

To power the RC unit and transmit control voltage to the actuator (relay), a cable with at least three cores and a cross-section of at least 0.75 mm<sup>2</sup> is required.

For the SIUR-03V2.5M variant of the barrier, the cables connecting the RC and TR units with the BS unit are included in the delivery set.

7.3.5 Electrical relays or other electrical devices designed for an operating voltage of 24V and a consumption current of up to 150mA can be used as an information receiver (executive device).

7.3.6 When installing several barriers close to each other, it is necessary to prevent the microwave signal from one barrier from reaching the receiver from another set. To do this, it is recommended that when installing barriers, they be placed so that the distance between the ends of the transmitter probes of one barrier and the receiver of another is as large as possible.

To detect the influence of the radiation of the transmitter of one set on the receiver from another set, you should turn off the transmitter of the second set and make sure that the radiation of the transmitter of the first set does not cause the receiver of the second set to operate. Then repeat the same procedure for the receiver of the first set.

The time it takes for the barrier to be ready for operation after the supply voltage is applied does not exceed 2 minutes.

## 8. Safety precautions

8.1 It is prohibited to operate the barrier for level without grounding of the external 24V power source.

8.2 As an additional safety measure, it is recommended to connect the “-24V” terminal of the power source to the ground bus.

8.3 It is prohibited to operate the barrier for level with the covers removed.

8.4 Only persons who have studied this technical description and operating instructions, and who have been instructed in safety precautions for working with electrical installations and electronic equipment, should be allowed to install (dismantle), operate, service and repair the barrier.

8.5 All types of maintenance, repair and installation related to re-soldering of electrical and radio components, unsoldering of cables, replacement of failed components, elimination of wire breaks, etc., as well as dismantling of the barrier for level, should be performed only when it is disconnected from the power source.

8.6 It is not permitted to operate the barrier for level if the connectors are not tightly inserted and the covers are removed.

## 9. Installation rules

9.1 When installing and assembling the barrier for level, the safety regulations set out in Section 8 of this manual and in the regulatory and technical documents in force at the consumer enterprise must be strictly observed.

9.2 For installation at the facility, the barrier for level is supplied that has passed the technical check in accordance with the methodology of Section 11.

9.3 At the first stage, it is necessary to select the installation locations for the electronic units of the transmitter and receiver; when choosing, it is necessary to take into account the permissible operating conditions. Prepare the installation and fastening locations for the component parts of the barrier in accordance with the overall and installation dimensions of the units.

9.4 Depending on the design, the antennas of the barrier are installed either directly in the holes made in the walls of the tank, or near the specified holes.

**CAUTION! When installing antennas of any barrier version, it is necessary to ensure the same polarity of the transmitting and receiving antennas. When installing the transmitting and receiving units, their housings shall be turned around the axis of antennas so that their similar axes are parallel (connectors/cable glands will be directed in one direction or in opposite directions).**

9.5 Barrier antennas The barrier antennas can be installed without direct contact with the tank walls. The possible distance of the antenna radiating surface from the wall is determined by the dimensions of the hole in the wall. The larger the dimensions of the hole, the greater the distance that the antenna aperture can be moved without loss of microwave signal power. The dimensions of the hole in all cases must be no less than the cross-sectional dimensions of the waveguide. For round waveguides, the diameter of the hole must be no less than Ø35 mm, and the antenna must be positioned relative to the hole in such a way that the edges of the hole do not overlap the radiating aperture of the antenna.

9.6 Lay the cables between the barrier units and the power source and actuator (relay) and connect the barrier in accordance with the connection diagram given in Appendices 8 or 9 and according to the planning drawing of the consumer enterprise.

## 10. Preparation and working procedure

10.1 The barrier is operated by an operator familiar with the operation of electronic equipment, who has studied this technical description and operating instructions, and who has been briefed on safety precautions and on working with radio and electrical equipment.

10.2 The barriers operate in one mode - continuous remote monitoring of the maximum filling level of the tank.

10.3 Preparation for work is carried out in the following order:

10.3.1 Make sure that the barrier is correctly connected to the power source and the actuator (relay), check the reliability of the communication line connections.

10.3.2 Before connecting the barrier to the power source, use a voltmeter to check the set voltage on the power source, which should not go beyond +23 ... 25V.

10.4 Turn on the power source. The power control and generator operation control LEDs on the generator body should light up. The power control LED on the receiver body should light up.

10.5 When switching on for the first time, make sure that the response level (sensitivity) of the receiver set by the manufacturer corresponds to the application features.

A mandatory condition for performing this operation is the absence of loaded material and any other objects along the beam between the transmitter and receiver antennas.

Note. The beam width is at least 30 degrees, so it is not necessary to achieve precise placement of the antennas along one line.

Sensitivity testing is performed after all operations for placing and securing the barrier units have been completed. If the receiver receives a signal from the transmitter, a green/yellow indicator lights up on the receiver body. Moreover, when a microwave signal appears, the green LED lights up first, and then, after 3 seconds, its glow turns yellow. When the beam is blocked (the signal weakens below the threshold), the green/yellow indicator first switches to red, and then, after 3 seconds, goes out.

If the sensitivity is insufficient (the signal is not received or is received unstably in the absence of objects in the path of its propagation), then it is necessary to increase the sensitivity.

Too high sensitivity will manifest itself in the fact that when the tank is filled, the barrier will switch off the output relay with an excessively long delay or will not operate at all. With increased sensitivity, along with radio signals propagating along the line between the antennas, radio signals reflected from the walls of the tank are also received.

10.6 To adjust the sensitivity, adjust the trimmer resistor installed inside the PM unit. To do this, use a watch screwdriver to turn the resistor terminal: clockwise rotation leads to an increase in sensitivity, counterclockwise - to a decrease.

To exclude the reception of microwave signal reflections from the walls of the tank, the sensitivity must not be set too high, but, at the same time, it must be sufficient for stable and reliable reception of the signal that has passed along the line between the antennas. To achieve the optimum sensitivity value, rotate the resistor terminal to select a position at which the signal level control LED is at the turn-on threshold, and then increase the sensitivity to a level that ensures stable reception of the microwave signal.

After completing the adjustment, secure the resistor terminal with a lock nut.

The sensitivity can also be adjusted using an oscilloscope or voltmeter according to paragraph 4.4.3.

Note. The sensitivity level of the barrier set by the manufacturer is optimal in most applications. Therefore, before adjusting the sensitivity, make sure it is necessary and check that the requirements of paragraphs 9.4 and 10.5 are met.

## 11. Maintenance check

The list of basic maintenance checks is given in Table 3.

Table 3

Check types	Technical requirements
1. Grounding check with an ohmmeter	The standard transient resistance of wires and grounding terminals determined by regulatory documents in force at the customer plant, and Electrical Installation Code
2. Barrier current consumption check	The value of the current consumed by the barrier must be within 400...600mA.
3. Supply voltage check	The DC voltage at the power supply output terminals when the barrier is connected must be within 23 ...25V.

## 12. Troubleshooting

12.1 Any malfunctions detected must be eliminated only when the barrier is disconnected from the power supply.

12.2 When replacing failed circuit elements, strictly follow the instructions of Section 13 of this manual.

12.3 The replacement of the failed elements and the inspection of the barrier after the elimination of the detected malfunction shall be carried out by a specialist in its maintenance.

12.4 The list of potential malfunctions is given in Table 4.

Table 4

Description of malfunction, external manifestations and additional signs	Probable cause	Method of elimination
1. Power LEDs do not light up when the barrier is energized. Additional signs: - supply voltage at the input of the power supply wire of the communication line is 24V - There is no current in the power supply circuit of one or both units.	Broken power wire, blown fuse	Persons responsible for the operation shall eliminate the malfunction in accordance with the applicable rules.
2. Power LEDs do not light up when the barrier is energized. Additional signs: - Current in the power supply circuit is more than (600mA).	Short circuit in the barrier power supply circuit	Persons responsible for the operation shall eliminate the malfunction in accordance with the applicable rules.
3. When the tank is not filled, the barrier gives information about its filling above the control level (i.e. there is no microwave signal reception).	Malfunction in the power line. Incorrectly installed units, e.g. the TR and RC units are turned relative to each other by 90° or their antennas are not directed at each other	Make sure that power supply circuits operate properly and that the installation is correct. Dismantle the TR and RC units from the installation places and check them for compliance with Paragraph 4 of Table 3.

<p>4. When the tank is full, the barrier gives information about the absence of filling (i.e. the received microwave signal has a high level).</p>	<p>Incorrectly installed units:  a) The gap between the antennas and holes in the hopper walls is too large, while the microwave signal between the units propagates outside the hopper.  b) The microwave signal is re-reflected from the inner walls of the hopper and does not propagate in a straight line between them due to the incorrectly oriented antennas with the excessive RC unit sensitivity.</p>	<p>Make sure that the TR and RC units are installed correctly. Make sure that power supply lines of the barrier are properly grounded.  Dismantle the TR and RC units from the installation places and check them for compliance with Paragraph 4 of Table 3. Adjust the sensitivity in accordance with Section 10.6.</p>
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### 13. Storage rules

Barrier storage and transportation conditions are in accordance with GOST 15150-69 for Group 3 and Group 5, respectively.

13.1 Depending on the period, barrier components the manufacturer's package can be stored in hard-wall heated or unheated premises with the air free from acid vapors, alkalis and other harmful substances that cause corrosion.

13.2 The barrier storage period in the manufacturer's package is one year. At the same time, when stored in hard-wall unheated premises at a temperature of +50...-40°C and relative humidity up to 80% at a temperature of +25°C, the storage period is 3 months.

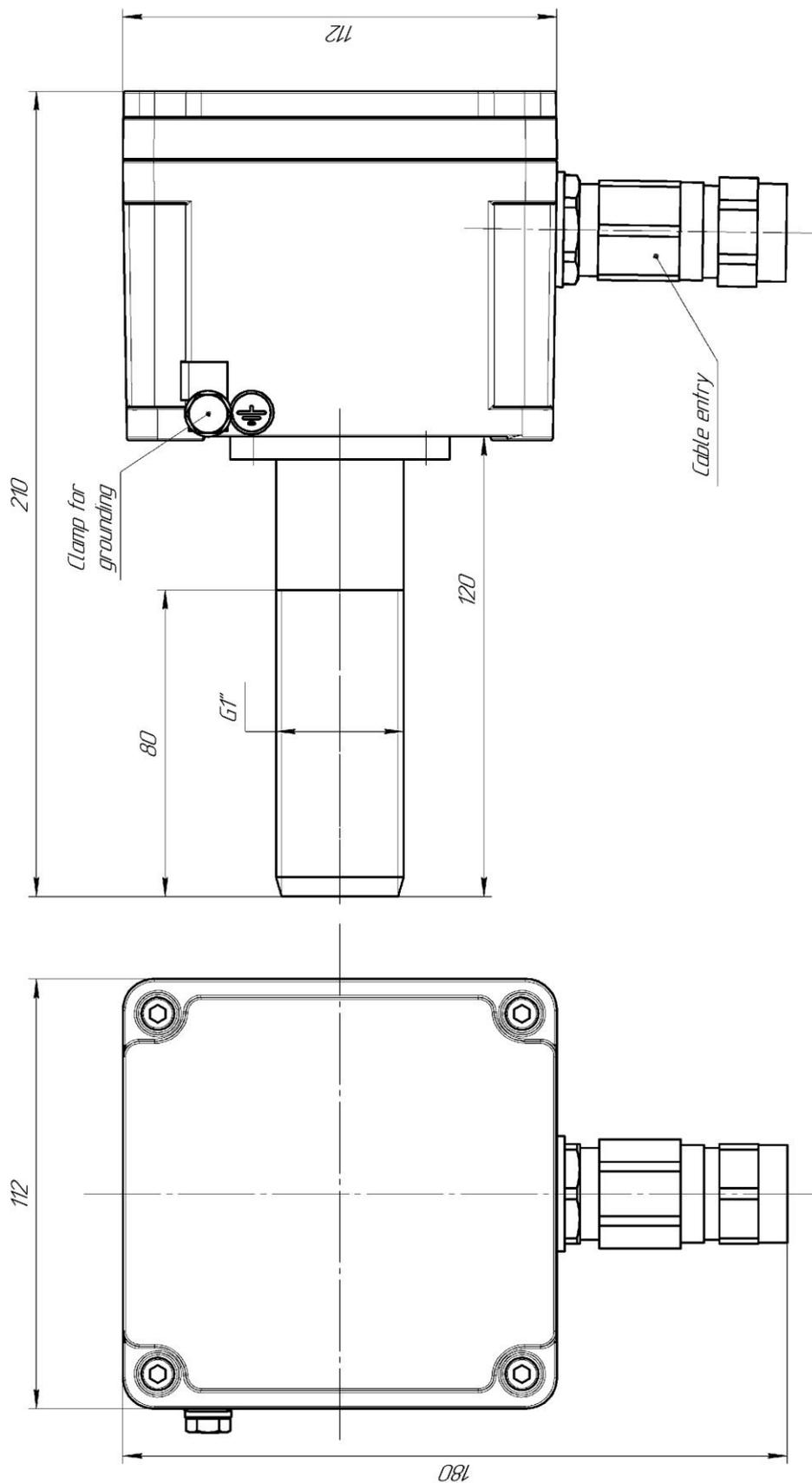
The rest of the time it shall be stored in the conditions of hard-wall heated rooms at a temperature of +5...+30°C and relative humidity up to 65% at a temperature of +25 °C.

### 14. Transportation

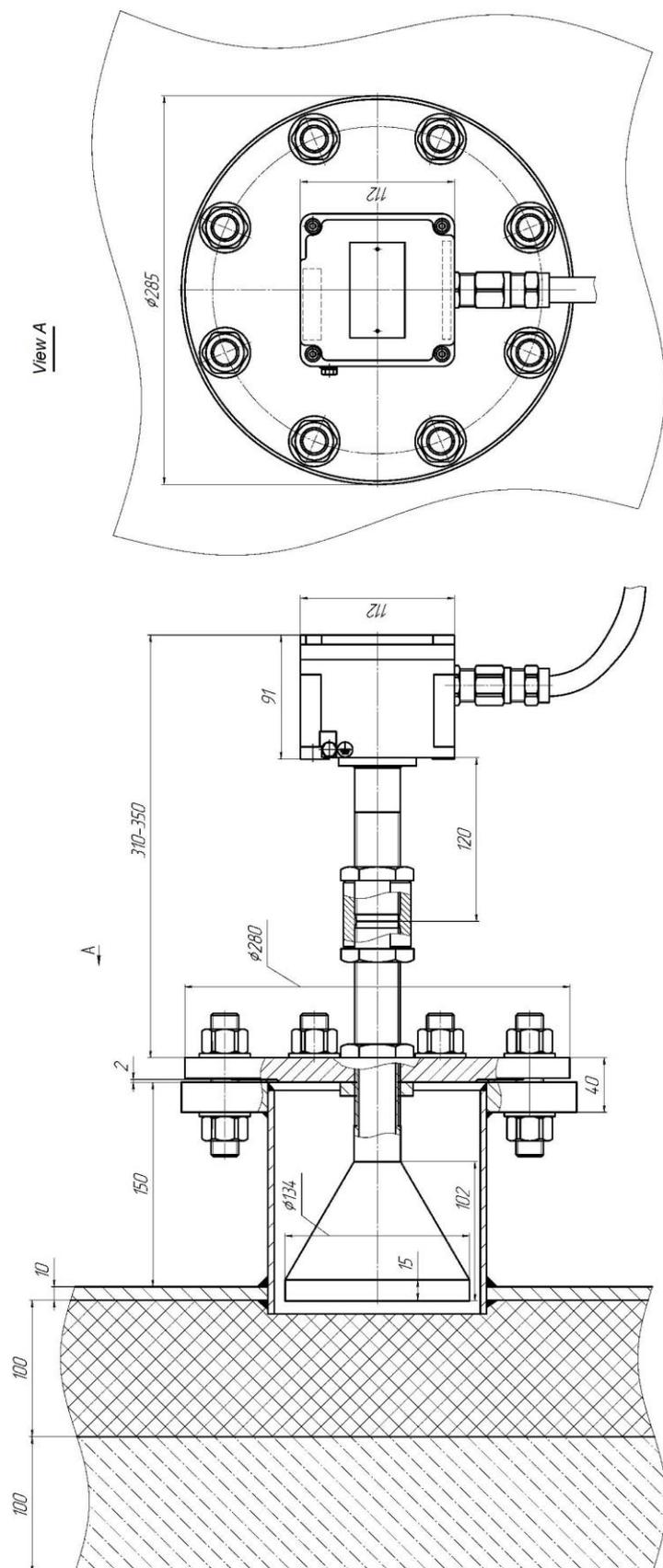
14.1 The barrier packed in a transport container can be transported by any means of transport in closed vehicles for any distance.

14.2 Boxes with packed barrier parts shall be secured on vehicles so that to eliminate the risk of box displacement or collision. Transportation is carried out in compliance with all precautions. It is prohibited to throw and turn over boxes with packaging.

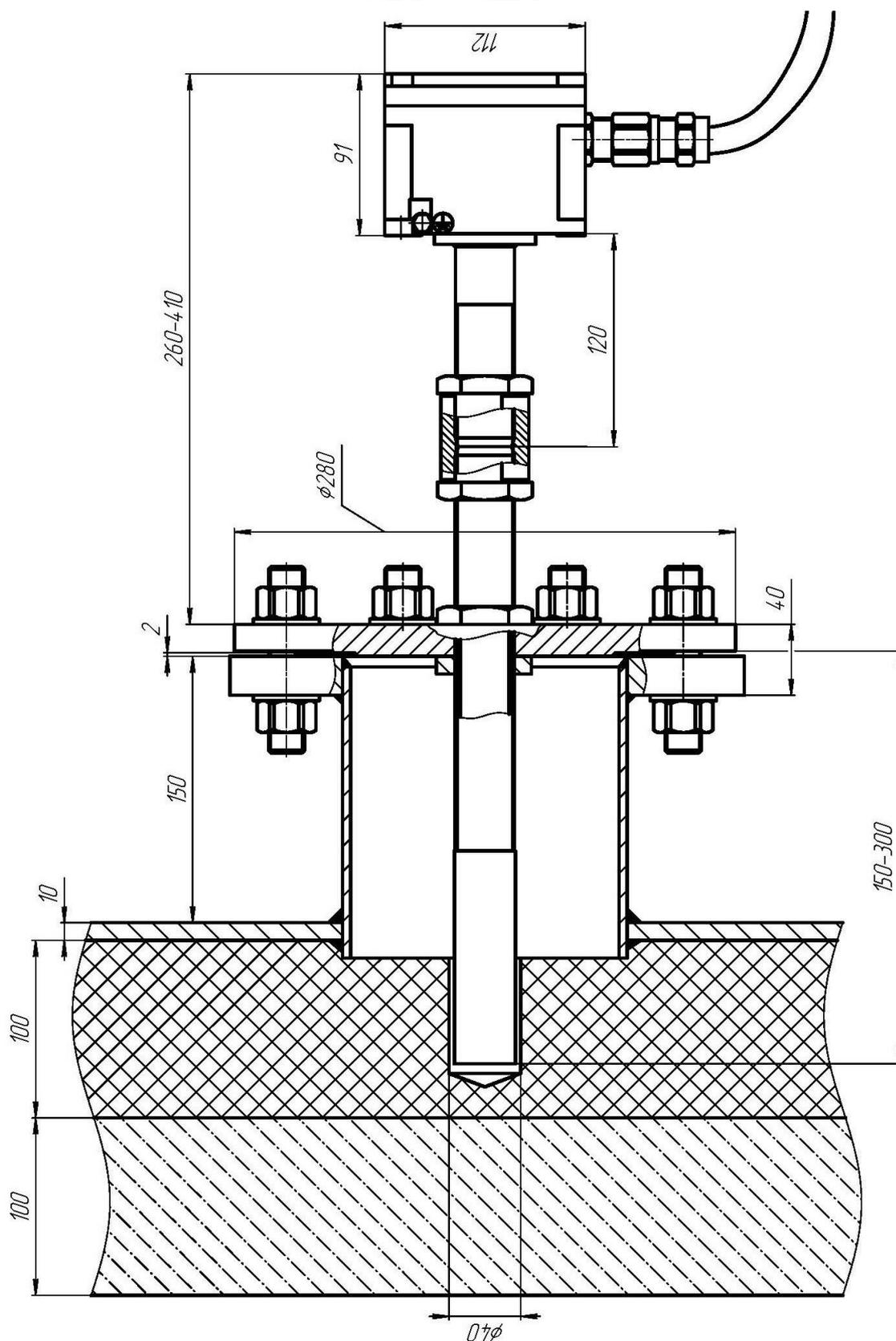
**Appendix 1. Drawing of the TR and RC units of the SIUR-03V2.5M barrier (2.51M)**



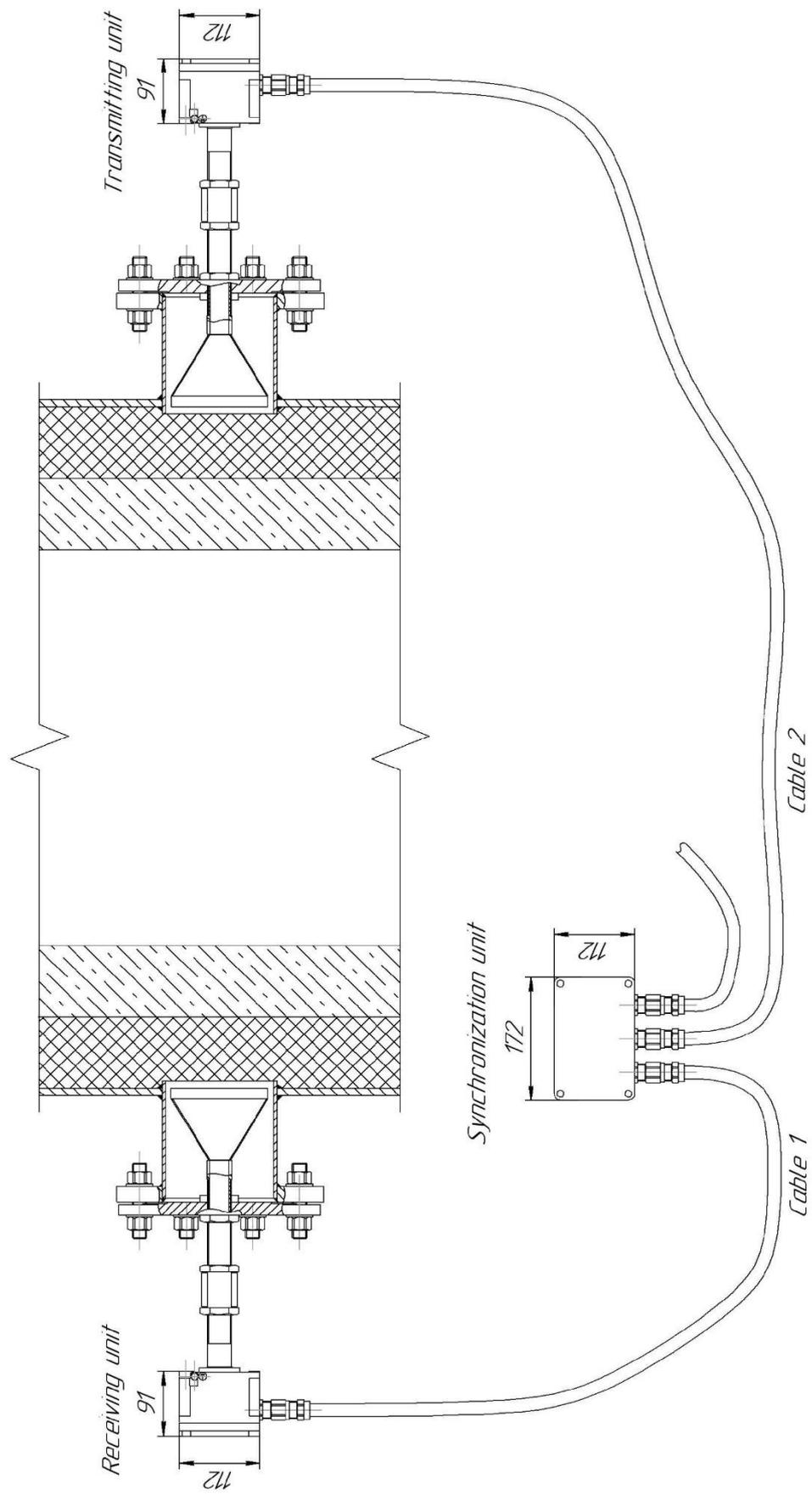
## Appendix 2. Drawing of securing TR and RC units with horn antennas to the wall of a concrete bunker



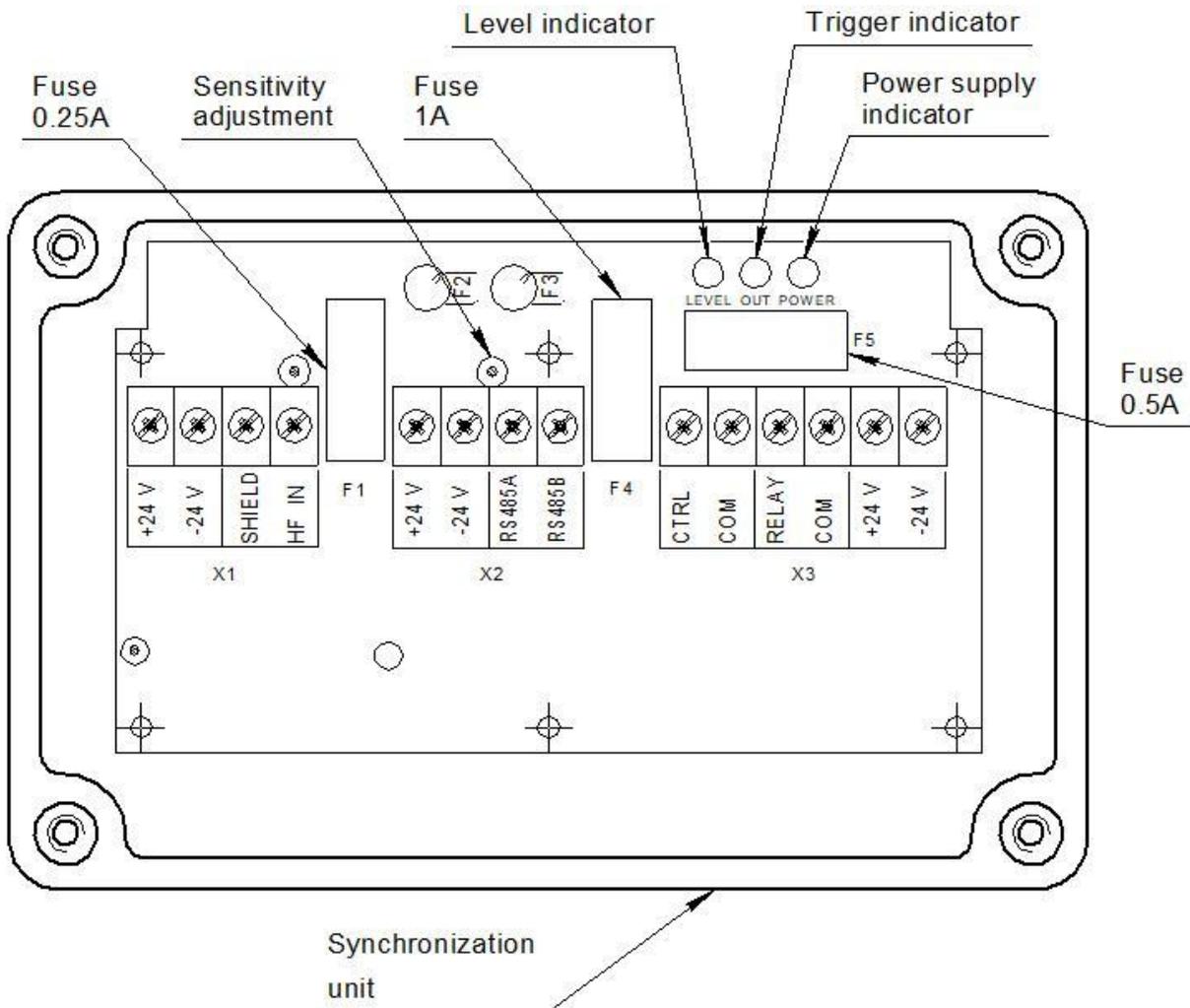
**Appendix 3. Drawing of securing TR and RC units with cylindrical emitters on the wall of a concrete bunker**



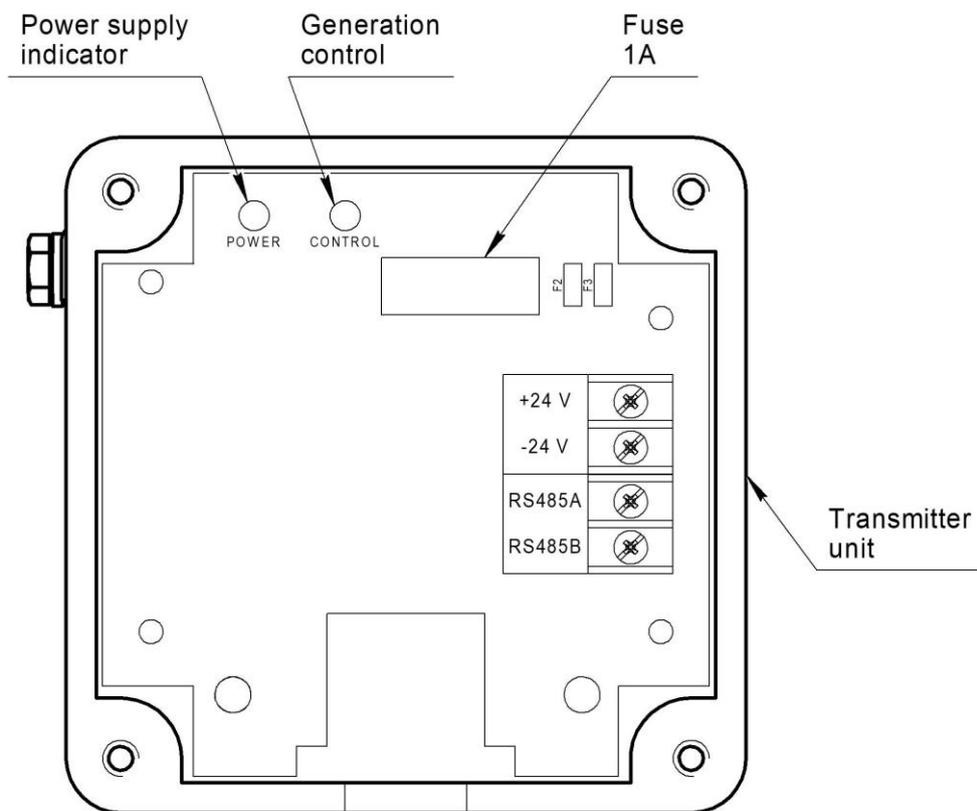
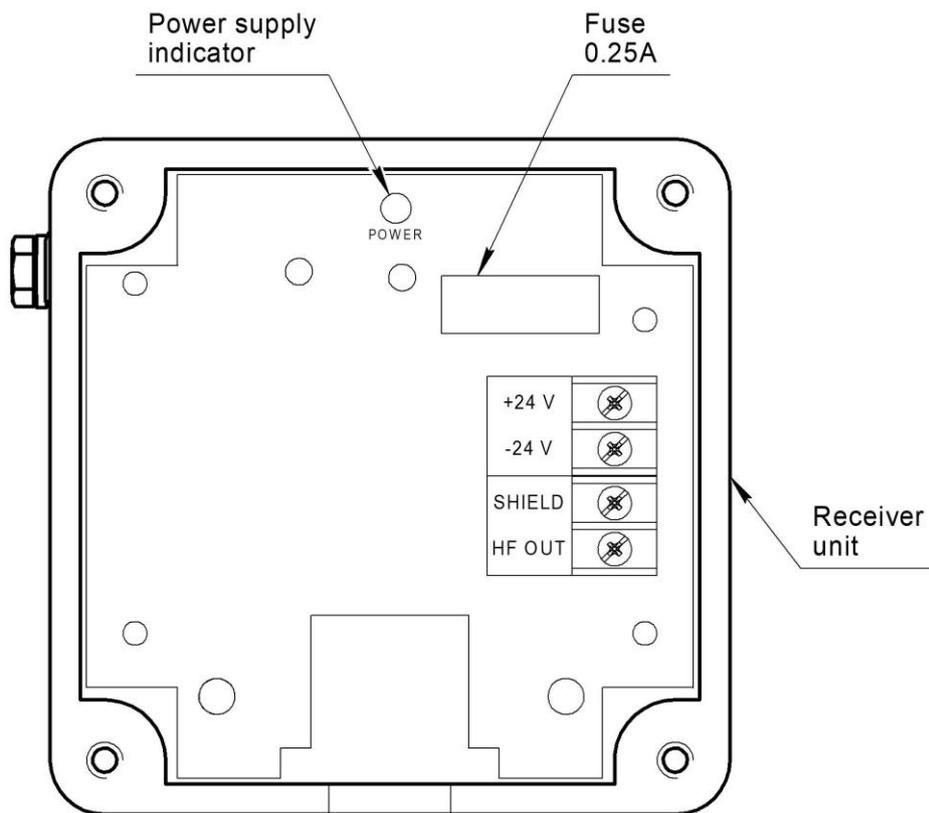
**Appendix 4. Layout of TR, RC and BS units of the barrier for level SIUR-03V2.5M (2.51M) on a bunker**



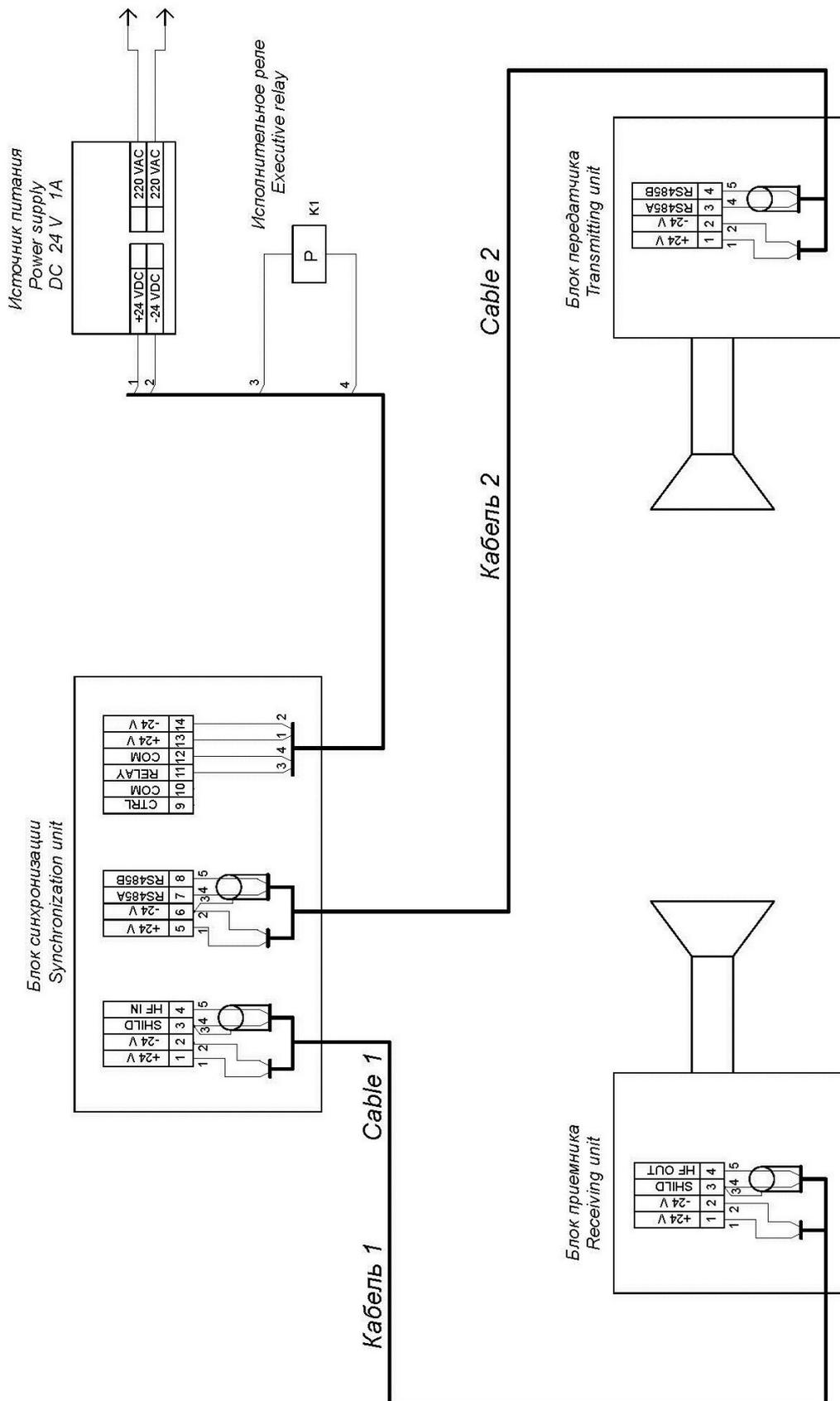
**Appendix 5. Main parts layout in the synchronization unit (BS) of the barrier for level SIUR-03V2.5M (SIUR-03V2.5 VIGT.407269.025)**



**Appendix 6. Layout of main components in the TR an RC units of the barrier for level SIUR-03V2.5M (2.51M)**



## Appendix 7. Wiring diagram of the barrier for level SIUR-03V2.5M (2.51M)



**Appendix 8. Appearance of the TR and RC units of the barrier for level SIUR-03V2.5M  
(2.51M) complete with horn antennas**



## Appendix 9. Wiring diagram of the barrier for level SIUR-03V2.5

