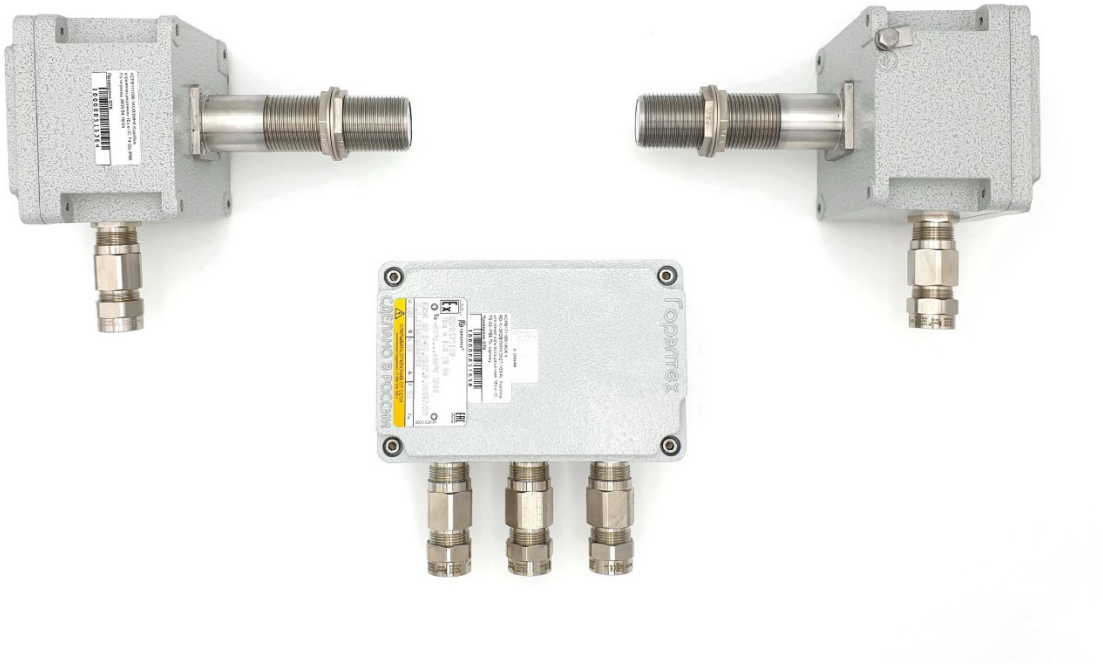
DESIGN BUREAU FIZELEKTRONPRIBOR

Russian National Product Classifier 42 1450

Barrier for Level
SIUR-03V2

Technical description and
operation manual
VIGT.407629.001-05 RE
(Rev. 10.3)



Samara, 2023

TABLE OF CONTENTS

1. Introduction

1.1 This technical specification and operating manual is intended for familiarization with the device, operating principle, rules of installation, preparation, testing, adjustment and service maintenance of the Radiowave Barrier for Level SIUR-03V2 (hereafter referred to as "barrier"), namely: SIUR-03V2.5M and SIUR-03V2.51M enhanced sensitivity designs.

1.2 Barriers correspond to Class III of protection against electric shock according to GOST 12.2.007.0-75. Barriers are designed for operation at the safety extra-low voltage (24 V), they do 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:

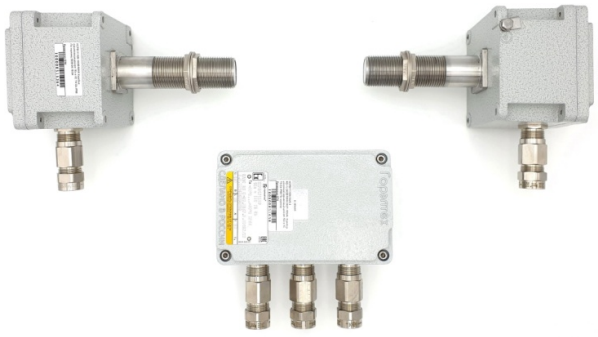
AN — antenna (emitter);
RM — receiver unit (receiving module);
TR — transmitter unit (transmitting module);
BS — synchronization unit;
SHF — super-high frequencies (microwave band);
SPTA — spare parts and accessories.

2. Purpose

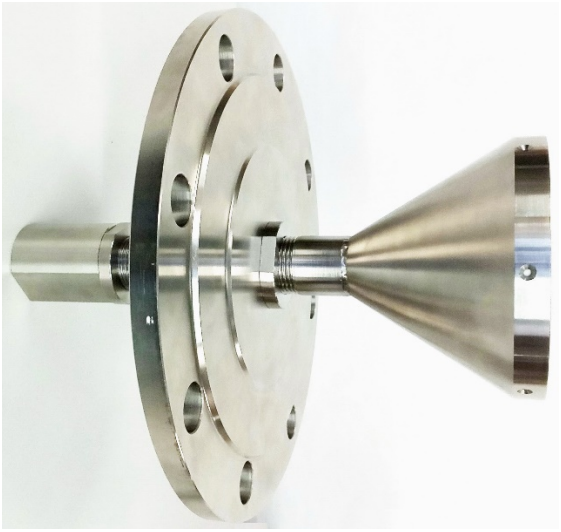
2.1 Barriers are intended for monitoring the threshold level of filling the bunkers (tanks) with bulk and liquid materials, and also can be used for monitoring of objects positioning (e. g. railroad cars, trucks on weighing platforms). The barrier may be used at high temperatures and under high dusty conditions.

2.2 Barrier for level design variants and their scope of supply are shown in Table 1.

Table 1

Barrier designation	Permissible temperature of unit housing	Design description
Barrier for Level SIUR-03V2 VIGT.407629.025 with an additional synchronization unit **(SIUR-03V2.5M)**	-25…+85 °C	 Barrier for level includes two units, RC and TR, with receiving and transmitting antennas, and a synchronization unit (BS). The scope of supply includes cables for connecting RC and TR units to the BS unit.
Barrier for Level SIUR-03V2 VIGT.407629.025-01 with an additional synchronization unit **(SIUR-03V2.51M)**	-45…+85 °C	

Samara Tel. +7 (846) 925-63-53, +7 (846) 359-17-01, +7-927-778-79-34
E-mail: info@fizepr.ru Website: http://www.fizepr.ru

Set of two horn antennas VIGT.407629.101-02, with flanges	Permissible temperature of antenna heating is up to +400 °C	 Horn antennas, flanges (DN150, PN10), couplings G1 and lock nuts G1 are made of 12X18H10T steel. Horn antennas are connected to the barrier's emitters with a coupling (threaded fitting) with 1" G thread (G1) and fixed with lock (clamp) nuts.
Set of two emitter pipes VIGT.407629.101-03	Permissible temperature of pipe ends heating is up to +400 °C	 Set of two probe pipes 370 mm long equipped with a ceramic plug at the end. Pipe length is agreed upon with the customer and may be changed according to specific application conditions. Pipe are connected to barrier antennas with a coupling (threaded fitting) with 1" G thread (G1), pipe material is 12X18H10T steel.

The barrier for level consists of three units: receiver (RC) and transmitter (TR) units, which are installed on the bunker walls, and a synchronization unit (BS). The synchronization unit provides high selectivity of a received signal, and also serves as a power supply for RC and TR units. Overall and coupling dimensions of RC and TR units are shown in Appendix 1. In Appendices 2–4 show options for installing the barrier on the bunker walls.

RC and TR units are equipped with antennas (emitters) designed in the shape of pipes with G1 thread (1" G thread in accordance with GOST 6357-81), capped with PTFE plugs. Antennas are made of 12X18H10T steel and are 115…120 mm long. Unit housings are sealed, the protection rating for the barrier units' enclosures against dust and water is IP66 (GOST 14254-2015). Barrier units are

equipped with the KOB1M sealed cable glands for the armored cable with an outer diameter of 9…17 mm, but these glands also allow for connecting the cable laid in a flexible metal conduit with a nominal diameter of 12 mm (e. g. in a RZ-TsKh-12 flexible metal conduit). The scope of supply includes cables for connecting RC and TR units to the BS unit. Cable length is agreed upon when ordering.

Probing microwave signal enters the bunker through holes in its walls. The holes must be made on the level to be monitored. Presence of material at a given level is determined by the attenuation of the probing signal when it passes from the transmitter module to the receiver module.

If the bunker walls are non-metallic (concrete, brick), it is also possible to install the barriers without making through-holes in its walls. At the same time, the attenuation of the probing microwave signal must not exceed the barrier sensitivity threshold. Decision to use the barrier without making holes may be made after the experimental test of the microwave signal attenuation value under the actual operating conditions. To enhance the barrier sensitivity, use horn antennas, which are better consistent with the probed medium and have a narrow beam in comparison to cylindrical antennas.

To reliably measure the bunker filling level, it is necessary that the probing microwave signal (emitted by the TR unit and received by the RC unit), when passing through a layer of the controlled material, is attenuated by power in 3…5 times or more compared to its attenuation in the empty bunker. The thicker the layer of material on the microwaves' propagation path, the more its attenuation. For some materials (e. g. sodium carbonate, cement) the microwave signal attenuation is low, thus for the reliable operation of the barrier with this material the controlled material layer must be several meters wide. On the other hand, when such material sticks to the antennas, even the comparatively thick layer (5...10 cm) will not lead to loss of barrier functionality. It allows for use of the barriers under the conditions when such material sticks on the sensor and bunker walls, which is relevant, for example, for cement storage bunkers. Take a note: allowed thickness of the stuck layer depends on the electrical conductivity and humidity of the controlled material. With high humidity or electrical conductivity, even a comparatively thin layer of adhering material may completely damp the probing signal, and in this case the barrier will not function.

It is important to note that a high environment temperature inside the bunker and the presence of dust do not affect the microwave propagation. The microwave signal easily passes through the open flame which allows using barriers to monitor the level of burning fuel in boilers.

Design of the SIUR-03B barriers is protected by RU 2631519 patent.

Example of barrier designation for ordering and in the technical documentation of other products:

SIUR-03V2 VIGT.407629.025 Barrier for level.

3. Specifications

Basic technical specifications of SIUR-03V2.5M (2.51M) barriers are shown in Table 2.

Table 2

Item No.	Parameter	Value
1	Maximum sensitivity: - maximum threshold microwave signal attenuation level corresponding to a filled bunker, dB - maximum threshold attenuation level corresponding to an empty bunker, dB ***Note:*** *threshold attenuation levels preset at the manufacturing plants are specified in the technical data sheet of the device and for some applications may differ from the specified maximum values*	 92 88
2	Output voltage, V - if the bunker is empty on the monitored level (microwave signal passes through the bunker with low attenuation level) with the 24 V power supply voltage, min - if the tank is filled on the monitored level, max ***Note:*** *the output switch is based on a p-type FET*	 23 1
3	Delay time of the output transistor switch, sec	3
4	Ambient temperature in the place of installation of RC, TR and BS units (permissible temperature of the units' housings during operation), °C - for SIUR-03V2.5M - for SIUR-03V2.51M	 -25 … +85 -45 … +85
5	Maximum permissible heating temperature of the antennas outer (emitting) end (provided that the ambient conditions in item 4 are met), °C,	+200
6	Hole sizes in the bunker walls, mm, min	Ø35
7	Working range of the probing microwave signal wave lengths, cm	3
8	Average strength of the probing signal, mW	50
9	Electrical load of the outer transistor switch, max, mA	150
10	Supply voltage (Usup) of the barrier (direct-current power supply), V - rated - maximum permissible - minimum permissible	 +24 +27 +20
11	Current consumption with the 24 V supply voltage, max, mA - receiver unit - transmitter unit - synchronization unit (total current excluding the current consumed by the external load)	 100 400 500
12	Dimensions of the RC and TR units (excluding antennas and cable glands), mm	110x110x90
13	Dimensions of the BS unit (excluding cable glands), mm	180x110x90
14	Dimensions of the antennas, mm - horn antenna (VIGT.407629.101-02) - cylindrical antenna (VIGT.407629.101-03)	 Ø135, L=280 Ø34, L=370
15	Degree of ingress protection for the barrier units in accordance with GOST 14254-2015	IP66
16	Weight of the units, kg - transmitter unit - receiver unit - synchronization unit	 1.5 1.5 1.9

4. Barrier design and operating principle

4.1 Barrier for level is a radio impulse microwave signal (microwave signals) receiver and transmitter device and consists of three units:

- transmitter unit (TR);
- receiver unit (RM).
- synchronization unit (BS).

4.2 Transmitter and receiver units with antennas are installed on the opposite walls of the tank on the monitored level. Waves (microwaves) are transmitted and received by antennas through the bunker walls.

The TR unit, transmits a microwave signal to the bunker through an antenna connected to it. The signal passes through the RC unit's antenna to the receiver where it is converted into a data signal. The presence or absence of bulk material at a controlled level in the bunker is determined by the degree of absorption of the microwave signal on the path from the transmitting antenna to the receiving antenna.

4.3 The TR unit has a microwave modulator and a voltage stabilizer with +11 V output voltage. Gunn effect microwave oscillator generates RF pulses with the pulse power of 100 mW with a carrier frequency in the 3 cm wavelength range (approximately 10 GHz). There are two LEDS installed in the transmitter unit; they allow monitoring its operation. One LED is connected to the +24 V input supply circuit and lights up when the supply voltage is applied. The second LED allows monitoring the microwave oscillator operation.

4.4 RM unit is a microwave signal detector receiver which includes: microwave detector, video signal amplifier with a frequency from 60 to 80 kHz and supply voltage stabilizer with +12 V output voltage.

The synchronization unit (BS) includes:

- synchronizing clock for RC and TR units;
- synchronous detector;
- comparator determining the output transistor switch actuation threshold level;
- integrator providing the delay time of 3 sec;
- output *p*-channel FET switch, the source of which is connected to the +24 V power bus.

Barrier for level sensitivity may be adjusted with a trimmer resistor in the BS unit (see Appendix 5).

4.5 The barrier operating principle is as follows:

When there is no bulk material at the controlled level, the microwave signal passes from the TR transmitter to the RC receiver with a low attenuation, at the same time, the output transistor switch of the BS unit is open and its output voltage is equal to the power supply voltage (+24 V). When the tank is filled with bulk material to a level at which the material blocks the microwave signal beam, the received signal amplitude is attenuated and the output transistor switch of the BS unit is locked.

Barrier sensitivity (threshold microwave signal attenuation level) is adjusted with a trimmer resistor located on the lower circuit board under the BS unit's cover. For its adjustment, there is hole at the upper circuit of the BS unit for inserting a screwdriver (see Appendix 5). When the barrier is factory preset the specified resistor is set into the position corresponding to the assumed attenuation level in accordance with the use conditions agreed upon with the customer. Values of preset threshold attenuation are specified in the technical data sheet of the device. Barrier for level sensitivity may vary from 50 to 90 dB and is set at the beginning of the barrier operation for the specific use conditions.

Note: *50 dB attenuation level corresponds to a distance between the receiver and transmitter in open space and is approximately 12 m. 90 dB attenuation level corresponds to a distance between the receiver and transmitter and is approximately 1,200 m.*

Threshold microwave signal attenuation levels when the output transistor switch of the barrier is turned on or off differ by about 3...4 dB which allows preventing the false actuation of the barrier when the bunker is being filled and when the filling material blocks the microwave signal beam. Time delay of the output stage switching over is used to achieve the same goal and is about 3 sec. Specified delay also allows reducing the turn-on frequency of electromechanical devices controlling the bunker filling.

4.6 For easier setup of the barrier, the upper circuit board of the synchronization unit has two LEDs (see Appendix 5).

One LED connected to the +24 V input supply circuit lights up when the supply voltage is applied. The second LED is two-colored and contains two light elements. When the microwave signal level at the receiver input is strong enough, this LED is green. The stronger is the microwave signal, the brighter the LED light. After the set delay time (3 sec), when the output stage is activated, the second element (red) of this LED switches on and as a result, the LED light becomes yellow. When the microwave signal beam is blocked, the brightness of this LED's green element starts to decrease until it disappears. In 3 seconds after reaching the lower threshold, the output transistor switch and the LED are switched off at the same time.

4.7 The RC and TR units are identical in arrangement, dimension sizes and coupling dimensions. A housing with a cover is the basic structures of every unit. The housing contains:

- microwave oscillator (in the TR unit);
- microwave detector (in the RM unit);
- circuit boards of low frequency devices.

Unit's cover is fastened to the housing with screws, and sealing is provided with rubber gaskets.

4.8 Dimensions of RC and TR units of the barrier are shown in Appendix 1. Figure in Appendix 4 shows the barrier arrangement in the reinforced concrete bunker. Appendix 7 has the barrier connection diagram.

5. Labeling and sealing

5.1 The following signs and inscriptions are applied to the unit housings: name and type of the device, unit type (RC, TR and BS), sequential number in accordance with the manufacturing company numbering system, year of manufacture.

5.2 To prevent unauthorized opening, seals may be installed inside the RC, TR and BS units.

6. Containers and packaging

6.1 Containers and packaging are designed for storage and transportation of the barrier and provide its safety during storage and transportation.

6.2 Barrier for level units, parts and components included in the scope of supply, spare parts and accessories and operating instructions must be put into the container.

6.3 Operating instructions are wrapped in the polyethylene film.

6.4 The shipping package must include a packing list with designation and quantity of the shipped products.

7. General operating principles

7.1 Unpacking rules

7.1.1 Upon receiving, the shipping package with the barrier must be visually inspected in the presence of a person responsible for its transportation. It is necessary to make sure the container is completely intact. If the container is damaged, a report must be drawn up and signed by persons responsible for transportation and acceptance, certified by the seal and sent to the transportation organization.

7.1.2 In cold months, the containers may be unpacked only after they were held in the warm room at temperatures above +18 °C.

7.1.3 Once the containers unpacked compare the packages contents with the packing list. Name, designation, sequential number and quantity of the products must comply with the packing lists.

7.2 Inspection rules

7.2.1 During the visual inspection, check the condition of the barrier units' housings, their integrity and the absence of damage. The product must have no scratches, cracks, nicks, instances of corrosion or other defects which may be discovered during the visual inspection.

7.2.2 All defects and non-conformities discovered during unpacking, visual inspection and completeness check must be documented in the certificate of defect signed by persons responsible for the barrier acceptance, approved by the director of the customer company and sent to the manufacturing company.

7.3 Connection rules

7.3.1 The barrier must be powered from the general-purpose stabilized direct-current voltage source with output voltage from 23 to 25 V (permissible supply voltage limit values are from 20 to 27 V). Barrier for level readiness for operation time after voltage supply must not exceed 2 min.

7.3.2 Galvanic separation of output circuits of the 220 V mains power source must be rated for at least 500 V.

7.3.3 To prevent the mains voltage from entering the barrier housing in emergency (in case of power supply failure), it is recommended to connect the
-24 V output power supply to the grounding bus, and install electronic units' housings on metal supports connected to the grounding bus.

7.3.4 Length of the power cables to the BS unit and the cross-section of their conductors must be selected so that at the maximum current of 600 mA the voltage drop on the conductors does not result in decrease of the operating voltage below the limit level of 20 V. Own energy consumption of the barrier (without taking into account the actuator consumption power) does not exceed 15 W.

The RC and TR units are connected to the BS unit with special cables included into the scope of supply (see Appendix 4).

7.3.5 Electric relays or other electrical devices designed for operating voltage of 24 V and current consumption of up to up to 150 mA can be used as a data receiver (actuator).

8. Safety precautions

8.1 The barrier must not be operated if the 24 V external power supply is not grounded.

8.2 The output of -24 V power supply should be connected to the ground bus as an additional safety measure.

8.3 The barrier must not be operated when the covers are removed.

8.4 Only persons who have studied this technical specification and operating manual and who have passed the safety training for operation of electrical installations and radio-electronic equipment must be allowed to install (dismantle), operate, maintain and repair the barrier.

8.5 All types of technical maintenance, repair and installation related to re-soldering of electrical and radio elements, arrangement of soldered connections of cables, replacement of failed components, elimination of broken wires, etc., and disassembly of the barrier must be done only when the barrier is isolated.

8.6 No operation of the barrier is allowed with poorly fixed lead wires and removed covers.

9. Installation rules

9.1 While installing and assembling the barrier, the safety regulations listed in Section 8 hereof and in regulatory documents applicable in the Customer enterprise must be strictly followed.

9.2 The barrier that was technically tested in accordance with the method of Section 11 is delivered for on-site installation.

9.3 At the first stage, select places for transmitter and receiver units' installation. In doing this, the accessible operating conditions must be taken into account. Places of installation and fixing of the barrier components must be prepared according to the overall and installation dimensions of the units.

9.4 RC and TR units of the barrier can be directly installed in holes of the tank walls. They can be fixed to bushings with G1 thread and flanges welded in the holes as shown in Appendices 2 and 3. In case of vibrations, the units are fixed on the brackets next to the holes. The units fixed on the brackets can also be fastened to antennas, as well as using lugs with holes 6 mm in diameter located on the unit housings. The BS unit is fastened using lugs with holes 6 mm in diameter.

Note: *while installing the SU units, the similar polarization of the transmitting and receiving antennas must be ensured. To do this, the housings of the RC and TR units must be rotated around the antenna axis so that the unit cable glands are in the same plane, i.e. as shown in Appendix 9.*

9.5 When the barrier is installed next to the tank holes (without direct contact with the tank walls), the possible distance between the emitting surface of the antenna and the wall is determined by the size of the wall hole. The greater is the hole, the greater is the distance to the antenna end without losing the microwave signal strength. In any case, the hole must have a diameter of at least 35 mm, and the antenna must be placed relative to the hole so that the hole edges do not cover the emitting aperture of the antenna.

Note: if there is a gap between the barrier antennas and a bunker wall, a part of the probing microwave signal (parasite signal) will be propagated outside the bunker. With the barrier sensitivity set to the maximum, the parasite signal will result in the barrier failure. Thus, if it is necessary to ensure the operation of the barrier with maximum attenuation of the microwave signal, the RC and TR units must be installed on the bunker walls using a flanged pipe as shown in Appendices 2 and 3. The RC and TR units can be installed with a gap when the maximum sensitivity of the barrier is not required.

9.6 When installing several barriers close to each other, the direct effect of a microwave signal from one barrier oscillator to the receiver from another set must be excluded. To do this, they must be arranged so that the distance between the TR unit of one barrier and RC unit of another barrier is the greatest. It is also recommended that closely spaced sets of barriers be installed so that their radiation planes are mutually orthogonal (see note to section 9.4).

To detect parasitic coupling between barriers, alternatively de-energize the TR units of every set and simultaneously monitor how this affects the signals at the control outputs of both RC units. Use a DC voltmeter (multimeter in voltage measurement mode) to test it. In doing this the voltmeter

negative output must be connected to the COM terminal, whereas the positive one must be connected to the CTRL terminal (see Appendix 5).

If several sets of barriers must be installed in one place (the same bunker), it is recommended to use barriers with spaced (different) modulation frequencies (modulation frequency range is 60 to 80 kHz and is indicated in the barrier certificate). While ordering the barriers installed at the same place (same bunker), the requirement to modulation frequency diversity must be specified.

9.7 When the units are installed, lay cables between the barrier units, and cables to the supply source and actuator (relay). Then, connect the barrier according to the connection diagram show in Appendix 7 and according to the layout drawing of the Customer enterprise.

10. Preparation and working procedures

10.1 The barrier must be serviced by an operator who is familiar with the operation of the electronic equipment, has studied the technical specification and operating manual, passed the safety training for operation of radio- and electrical equipment.

10.2 Before the barrier installation on the tank, employees responsible for installation and operation of the barrier must simulate attenuation of the microwave signal and learn how to control this attenuation value by the voltage at the barrier control output. To do this, the RC and TR units must be located opposite each other at a distance of 4–6 meters, and so that the planes of polarization of the units' microwave signal coincide (cable entries of the units must be parallel). Then it is necessary to follow the instruction below. It is also recommended to watch the training videos on the Design Bureau FIZELEKTRONPRIBOR's website: https://fizepr.ru/

10.3 Work preparation is done in the following sequence:

10.3.1 Remove covers from RC, TR and BS units.

10.3.2 Make sure that the connections between the units are performed properly and safely in accordance with the wiring diagram (see Appendix 7) and also check the connections to the power supply and actuator (relay).

10.3.3 Before connecting the barrier to the power source, check the power supply voltage with a voltmeter. It must not exceed +23...25 V.

10.4 Switch on the power supply. In the oscillator unit (TR), power and generation LED indicators must be on. The receiver (PM) unit must have power control indicators on. Then the covers of the TR and RC units can be closed.

10.5 When switching on for the first time, make sure that the barrier sensitivity level set by the manufacturer corresponds to the specific application.

A prerequisite for performing this operation is the absence of loaded material and any other obstacles between the transmitter and receiver antennas.

Note: *the directional pattern of microwave antennas is very wide (at least 30 °). Thus, there is no need to have an exact antenna orientation along the same line and a shift of 1…2 ° is permissible.*

Sensitivity is controlled as soon as all operations related to installation and attachment of units are over. If the receiver receives the transmitter signal, the CTRL LED in the BS unit is on (green or yellow). Moreover, when a microwave signal appears, the LED is first green, and then, when the threshold level is reached and in 3 sec, it turns to yellow (green + red). When the microwave beam is blocked, the brightness of the green element will get decreased until its complete disappearance. When the microwave signal intensity is decreased until the threshold with a delay of 3 s, the output transistor switch is turned off and the LED is completely off.

When the microwave signal is absent (including when the TR unit power is off), the CTRL control output voltage of the TR unit must not exceed 1 V.

When the strength of the received microwave signal is increased, the control output voltage is increased. With increasing the voltage, the brightness of the green element is growing. The barrier is on (red light is on) when the control output voltage is about 7 V. With a further increase in the microwave signal, the voltage increases to a saturation voltage of 10.6 V.

When the strength of the received microwave signal is decreased, the control output voltage is decreased. Green CTRL LED looks less bright at the same time. When the control output voltage of the BS unit is less than 3.5 V, the output transistor is off (and at the same time the red element of the LED is turned off). Thus, the threshold voltage for turning on the output stage is 7 V, whereas the threshold voltage for turning off the output cascade is 3.5 V.

As experience in operating the barriers shows, when installing the barriers on the tank, in most cases it is not necessary to change the settings made by the manufacturer. LEDs are enough to monitor the operation. Nevertheless, the barrier provides the ability to control the microwave signal attenuation by the output voltage of the synchronous detector. Use a DC voltmeter (multimeter in voltage measurement mode) to test it. In doing this the voltmeter negative output must be connected to the COM terminal, whereas the positive one must be connected to the CTRL terminal (see Appendix 5). When the tank is not filled in, the voltage must be within 7.2...10 V, when the tank (no microwave signal) is filled in, the voltage must not exceed 3 V.

10.6 If the barrier sensitivity is too high (control voltage is always higher than 7 V), it must be decreased. The sign of too high sensitivity is following: when the tank is filled in, the output transistor of the barrier will turn off with an excessive delay or will not turn off at all. In case of an increased sensitivity, both the probing signals propagating along the line between antennas and microwave signals repeatedly reflected from the bunker walls are received. If the sensitivity is not sufficient and the control voltage is always lower than 7 V (when the tanks are not filled in), the sensitivity must be increased using the trimmer resistor (see Appendix 5).

If increasing the sensitivity using the trimmer resistor does not result in increase of the control voltage, this means that the microwave signal attenuation is unacceptably high. In this case, it is necessary to make through holes in the concrete wall of the tank, or use horn antennas (see Appendix 4).

10.7 To adjust the sensitivity, the trimmer resistor inside the BS unit must be set (see Appendix 5). To do this, use a small screwdriver to rotate the resistor terminal: clockwise rotation increases the sensitivity, counterclockwise rotation decreases it.

To prevent the reception of multiple reflections of microwave signal from walls inside the bunker, the sensitivity cannot be set too high, but at the same time, it must be sufficient enough for stable and reliable reception of the signal passing along the line between the antennas. To achieve an optimal sensitivity value, rotate the resistor slider to select a position at which the control voltage exceeds the trigger threshold limit of 7 V but is still below the saturation voltage of 10.6 V. The voltage of 7.2...8 V is optimal.

11. Maintenance check

The list of main checks of the technical conditions is presented in Table 3.

Table 3

Types of checks	Specifications
1. Checking the grounding with an ohmmeter	The standard for the value of the transition resistance of wires and grounding contacts, determined according to the regulatory documents applicable at the Customer enterprise and according to the electrical installation code.
2. Checking the barrier current consumption	The value of consumed current must vary within 400...600 mA.
3. Checking the supply voltage	When the barrier is on, the DC voltage on power supply output terminals must be within 23...25 V.

12. Troubleshooting

12.1 The discovered faults can be eliminated only when the barrier is disconnected from the power supply.

12.2 When replacing failed circuit elements, strictly follow the instructions in Section 13 hereof.

12.3 The failed circuit elements must be replaced and the barrier operation after elimination of the fault must be checked by the maintenance operator.

12.4 A list of typical faults is given in Table 4.

Table 4

Fault name, external and additional signs	Probable reason	Method of elimination
1. Power LEDs do not light up when the barrier is energized. Additional signs: - power supply voltage at the input of the communication line power lead is 24 V; - there is no current in the power circuit of at least one of the units.	Wire is broken and fuse is blown	The fault must be eliminated in accordance with the applicable rules.
2. When the voltage is applied to the barrier, the power LEDs are off. Additional sign: the supply circuit current is over 600 mA.	Short circuit in the barrier power circuit	
3. When the tank is empty, the barrier displays that the filling level exceeds the control level (i.e., the microwave signal level is too low).	Power failure. The TR and RC units are not properly installed, for example, the units are turned around 90° relative to each other, or their antennas are not directed at each other, or the set sensitivity level is too low.	Make sure that the TR and RC units are installed properly. In case of a proper installation, the TR and

4. When the tank is filled in, the barrier shows that there is no filling (i.e., the received microwave signal is too high).	a) The TR and RC units are not properly installed or the sensitivity level is too high. b) There is a gap between antennas and holes in the bunker walls through which the parasitic microwave signal goes and propagates outside the bunker. c) The barrier microwave signal does not propagate along a straight line inside the bunker that connects the TR and RC units, but propagates due to multiple reflections from the walls inside the bunker.	RC units must be dismantled and checked in accordance with section 10.5. Sensitivity must be adjusted in accordance with section 10.6.

13. Storage rules

The rules of barrier storage and transportation are in accordance with GOST 15150-69 groups 3 and 5, respectively.

13.1 The barrier components in the manufacturer's packaging, depending on the shelf life, can be stored in heated or unheated hard-wall premises, when the air does not contain vapors of acids, alkalis and other harmful substances that cause corrosion.

13.2 The shelf life of the barrier in the manufacturer's packaging is 1 year. Moreover, in unheated hard-wall premises at a temperature of -40 ... +50 °C and a relative humidity up to 80 % at a temperature of +25 °C the shelf life is 3 months. The rest of the time, it is stored at heated hard-wall premises at a temperature of +5... +30 °C and a relative humidity of up to 65 % at a temperature of +25 °C.

14. Transportation

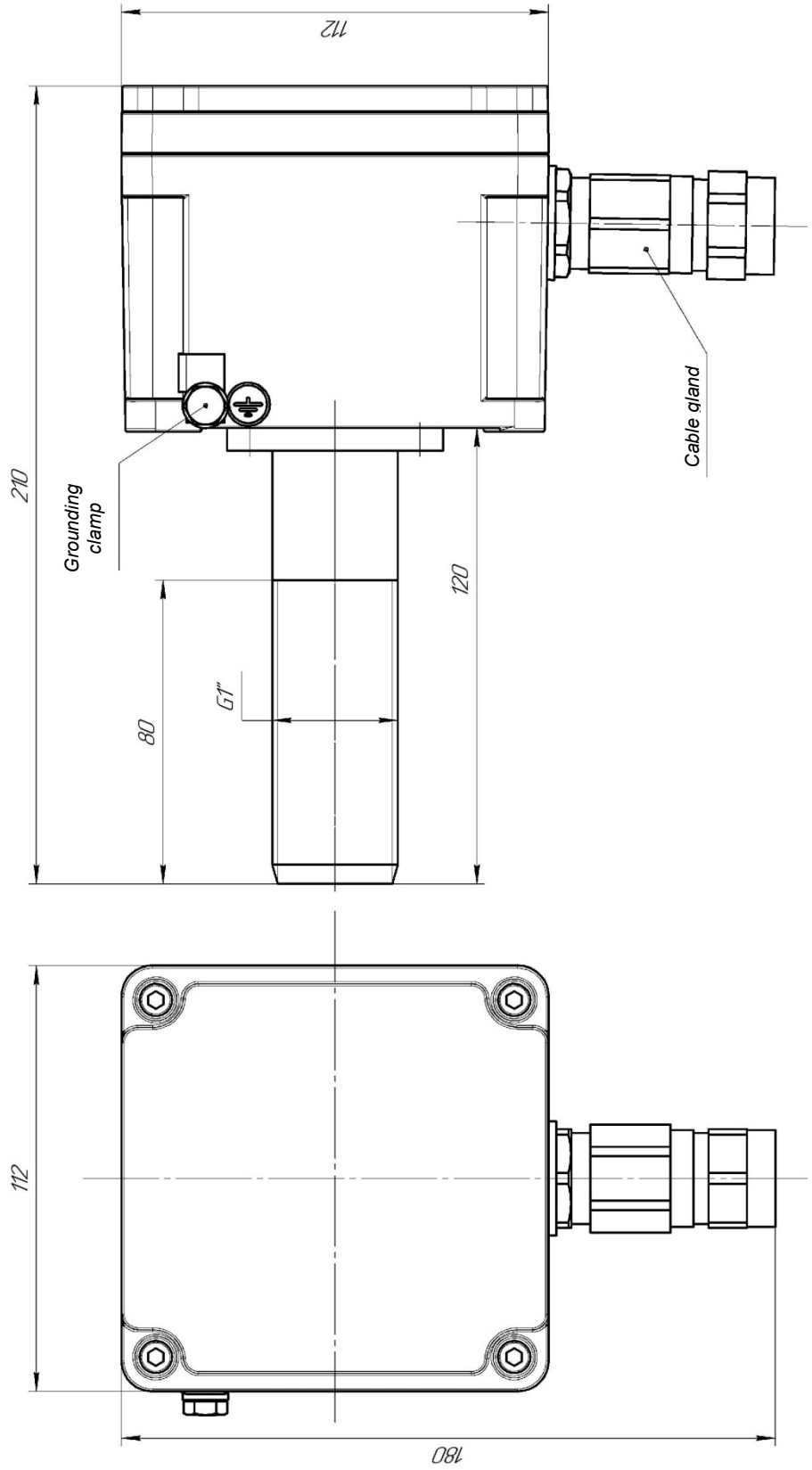
14.1 The barrier in a transport package can be transported by any means of transport in closed vehicles over all distances, including by plane. The barrier does not contain batteries, explosive or flammable substances, sources of ionizing radiation, as well as pressure vessels.

14.2 Cases with packed parts of the barrier must be secured in vehicles so to exclude the possibility of case displacement and collision. It must be transported with all the precautions. The packed cases must not be dropped or tilted.

15. Warranties

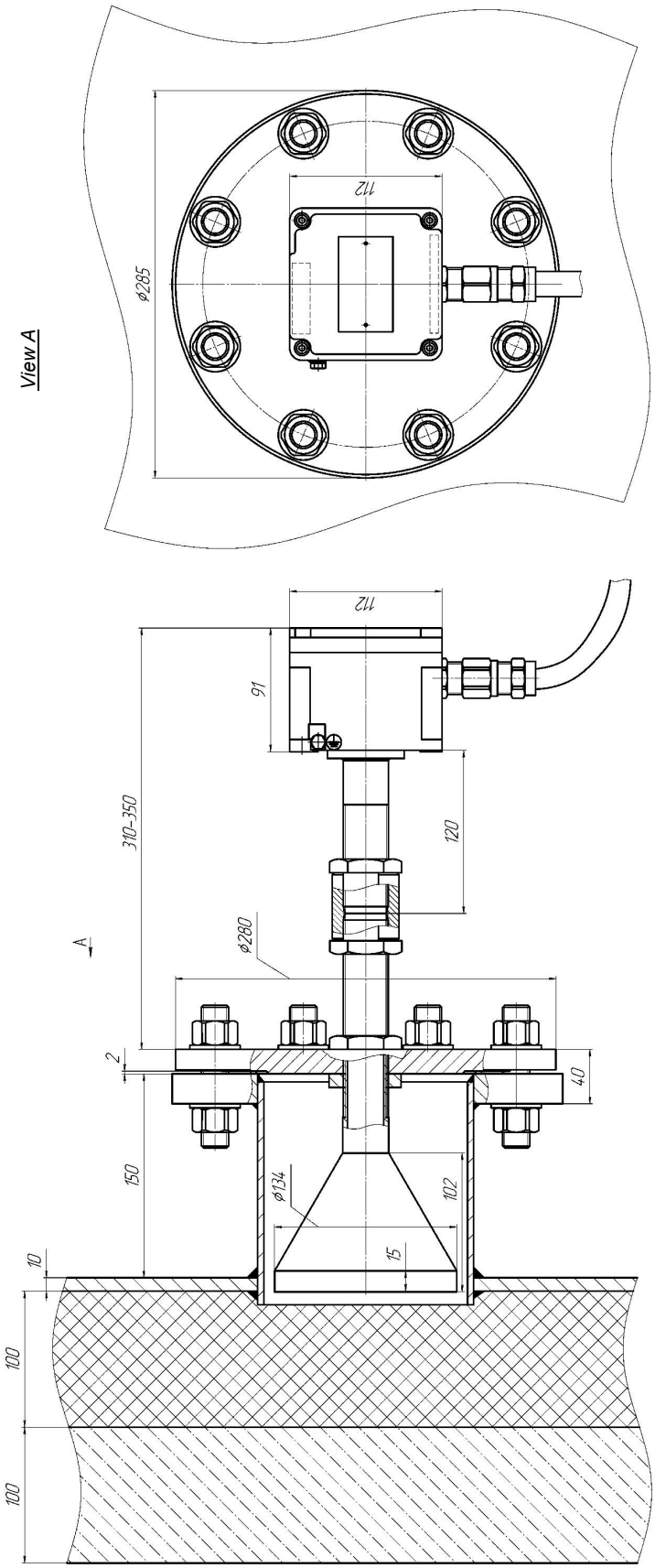
The barrier warranty period is 24 months from the date of shipment to the customer. If the barrier fails during the warranty period, the manufacturer undertakes to repair it at its own expense. Mechanical damage, as well as use of the barrier in conditions other than those specified in this operating manual, completely voids the manufacturer's warranty obligations.

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

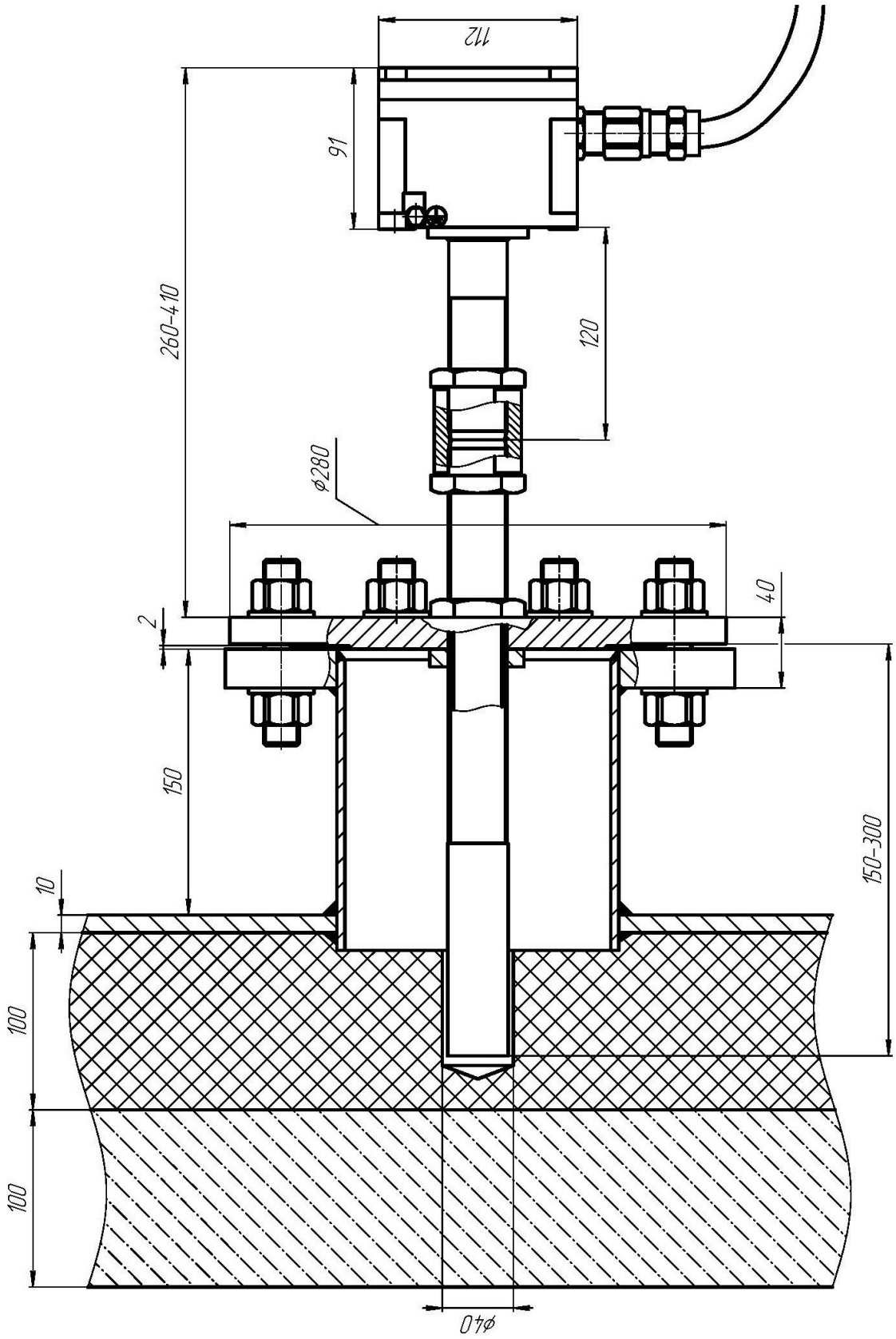


Samara Tel. +7 (846) 925-63-53, +7 (846) 359-17-01, +7-927-778-79-34
E-mail: info@fizepr.ru Website: http://www.fizepr.ru

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

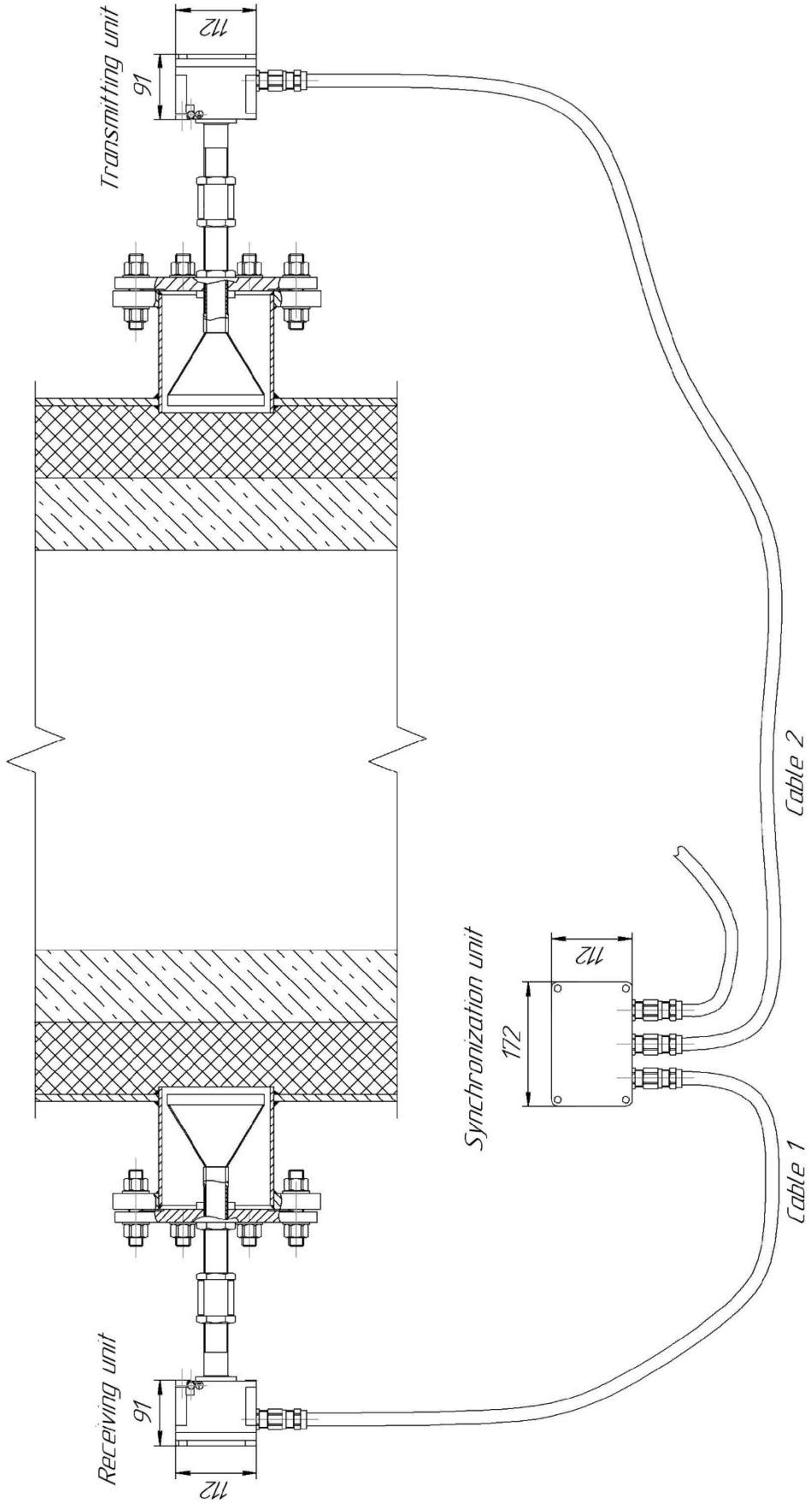


Appendix 3. Drawing of securing TR and RC units with cylindrical emitters on the wall of a concrete bunker

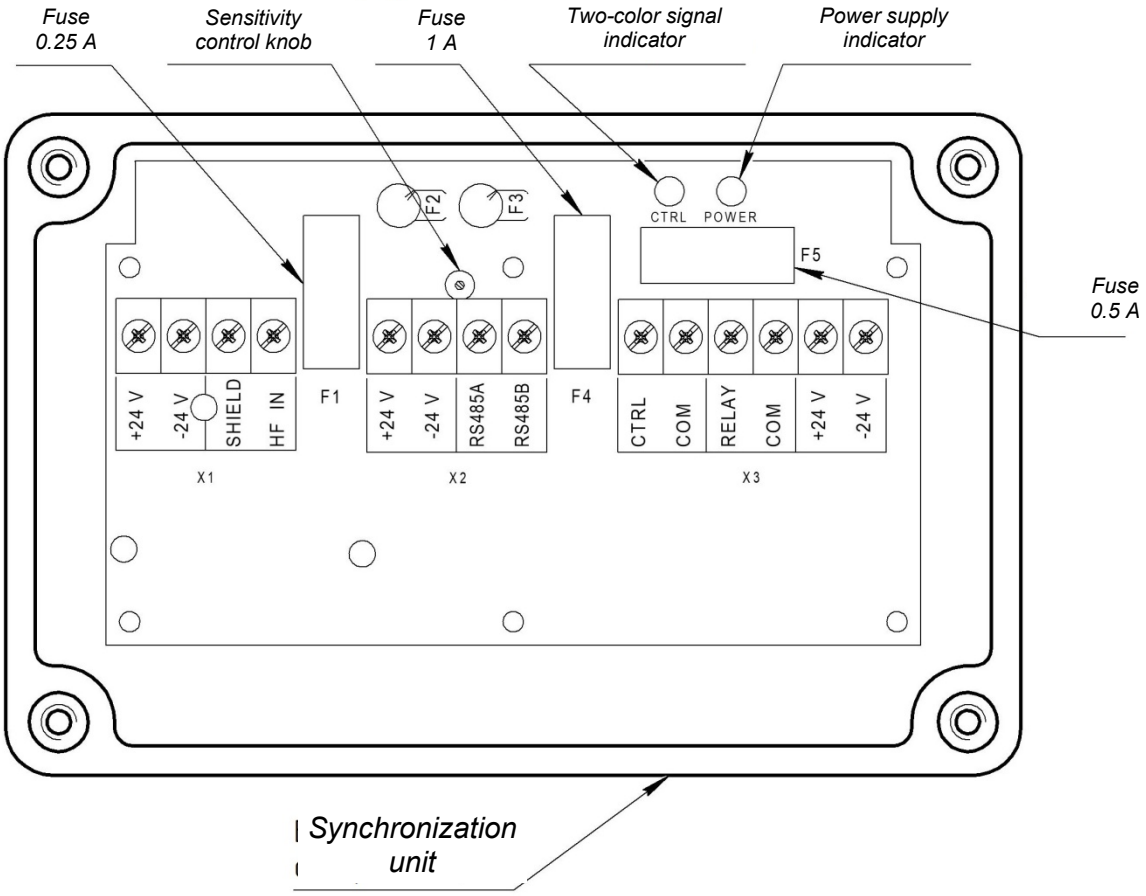


Samara Tel. +7 (846) 925-63-53, +7 (846) 359-17-01, +7-927-778-79-34
E-mail: info@fizepr.ru Website: http://www.fizepr.ru

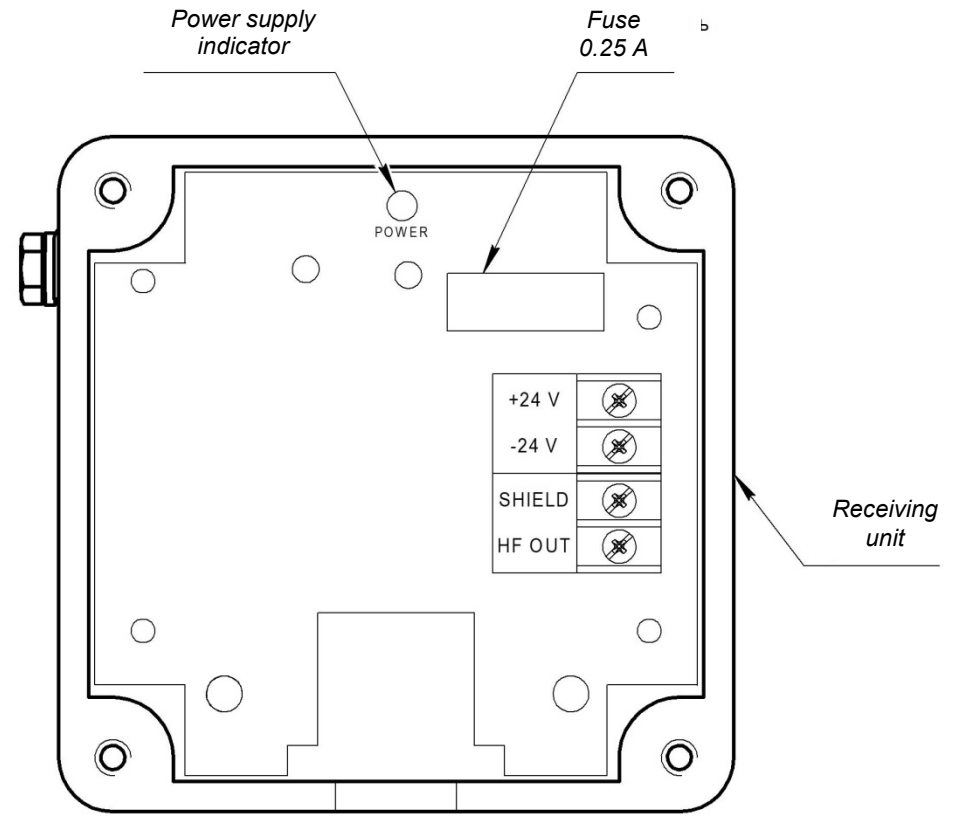
Appendix 4. Layout of TR, RC and BS units of the barrier for level SIUR-03V2.5M (2.51M) on a bunker

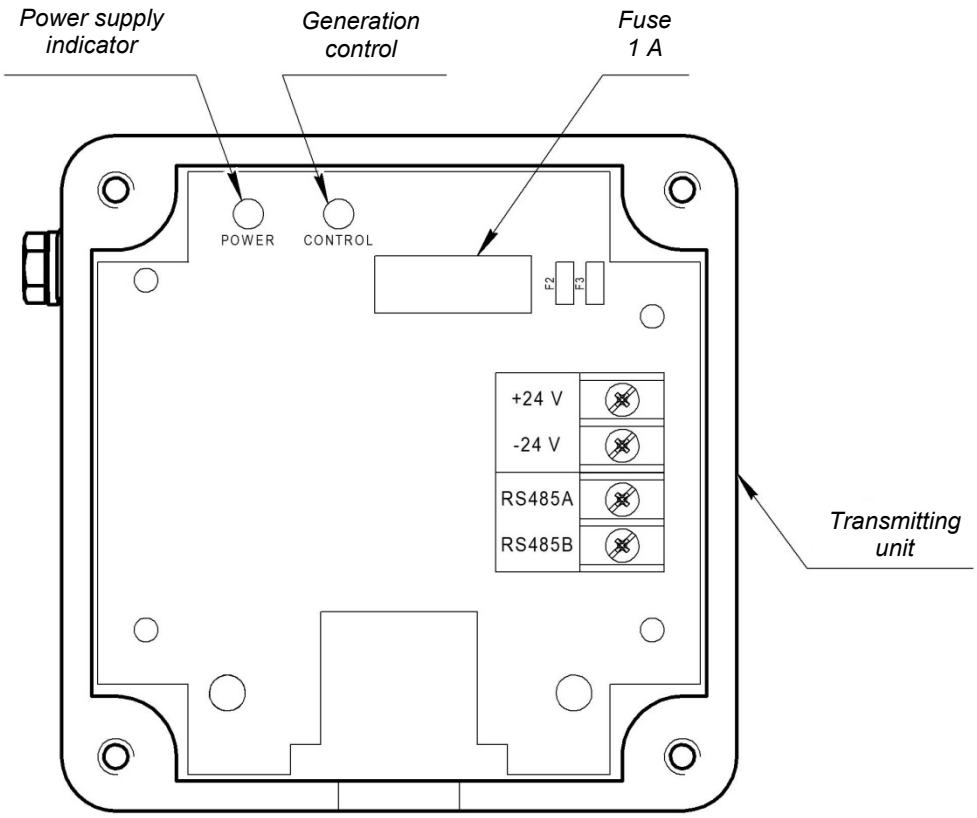


Appendix 5. Layout of main components in the BS unit of the barrier for level SIUR-03V2.5M (2.51M)

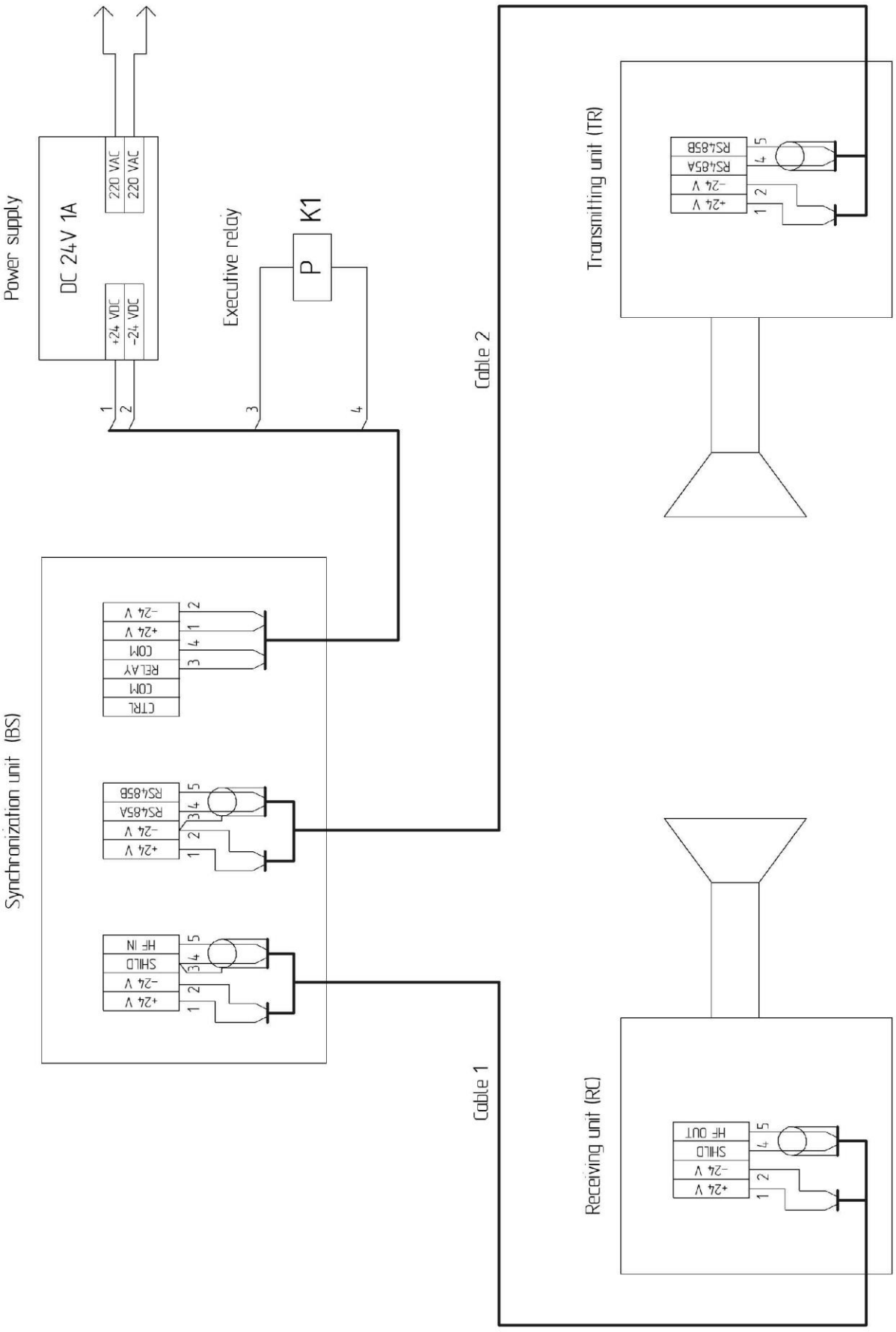


Appendix 6. Layout of main components in the TR an RC units of the barrier for level SIUR-03V2.5M (2.51M)





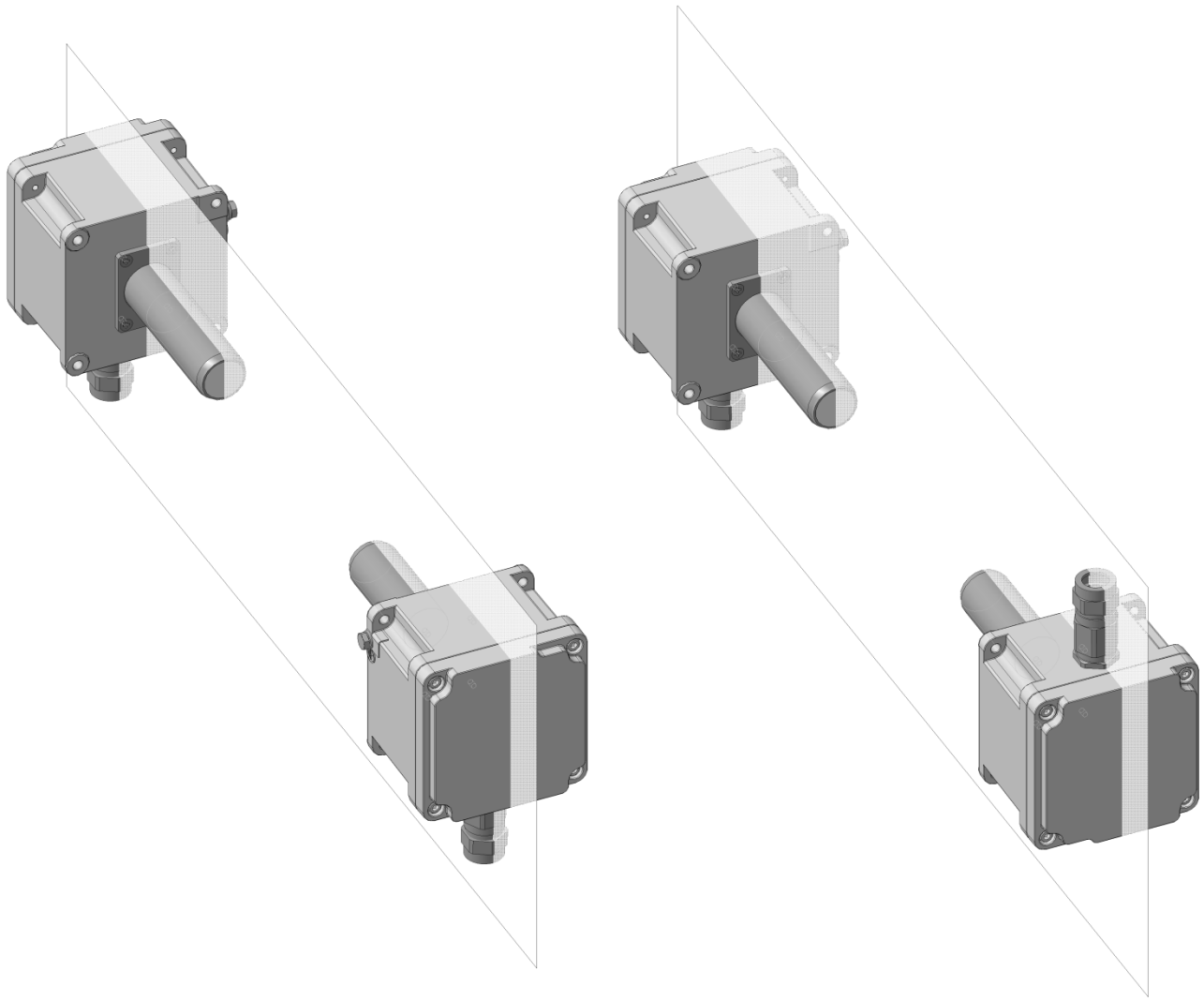
Appendix 7. Wiring diagram of the barrier for level SIUR-03V2.5M (2.51M)



Samara Tel. +7 (846) 925-63-53, +7 (846) 359-17-01, +7-927-778-79-34
E-mail: info@fizepr.ru Website: http://www.fizepr.ru

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. Mutual orientation of the TR and RC units of the barrier for level SIUR-03V2.5M (2.51M) to ensure the same polarization of microwave signals



Samara Tel. +7 (846) 925-63-53, +7 (846) 359-17-01, +7-927-778-79-34
E-mail: info@fizepr.ru Website: http://www.fizepr.ru