Monostatic Microwave Intrusion Sensor

“FORTEZA-M60”

User manual

Document Part Number 4372-43071246-062

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1. Introduction

The present user manual contains information about the operation of the Monostatic Microwave Intrusion Sensor “FORTEZA-M60” and its performance variants: “volume”, “curtain”, “fan” (below the sensor):

- purpose and sensor principle of operation;
- sensor components and the possible sensor kit supply;
- sensor’s characteristics and its components;
- operating and servicing rules.

There is information about tare, packaging and the conditions of the sensors transportation in this document.

In this document there is information required for the correct operation, maintenance and storage.

The manufacturer constantly improves the sensor and can modify its construction which does not worsen the sensor specifications.

2. Purpose

2.1. The purpose of “FORTEZA-M60” is to protect perimeter sites, outside (inside) grounds of different objects and to detect an intruder moving in his full height or bent in a detection zone.

2.2 The sensor is intended for continuous outdoor round-the-clock operation. It keeps operating at the ambient temperature -50°…+50°C and relative humidity up to 98% at the temperature +35°C.

2.3. The distinctive feature of the sensor is the detection zone generation consisting of 12 cross-cut sub bands. They permit to control its operation by PC over USB - interface (cross-cut sub bands disconnection, separated sensitivity’s adjustment in every cross-cut sub band, etc).

3. Specifications

3.1. The maximum length of a detection zone is 60 m maximum (12 cross-cut sub bands for 5 m).

The detection zone is a volumetric part of the perimeter site and any intruder’s movement in which generates an alarm.

The characteristics of the detection zone for different performance variants are given in table 3.1.

Table 3.1.

Characteristics	Performance variant		
	"FORTEZA-M60-V" (volume)	"FORTEZA-M60-C" (curtain)	"FORTEZA-M60-F" (fan)
Width, m	15	5	25
Height, m	15	25	5

3.2. The sensor provides the adjustment of the length from 5 m to 60 m.

3.3. The sensor generates an alarm when:

- an intruder (to his full height or bowed) crosses the detection zone at a speed of 0,3...8 m/sec;
- the signal injection of the remote control;
- dump or supply voltage reduction up to 4.2 ±0,4 V;
- sabotage attempt by the radiation screening with radio reflecting or radio absorptive materials at the distance up to 2 m (anti masking function).

An alarm is generated by breaking the contacts of an individual point relay of 3 sec minimum. This signal is issued with the yellow and pink colored marked cables.

3.4. The characteristics of the individual optoelectronic point relay: switching current is 0,1 A maximum; the maximum voltage is 50 V. The resistance in the closed condition is 130 Ohm max (with the lightning guard elements).

3.5. The sensor generates a tamper alarm where the control devices are situated. Then the contacts of the tamper circuit are broken. This signal is issued by the blue and grey colored marked cables. Contact dimensions of this tamper circuit are: current up to 0,2A at voltage up to 80 VDC.

3.6. The recovery time of a standby state after an alarm is 1 sec maximum.

3.7. The time of the technical availability after the supply voltage signal is 5 sec maximum.

3.8. The sensors are supplied from the direct current of 6...30 V and pulsation 0,03 V maximum. The sensor's power is 0,6 Watt maximum.

3.9. The sensor has the automatic and remote control of the availability.

To operate with the remote control, dc voltage of 6…30 V with the duration of 1 sec is given on the green colored cable. In this case the sensor must generate an alarm.

3.10. The sensor doesn't generate an alarm when:

- rain, snow, fog;
- solar radiation;

- the influence of wind at a speed of 20m/sec. maximum;
- movement of the birds and animals with the linear sizes of 0,3 m max;
- the height of irregularities on the perimeter site up to ± 0,3 m;
- the height of snow up to 0,3m without additional adjustment;
- the height of grass up to 0,2 m;
- the influence of the ultra-short waves 433 MHz and the mobile phone at the distance more than 0,5 m from the sensor.

3.11. The sensor is immune to EMI (voltage impulses in supply circuits, breaks of mains supply, electrostatic discharges, electromagnetic fields).

3.12. Input circuits of the sensor are protected from electric pickup (electric storm too).

3.13. The sensor mean lifetime is 8 years.

3.14. The overall dimensions of the sensor without the mounting kit (MK) are 210x135x55 mm maximum;

3.15. Maximum weight of the units with a mounting kit, kg: 0.5

4. Sensor Components

4.1. The sensor components are given in table 4.1.

Table 4.1.

№	Name	Q-ty	Notes
1	Transmit-receive unit	1	
2	Mounting kit MK-1 (mounting on the support)	1	
3	Key S8x10	1	
4	USB – cable for PC connection	1	For five sensors, but 1 item min for the delivery
5	CD-disc with the software	1	For five sensors, but 1 item min for the delivery
6	User manual	1	
7	Package	1	
8	Safety visor	1	Delivered on the customer’s order
9	Mounting kit MK-2 (mounting on the wall)	1	Delivered on the customer’s order
10	Power supply	1	Delivered on the customer’s order
11	Junction box	1	Delivered on the customer’s order

5. Sensor Structure & Operation

5.1. Sensor Principle of Operation.

The sensor principle of operation is based on the method of linear frequency modulation wide used in the radiolocation where the generator operating frequency is changed linearly in small limits. The super high frequency transmitter of the transmit-receive module radiates electromagnetic oscillations in the direction of the protection zone that return from the goal and the objects and get to the super high frequency receiver of the transmit-receive module.

When an intruder moves in the detection zone, the changes of the received signal caused by Doppler Effect will intensity and will work according to the defined algorithm. If these changes top the threshold value, the sensor will generate an alarm.

The method of linear frequency modulation and 12 cross-cut sub bands increase the sensor interference immunity and the operating time of false alarms.

6. Sensor Construction

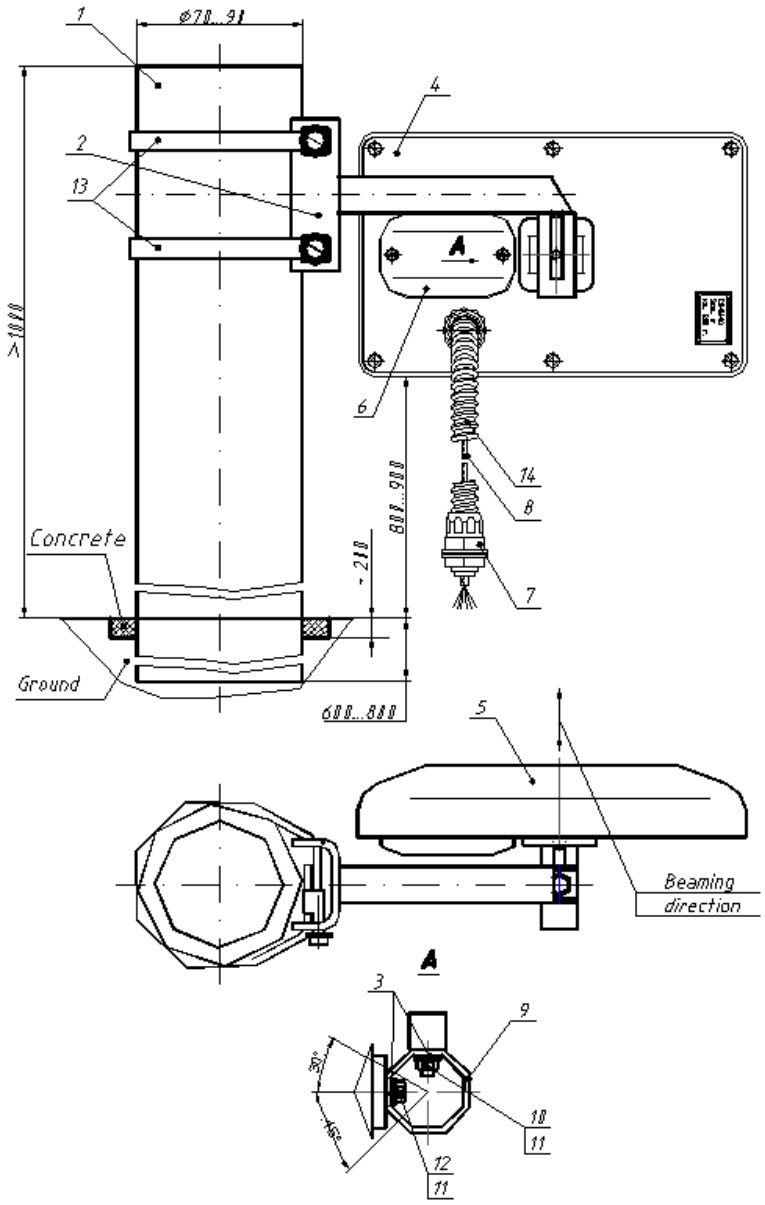
6.1. The sensor appearance and its adjustment on the support are given in fig.6.1. The sensor construction is mono block placed in dust-, splash-proof enclosure.

The basic unit construction is a base 4. There are a micro strip antenna and a board of the signal processing on the base 4. The mastic on the base pastes a radio parent enclosure 5. To prevent the condensate inside the unit, there are two bores in an underside of the enclosure. The lid dump 6 realizes the access to the adjustment elements and the indication. The cable 8 operating through the cable entry 7 generates the sensor connection to the receiving-control device.

6.2. The sensor transmit-receive unit is placed on the support 1 with the MK-1: bracket 2, ring 9 and buckle 13. The MK-1 provides the unit turn on a horizontal plane no more than ± 65º, on a vertical plane: down-30º minimum, up -90º minimum.

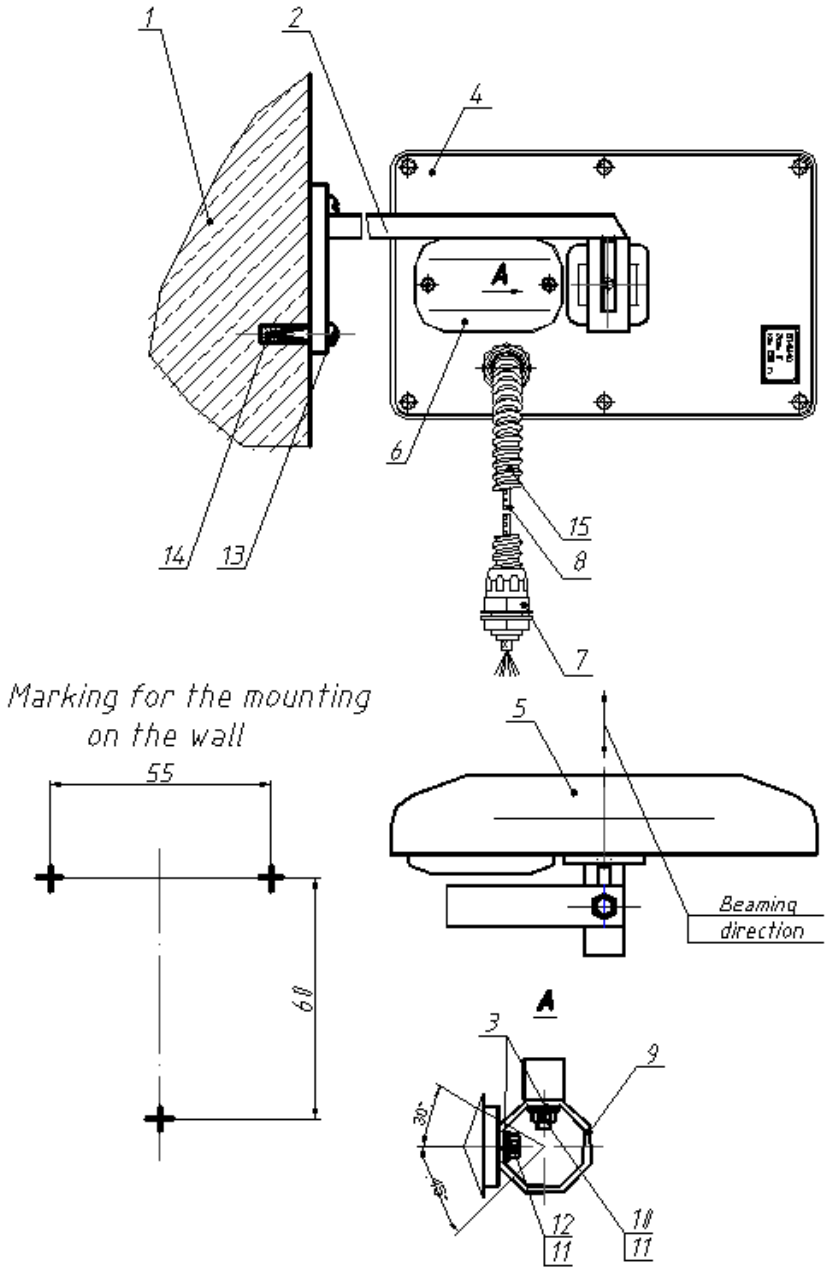
6.3. The sensor transmit-receive unit is installed on a vertical plane (wall, barrage, etc) with the MK-2: bracket 2, ring 9 according to fig.6.2. The MK-2 provides the unit turn on a horizontal plane not more than 65º, on a vertical plane: down - 30º minimum, up - 90º minimum.

The bracket 2 has 3 types: with the wall carry-over of 120 mm, 350 mm and 500 mm. The type of the bracket depends on the sensor application.



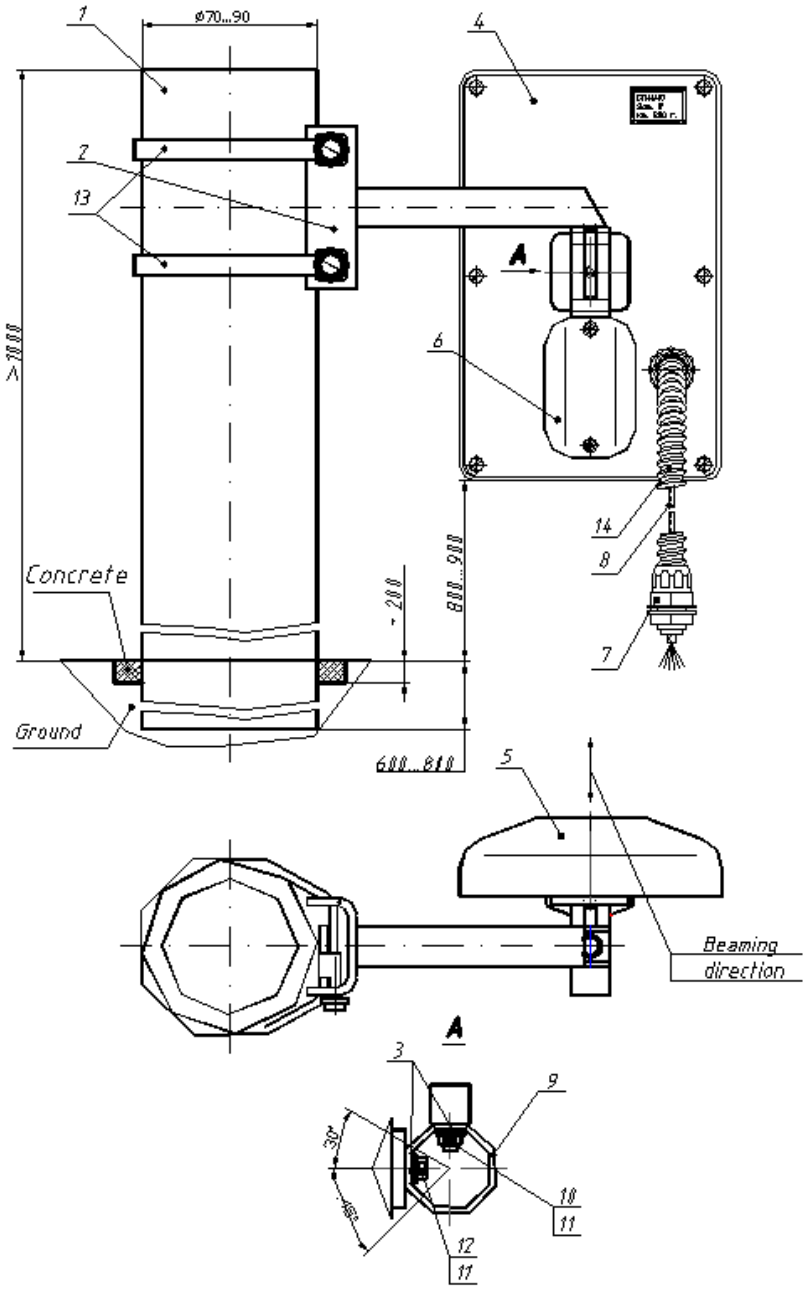
1-support (tube)-1 item; 2-bracket-1 item; 3-elastic washer - 2 items;
4- base –1 item; 5-enclosure –1 item; 6-cover -1 item;
7-cable entry - 1item; 8-cable -1item; 9-ring -1item;
10- nut M6 - 1 item; 11-washer 6 - 2 items; 12-bolt M6x16 - 1item;
13-buckle - 2 items;
14-corrugated tube - 1 item.

Fig. 6.1 Mounting on the support (variant performance – “curtain”)



1-support (wall) - 1 item; 2-bracket-1 item; 3-elastic washer - 2 items;
4- base –1 item; 5-enclosure –1 item; 6-cover - 1 item;
7-cable entry-1item; 8-cable -1 item; 9-ring-1item;
10- nut M6 - 1 item; 11-washer 6 - 2 items; 12-bolt M6x16 -1 item;
13-screw 4x30 - 3 items; 14-plug for the screw-3 items;
15-corrugated tube - 1 item.

Fig. 6.2 Mounting on the wall (performance variant – “curtain”)



1-support (tube) - 1 item; 2-bracket-1 item; 3-elastic washer - 1 item;
4- base –1 item; 5-enclosure –1 item; 6-cover - 1 item;
7-cable entry-1item; 8-cable -1 item; 9-ring-1item;
10- nut - 1 item; 11-washer 6 - 1 item; 12-bolt M6x16 -1 item;
13-buckle - 1 item; 14-corrugated tube - 1 item.

Fig. 6.3 Mounting on the support (performance variant – “volume”, “fan”)

7. Safety Measures

7.1. The current safety standards for the operation with electrical facilities with up to 1000 V voltage should be observed during mounting, prevention and repair of the sensor.

7.2. Cables should be laid, terminated and connected to the sockets only when supply voltage is OFF.

7.3. The power of the super high frequency energy beaming by the sensor satisfies the security standards and don't influence on the human health.

7.4. It is prohibited to mount and to maintain the sensor during lightning storm.

7.5. Technicians are allowed to install, maintain and repair the system after they learn special instructions and pass exam related to safety measures.

7.6. The failure to these exploitation requirements can provoke the sensor breakdown.

8. Mounting Procedure

8.1. Requirements for the sector (ground) to protect

The choice of a place and the correct sensor mounting on a protected sector or in a room are the basic factors providing its reliability working.

The protected ground where the system is mounted should meet the following requirements:

a) maximum height of the sector surface irregularities is $\pm$0,3m. If deflections of the sector surface from the plane exceed $\pm$0,3m; the specifications of the sensor can worsen. In this case the issue of the use of the sensor under these conditions is defined by the trial operation;

b) on the sector there should not be high grass, bushes and trees at the distance of 5 m minimum from the detection zone border;

c) the sensor should not be located on the range of vision (on the beaming direction) and behind the detection zone border at the distance of 20 m minimum from big objects and buildings moving by the wind influence (folds gates, tumbledown fences, etc);

d) height of grass should be 0,2 m maximum;

e) height of snow should be 0,3 m maximum;

f) people and animals can move outside the protected zone at the distance 5…10 m minimum from the detection zone borders;

g) to exclude a casual hit of people and animals, a barrier of a protected sector can be used at the minimum height of 1m;

h) to install the sensor on an outside wall, the gutter from the roof should be excluded next to the sensor enclosure;

8.2. Requirements for the room to protect

The sensor installation in a room should meet the following requirements:

a) it is necessary to install the sensor on the walls without some constant vibrations;
b) animals, birds, vibrated and moving objects (window leaves, doors, air-exhausters, etc) are not permissible in the site to protect;
c) the trees installation and the motor transport circulation should be at the distance of 3 m minimum from a protected sector in the rooms with a big square of glazing (shops, show-rooms, offices, etc);
d) during the sensor mounting it should not be directed in the window sides and thin partitions between the rooms;

8.3. Sensor mounting on the outside perimeter

8.3.1 It is recommended to use metal or asbestos-cement tube as supports 70…90 mm diameter (the best solution is the device "SUPPORT-2" produced by ZAO "OKHRANNAYA TECHNIKA"). As for the hard soils (argil, stone, etc), the support can be not concreted and embedded in the soil of 600…800 mm. During the support mounting of light soils (sand, etc) it is necessary to carry out the additional concreting from above (depth is 200 mm; diameter is 500 mm).

In the regions where there is a lot of snow (over 1 m), the superstructure of the support should be 1500 mm minimum (it is recommended to use the device "SUPPORT-2,5" produced by ZAO "OKHRANNAYA TECHNIKA"). In those areas where there is little snow the superstructure of the support should be 1100 mm maximum.

During the sensor prohibition of a barrage top, it is necessary to weldin the support for the most stability or to joint with this barrage. In this case the support elevation over the barrage should be 300 mm minimum.

8.3.2. Lay the mains cables according to the project documentation. As a signal cables it is recommended to use the cables of the types ТПП, КСП which have the screen or the metal case. The cables laying are performed in the ground or along to the fence.

8.3.3. The depth of the sensor installation is 0,8…0,9 m according to fig.6.1. To install the sensor on a round support, the МК-1 is used.

It is necessary to install the bracket 2 on the support 1 with the buckle 13.

8.3.4. Install the transmit-receive unit with the bolt 12 by drainage bores down on the bracket. The bracket should be pointed on the support in such a way that the enclosure surface of the sensor should be directed in the side of a protected sector.

8.3.5. Fix the sensor at a horizontal position (relative to the grounds) with the nut 10 and the bolt 12. The detection zone model is given in fig. 8.1 (performance variant “curtain”).

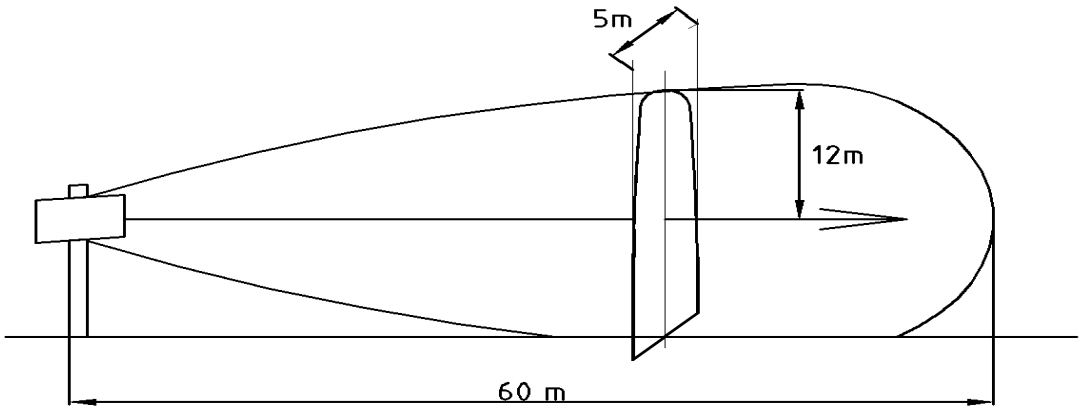


Fig. 8.1 Detection zone for the outside perimeter mounting (performance variant “curtain”)

8.4. Sensor mounting on the wall of the room

8.4.1. The MK-2 is used for the sensor mounting on the wall. For that:

- make the marking according to fig.6.2.
- fix the bracket 2 with the screws 13 on the wall 1 (three brackets modification with the carry-over of 120 mm, 350 mm and 500 mm;
- install the bolt 12 in the ring channel 9 and provide the transmit-receive unit mounting on the bracket 2;
- loosen nut 10 and point this unit on the necessary direction rotating it in a horizontal surface;
- tighten the nut 10;
- displacing the transmit-receive unit in a vertical surface relate to the ring channel 9, it is necessary to point the unit in a vertical surface and to tighten it with the bolt 12.

9. Sensor Preparation for the Operation & Adjustment

9.1. Preparation for working

9.1.1. Install the sensor according to i.8 and connect the supply circuit and the output circuit of the sensor in compliance with the color cables indication according to table 9.1.

Table 9.1.

Color cables indication	Purpose
white	Plus supply
brown	Minus supply
yellow	Relay contacts
pink	Relay contacts
green	Remote control
grey	Tamper
blue	Tamper

The model of the sensor connection with the lightning guard unit “LGU-4” and the power supply unit “PSU-15-0,15” given in fig 9.1. The tamper switch contacts are switched ON in series with the contacts of the individual point relay. In this case an alarm generates when the individual point relay or the tamper switch will generate a signal on one channel of the receiving-control device.

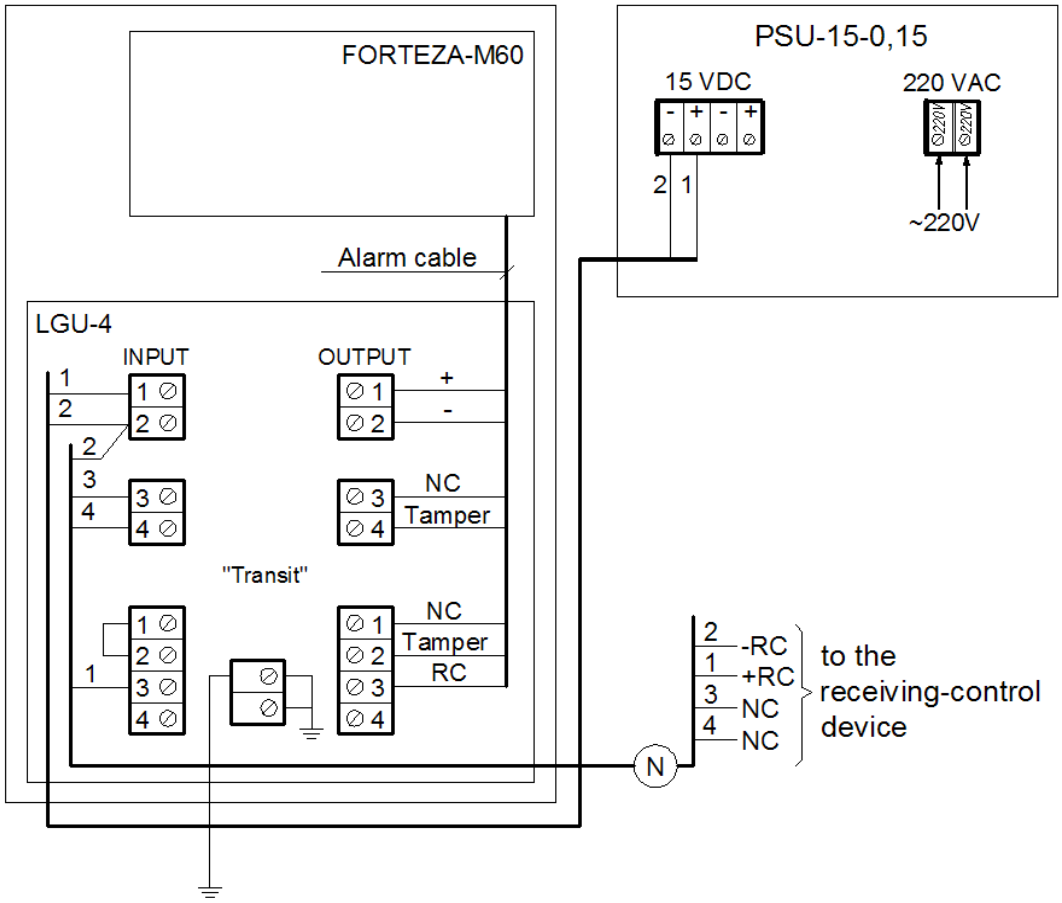
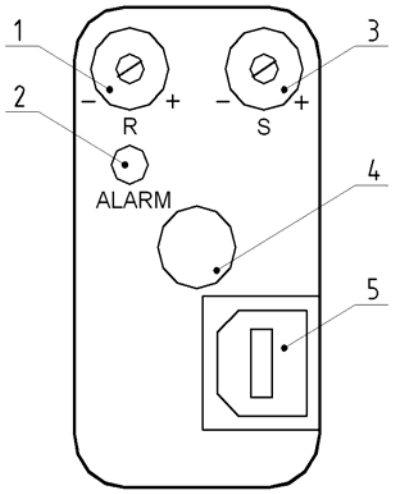


Fig.9.1

9.1.2. Remove the cover 6 (fig.6.1). During the indicator checking “Alarm” it is necessary to be situated at the side or behind the sensor.

9.1.3. The necessary length of the detection zone and the sensitivity are adjusted with the control devices “Distance” (“D”) and “Sensitivity” (“S”) according to fig.9.2.



1-Control device “Range”

2-Indicator “Alarm”

3-Control device “Sensitivity”

4-Tamper switch

5-USB

Fig.9.2

The compliances of the control device position “R” and the length of the detection zone (m) are given in table 9.2.

Table 9.2.

Control device “R”	Minimum (up to the anvil move counter-clockwise)	Mean (turnover of 50% of the course)	Maximum (up to the anvil move clock-wise)
The length of the detection zone	≥ 5 m	≥ 30 m	≥ 60 m

9.1.4. The control device “S” means the sensor sensitivity. The control device position “S” “until the anvil move clock-wise” corresponds to the maximum threshold of an alarm generation, the position “until the anvil move counter-clockwise”- to the minimum one.

ATTENTION! To exclude the false alarms of the sensor, it is necessary to avoid the adjustment of a very high sensitivity and too high range of the detection!

9.2. Sensor adjustment.

9.2.1. 2 persons adjust the sensor: one person imitates the intruder’s passages, other one adjusts the sensor. Switch ON the power supply. Install the control device “R” in the position nearly suitable to the necessary length of the protected sector according to table 9.2. Make the control passage moving in the beginning, the middle and the end of the perimeter site. Turning the control device “S”, obtain the exact alarm generation of the sensor.

9.2.2. Make the control passage every 3…5 m at a speed of 1,0…1,5 m/sec.

The correct adjusted sensor should generate an alarm in every passage.

9.2.3. In the case when the real length of the detection zone is less or more than the necessary one, increase or decrease the detection zone length turning the control device “R”.

9.2.4. Check the detection zone configuration. For that make some control passages through the detection zone on some range from the adjustment place of the sensor fixing the points what crosses the sensor and generate alarms. If the detection zone doesn’t coincide with the protected sector, it is necessary to change the sensor position in a way that the formed detection zone will coincide exactly with the protected sector.

9.2.5. After the sensor adjustment and its check install the cover 6 of the transmit-receiver unit.

10. Distinctive features of the Sensor adjustment with PC

10.1. The sensor “FORTEZA-M60” can be adjusted with the computer too. PC gives a good opportunity to control a complex detection zone, sensitivity and different modes of the sensor operation.

The sensor connection to PC is realized with standard connective cable USB A-USB B (a part of the delivery kit).

To manage the sensor with the computer, it is necessary to set up the software with the disc (a part of the delivery kit). The software set up includes 2 stages: COM-PORT installation and Sensor control program.

10.2. COM-PORT installation

Install the disc (which is a part of the delivery kit) in the computer.

Connect the sensor to the computer by USB cable. The supply is not obligatory for the sensor. The computer will identify the type of USB device and will ask to install the driver. For that follow the fig. 10.1-10.4.

Fig.10.1

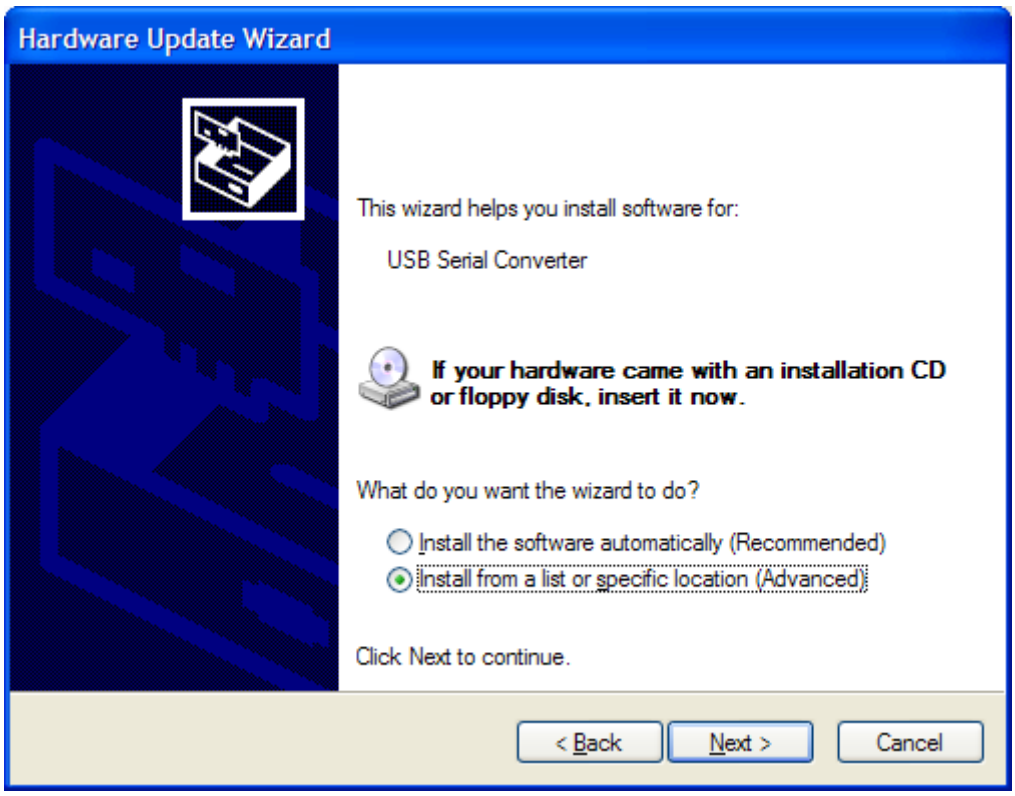


Fig.10.2

Please choose the folder COM-PORT from CD-disc in the window Search and installation options.

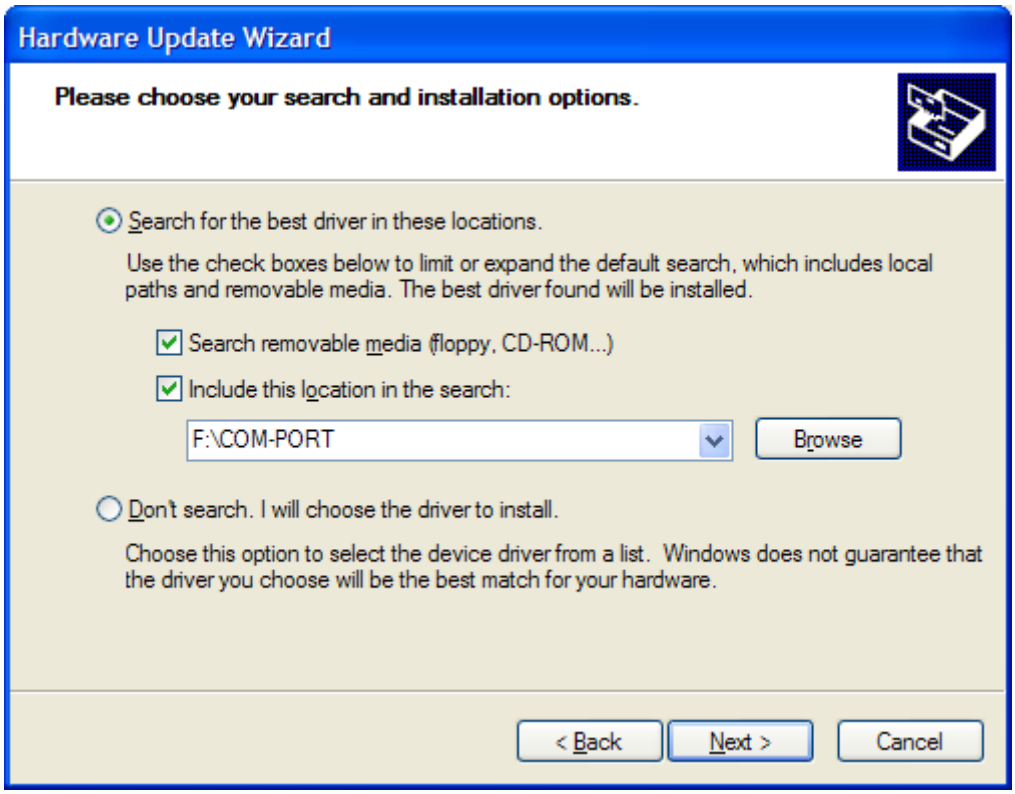


Fig.10.3

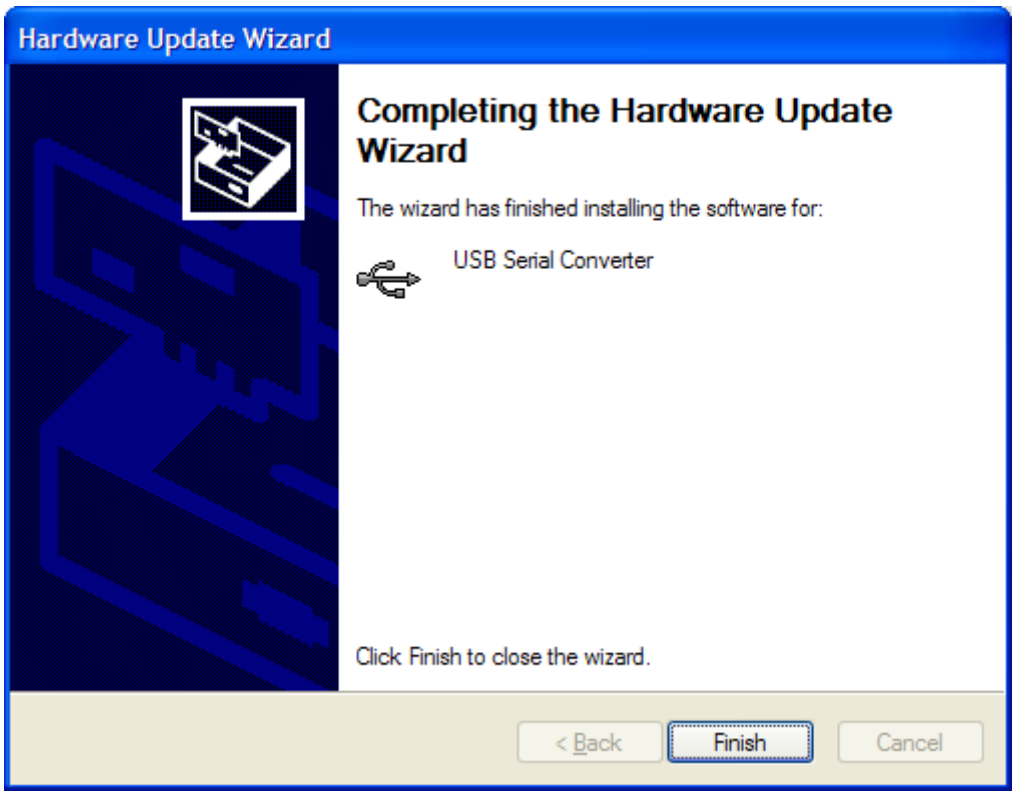


Fig.10.4

After clicking “Finish” the computer will install other Virtual COM-PORT driver. This operation is similar to the previous one.

After COM-PORT installing it is necessary to know its number. Please follow: START →OPTIONS →CONTROL PANEL→SYSTEM→DEVICE→DEVICES MANAGER→PORT (COM and LPT) →USB SERIAL PORT and count the value.

10.3. Sensor control program installation

Install the programs on the computer from the folder “PROGRAM” of the setup disc in series: “WindowsInstaller-KB893803-v2-x86.exe”, “NetFx20SP2_x86.exe”.

Create a folder “FORTEZA-M60”on the disc C and copy there the program “Forteza-M60.exe” from the folder “PROGRAM” of the setup disc.

The software setup is finished.

10.4. The sensor control by PC

Connect the sensor to the computer with USB cable, supply the sensor. Install the program “Forteza-M60.exe”. After the program installing the window will be opened (see fig.10.5).

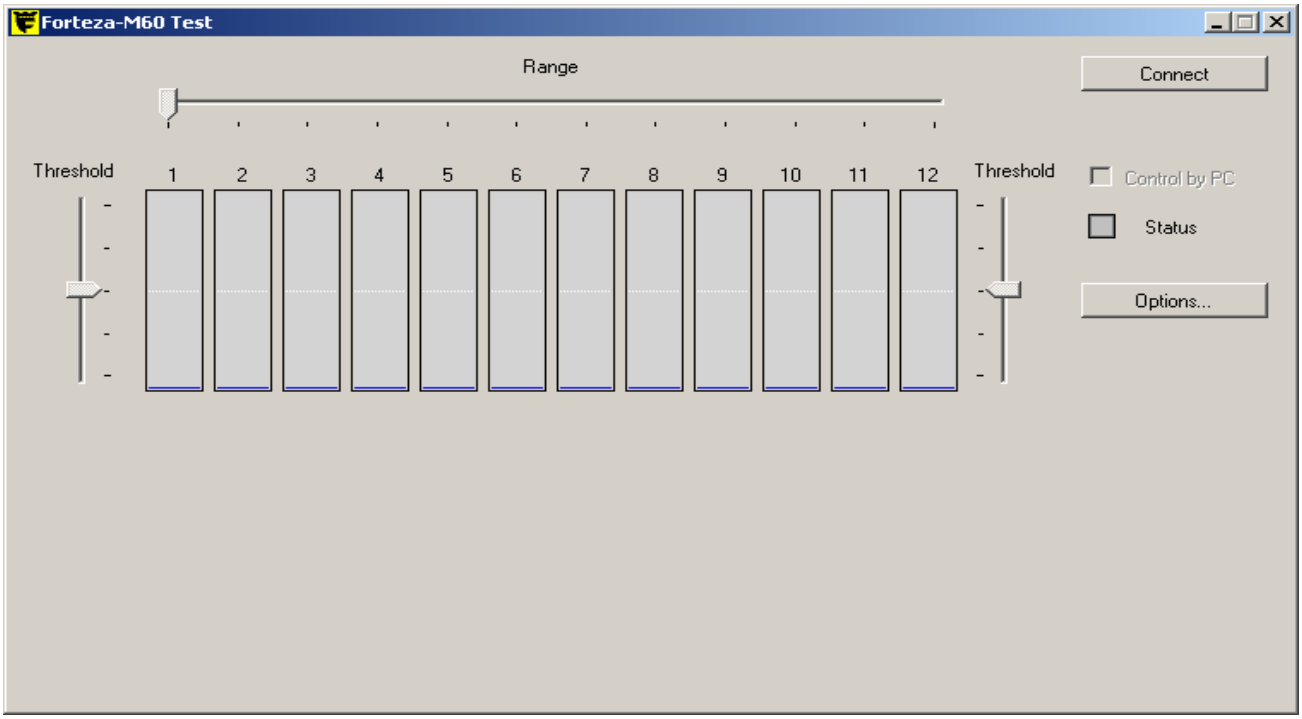


Fig.10.5

Click “Options” and choose COM-PORT according to Virtual COM-PORT number. After clicking “Connect” the computer will be connected to the sensor.

10.5. Sensor control modes

Mode A – Sensor control mode with the built in control devices

In this mode the sensor is controlled by the built-in control devices. The program displays the control devices state and the signal levels in every cross-cut sub bands separately.

This mode permits to facilitate the sensor adjustment because the signal levels can be checked visually in the cross-cut sub bands, adjusted thresholds and range.

In the mode A the operating program window displays the virtual thresholds control devices, range and 12 indicators of the signal level in the cross-cut sub bands (1 – the nearest zone, 12 – the farest one).

Mode B – Sensor control by PC

This mode is used during the sensor adjustment to generate the complex detection zone (irregular thresholds in the sub zones, approved passages and etc.).

In the mode B the built-in sensor control devices are switched OFF. The computer controls the sensor operation.

To pass in the mode B, it is necessary to choose “Control by PC” in the operating program window (see fig.10.6).

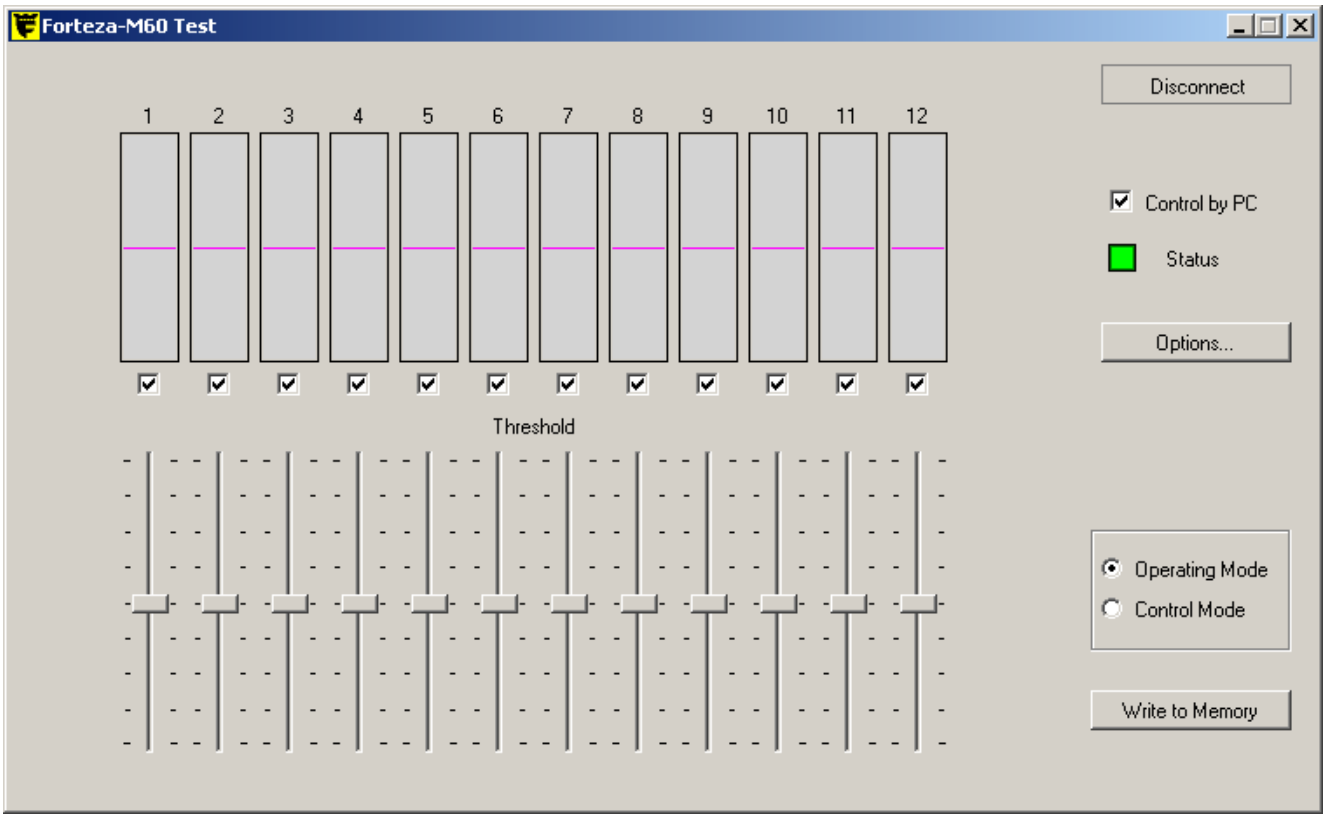


Fig.10.6

The operating window shows the signal levels in the cross-cut sub bands, 12 independent control devices in the cross-cut sub bands, the mode switch “Control Mode/ Operating Mode” and the button “Write to Memory”. You can switch ON or OFF the separated cross-cut sub bands. The model of the bands disposition in the detection zone is given in fig.10.7.

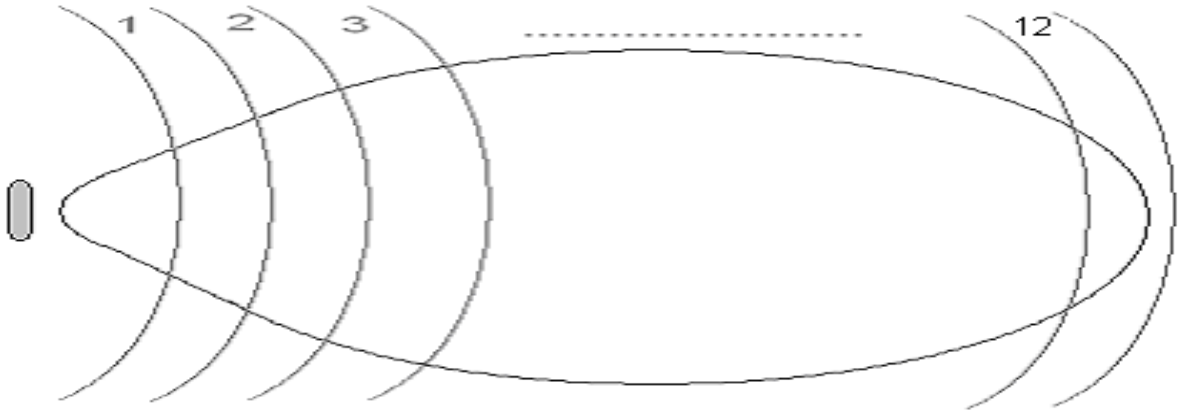


Fig.10.7

As a model we examine the sensor’s adjustment to generate the complex detection zone.

It is necessary to generate the detection zone of the length 40 m and with the approved passage of the width 10 m at the distance of 15 m from the sensor.

2 persons adjust the sensor: one of them imitates the intruder's passage; other one adjusts the sensor with PC. To generate the detection zone, transfer the sensor in the mode B – "Sensor control by PC". Transfer the switch "Control Mode/ Operating Mode" in the mode "Control Mode". The operating window will have the view given in fig.10.8.

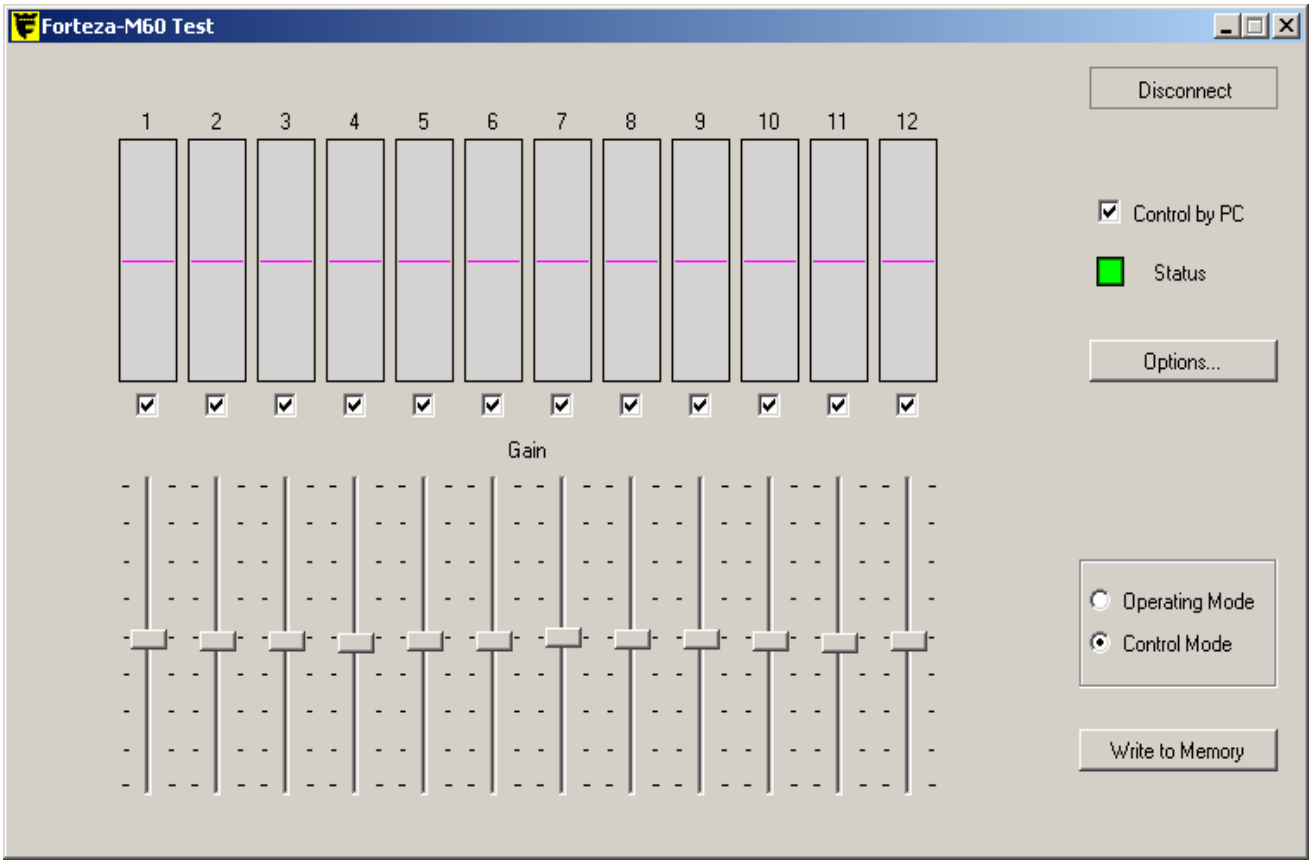


Fig.10.8

Obtain the equal signals level with the control devices "Gain" in the cross-cut sub bands for the required detection zone doing the checking passages. In this mode the sensor generates an alarm if the signal level in the cross-cut sub bands exeeds 50 %. The optimal signal level in the cross-cut sub bands exceeds the alarm signal (50%) for 5 %. After the equal sensitivity adjustment in the cross-cut sub bands transfer the switch "Control Mode/ Operating Mode" in the mode "Operating Mode". Doing the checking passages adjust the optimal thresholds with the control devices according to the required detection zone.

The final stage is to specify the required detection zone and the approved passages. For that switch OFF the needless cross-cut sub bands (in our case 4, 5 and 9-12 cross-cut sub bands) with the ticks.

The model of the software operating window for the required configuration is given in fig.10.9.

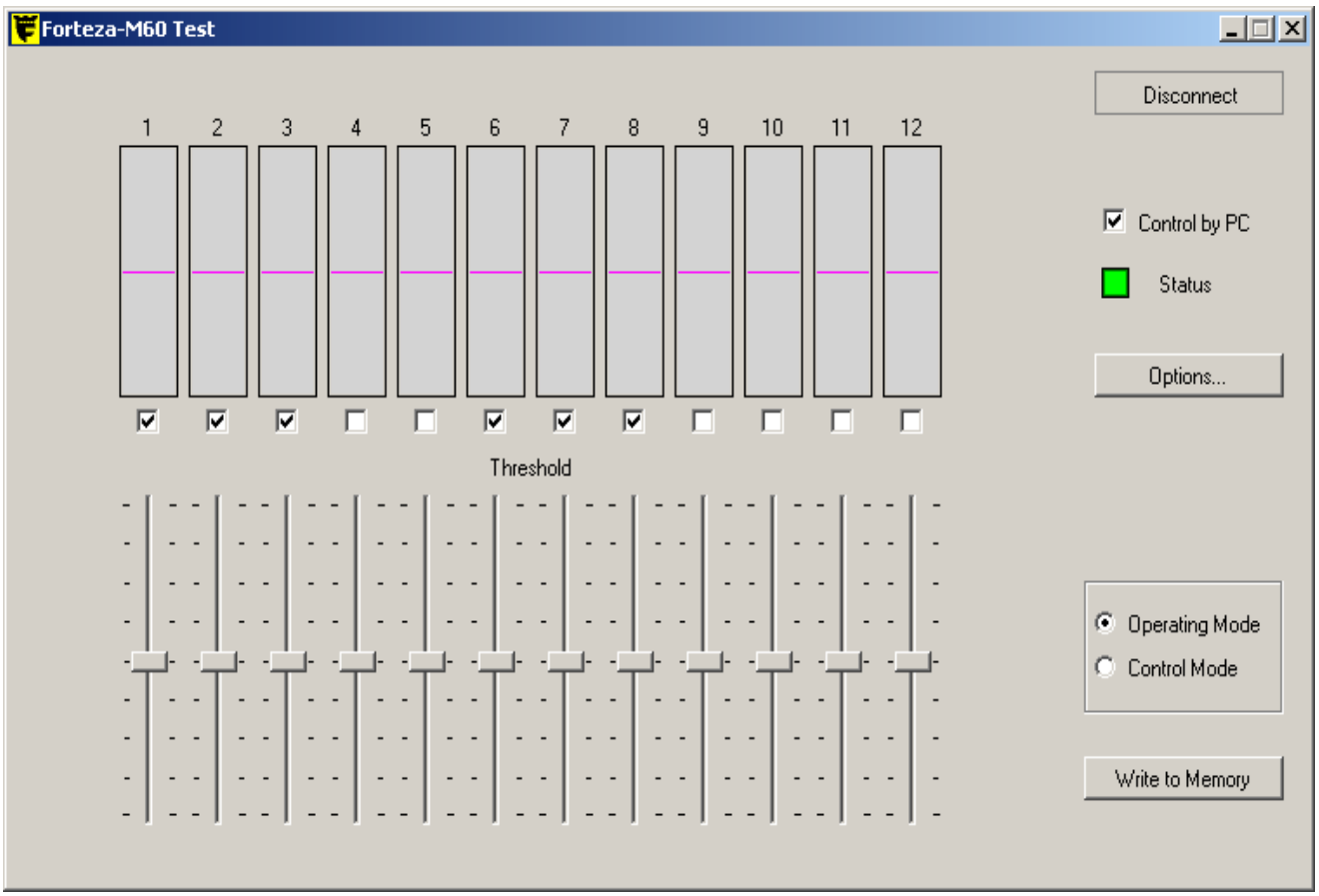


Fig.10.9

Doing the control passages check the detection zone too.

When the checking and adjustment are over, click "Write to Memory" on the software operating field to save the configuration in the nonvolatile memory of the sensor and to switch OFF the computer.

In the mode of the sensor "Control by PC" the built-in indicator "Alarm" generates the short alternating lights of the duration 0.25 sec and the interval of 4 sec. It says that it is IMPOSSIBLE to control the sensor with the built-in control devices!

11. Check of Technical State

11.1. The sensor should be served by the technicians after special training and instruction.

11.2. During the service of the sensor it is necessary to conduct check and preventive works.

11.2.1. Every month carry out external examination of the sensor units and the state of the sector where Tx and Rx are installed.

It is necessary to check:

- the absence of dust, dirt, snow and ice on the beaming side of the transmit-receive unit and clean them if necessary;

- the sector state according to the requirements of the issue 8.1.

11.2.2. Every quarter:

- carry out all the works specified as works carried out every month;
- check the state of the cables and cable connections;
- reliability of the bracket adjustment.

11.2.3. During seasonal works the height of the grass and snow is checked. If the height of the grass is over 0,2 m, the grass should be cut or removed by another method.

If the height of snow changes over 0,3 m, false alarms can be generated because of the decrease of the signal at the input of the transmit receive unit. In this case it is necessary to remove snow or to change the height of the sensor installation.

After changing the height of the sensor installation, it should be adjusted according to the procedure given before.

12. List of Possible Malfunctions and Their Repair

The list of possible malfunctions and their repair is given in table 12.1.

Table 12.1

Trouble	Possible Cause	Repair
1. An alarm is generated on the receiving-control device	1. Communication line is broken.	Check the cable integrity and the accuracy of its connection.
	2. The supply voltage is absent or below the norm.	Provide the necessary supply voltage of the sensor.
	3. A sector or a closed room doesn't correspond to the necessary requirements.	Inspect a sector or a closed room according to the requirements of the issue 8 and remove these defects.
	4. The transmit-receive unit is defective.	Replace the transmit receive unit.
2. False alarms of the sensor	1. Moving branches are in a detection zone and they cause alarms.	Inspect the sector and remove interference factors.
	2. Animals circulate in the sector.	
	3. Too high sensitivity.	Check the sensor according to the issue 9.
3. The sensor does not generate alarms when an intruder crosses the sector.	1. Too low sensitivity.	Check the sensor according to the issue 9.
	2. The transmit receive unit is defective.	Replace the transmit-receiver unit.

13. Storage

The sensor should be stored in the package for the transportation and correspond to the storage conditions 3 (cold storage).

During storage the influence of hostile environment should be prevented.

14. Transportation

Packaged sensors can be transported by any transport (if by plane – in hermetically modules) if they are transported in covered cars, holds or covered bodies they can be transported at the distance up to 10 000 km.

The boxes should be placed to prevent their shifting or fall in case of jolts and blows.

15. Acceptance certificate

The Monostatic Microwave Intrusion Sensor "FORTEZA-M60___", №_____meets performance specifications of the Document Part Number 4372-43071246-062 and it is considered as operable.

Date of issue _____2010 .

Quality department

16. MANUFACTURER'S GARANTEES

16.1. The manufacturer guarantees the conformity of the sensor specifications to the Document Part Number requirements 4372-43071246-062 if a user meets the service conditions and operating rules specified by the Document Part Number 4372-43071246-062.

16.2. Warranty period is 18 months since the date of sale by the manufacturer.

16.3. Guarantees do not cover sensors:

- with broken guarantee stamps;
- with mechanical failures,
- and also those which are out of order because of natural disasters (lightning, fire and flood).

16.4. Mean lifetime is 8 years.

For warranty and post-warranty service you can contact:

European Office:

JCS “Forteza”
M.Mazvido av.9A-18
92136 Klaipeda
Lithuania
Phone+370 46 411353
Fax+370 46 412231
E-mail forteza@forteza.com

Visit the site www.FORTEZA.com for more information about additional Service Centers