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Digital microwave barriers types BM120C, BM200C

User's and installer's manual
version 1.02+

1. Characteristics of the device

Microwave barriers BM120C and BM200C are digital versions of analogue barriers, types BM120M and BM200M, created by combining microwave circuits of barriers BM120M / BM20M of the Italian company of AVS ELECTRONICS S.p.A. with a digital signal processing module of STEKOP S.A. The product is based on proven solutions of both companies. Both the transmitting antenna and the wave generator inside the transmitter and the receiving antenna, microwave detector, input amplifier and the band-pass filter in the receiver are made by AVS ELECTRONICS S.p.A. They are standard parts manufactured by that company for analogue barriers, types BM120M/BM200M. The remaining circuits of BM120C and BM200C microwave barriers i.e. microprocessor controller, communication system, temperature adjustment system and power supply circuits are products of STEKOP S.A. They are successfully used by STEKOP in the sensor of HF 400 perimeter security system proven in actual installations of the Burglary and Intrusion Monitoring Systems. Also the algorithms for the digital analysis of the signal received are the same as those in HF400 sensor, used in BM120C and BM200C digital barriers and set to detect the intruders and eliminate environmental interference.
The use of the digital signal processing in BM120C/BM200C barriers allowed to increase the likelihood of intruder detection and improved the resistance of barriers to false alarms. Furthermore, it has become possible to remotely monitor the operation of and configure the barriers.

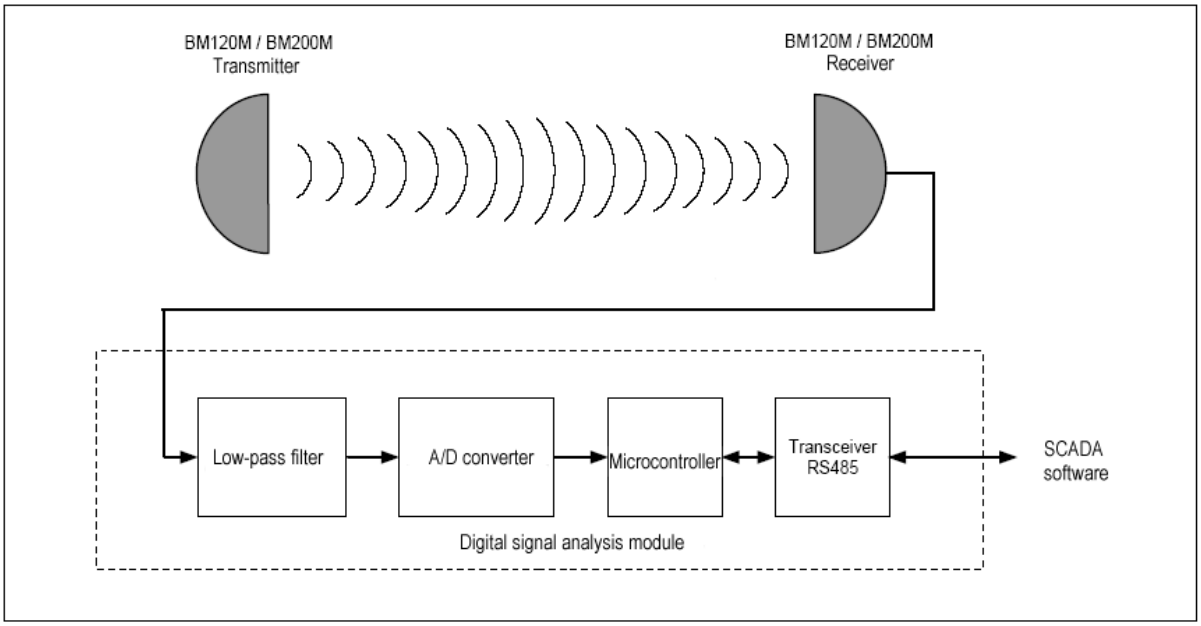

Fig. 1.1 *Block diagram of digital microwave barrier types BM120C/BM200C*

A single microwave barrier BM120C / BM200C is composed of two modules: transmitter (Tx) and receiver (Rx) – Fig. 1.1 which may operate in one of five channels. The transmitter emits electromagnetic wave modulated in amplitude of the frequency of 10.525 GHz which is received by the receiver. Each drop in level of the signal being received, caused by the interruption of the wave beam by the intruder between the transmitter and receiver antennas, is detected and indicated as an alarm. With proper selection of the numbers of the working channels it is possible to create, on the basis of microwave barriers type BM120C and BM200C, complex perimeter security systems where the operating pairs of transmitter-receiver of the microwave barriers do not interfere each other. Connection of all modules operating in the system using a two-cable RS485 bus significantly simplifies the cabling of the entire system and hence improves the system reliability while reducing the cost of installation and maintenance.

Large coverage area, reliability in intruder detection, high resistance to false alarms, possibility of remote control of barrier operation and configuration as well as high resistance to weather conditions make the microwave barriers types BM120C / BM200C perfect for use in protection of widespread premises of both indoor and outdoor type.

Microwave barriers BM120C, BM200C – basic specifications

- Maximum range: BM120C 120m
  BM200C 200m
- Maximum beam width: BM120C ..... 3 to 10m
  BM200C ..... 4 to 16 m
- Operating frequency 10.525GHz
- Number of channels 5
- Antenna orientation adjustment ..... vertical / azimuth / elevation
- Signal processing ..... digital (shape, duration, level)
- Inputs ..... 2 multi-purpose two-state inputs
- Outputs:
  - ALARM ..... NC/NO relay contacts 2A/50V DC/60Wmax
  - FAULT ..... NC/NO relay contacts 2A/50V DC/60Wmax
  - SABOTAGE ..... NC/NO relay contacts 2A/50V DC/60Wmax
  - AUX ..... NC/NO relay contacts 2A/50V DC/60Wmax
- Protection from sabotage:
  - enclosure opening sensor
  - antenna orientation change sensor
- Communication interface ..... RS485 (with galvanic isolation)
  - data rate ..... 9,600 bit/s
  - data word length ..... 8 bits
  - even parity bit ..... none
  - stop bits ..... 1 bit
- Supply voltage ..... +9V DC ... +15V DC
- Power consumption: transmitter ..... 80 mA @ 12V DC
  receiver ..... 100 mA @ 12V DC
  heater ..... 120 mA @ 12V DC
- Operating temperature range ..... -40ºC ... +55ºC
- Enclosure climate category IP54
- Dimensions ..... 225 x 225 x 136 mm

2. Transmitter

Transmitter is a component of the barrier which emits stable, directional beam of low power microwaves. View of the transmitter electronic package (Tx) is illustrated in Fig. 2.1. Detailed characteristics of terminal connections, configuration jumpers and indicators is included in Tables 2.1 ... 2.3.

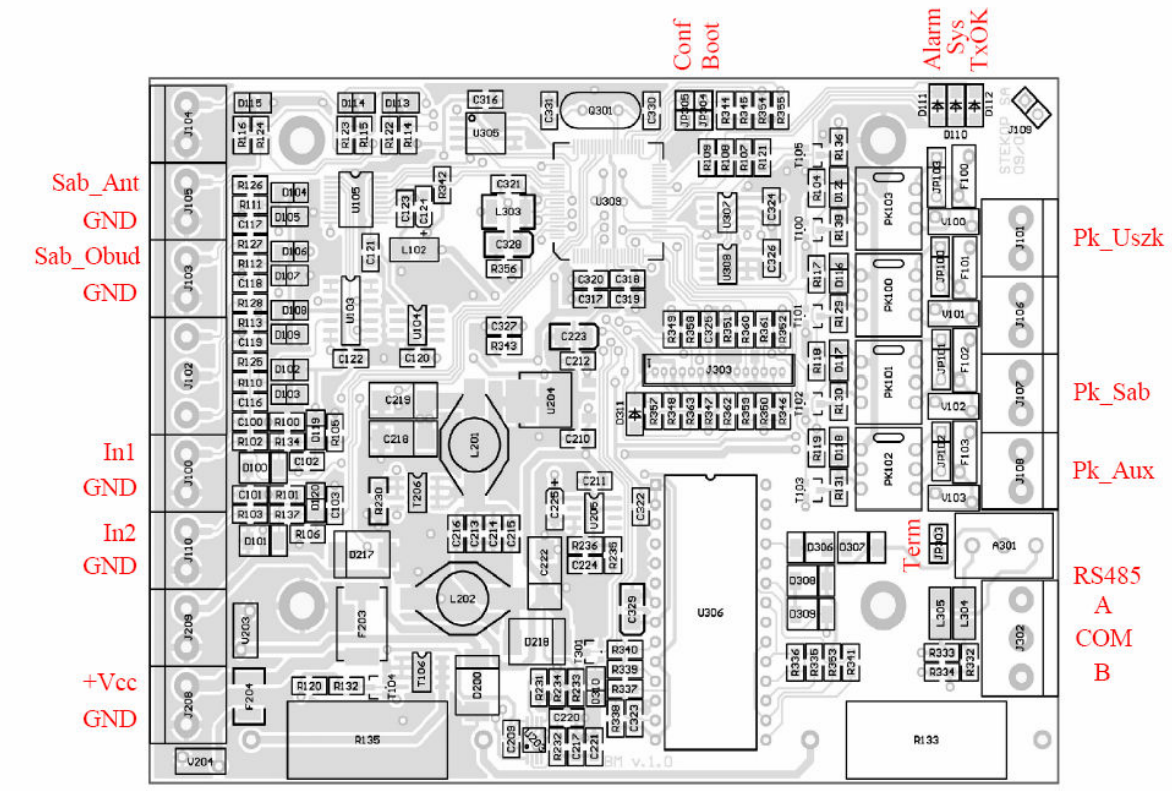

Fig. 2.1 *Electronic package of the transmitter of microwave barrier type BM120C, BM200C*

Table 2.1 *Connection terminals of the transmitter of microwave barrier type BM120C, BM200C*

Pos.	*Connector*	*Pin*	*Symbol*	*Description*	*Remarks*
1	J208	1	+Vcc	+9V DC ... +15 V DC supply voltage input	
		2	GND	power supply ground	
2	J100	1	In1	multi-purpose two-state input In1	
		2	GND	ground	
3	J110	1	In2	multi-purpose two-state input In2	
		2	GND	ground	
4	J103	1	Sab_Obud	enclosure opening sensor	
		2	GND	enclosure opening sensor ground	
5	J105	1	Sab_Ant	antenna orientation change sensor	
		2	GND	ground of antenna orientation change sensor	
6	J101	1,2	Pk_Uszk	FAILURE signal relay output	configuration of relay contacts (NC/NC) selected using JP103 jumper
7	J107	1,2	Pk_Sab	SABOTAGE signal relay output	configuration of relay contacts (NC/NC) selected using JP101 jumper

8	J108	1,2	Pk_Aux	multi-purpose AUX relay output	configuration of relay contacts (NC/NC) selected using JP102 jumper
9	J302	1	A	A RS485 line	
		2	COM	RS485 ground	
		3	B	B RS485 line	

Table 2.2 *Configuration jumpers of the transmitter of microwave barrier BM120C, BM200C*

Pos.	***Symbol***	***Function***	***Remarks***
1	JP305	loading of factory settings	
2	JP304	activation of bootloader function	
3	JP303	activation of RS485 bus terminator	

Table 2.3 *Indicators of the transmitter of microwave barrier BM120C, BM200C*

Pos.	***LED***	***Symbol***	***Colour***	***Function***	***Remarks***
1	D110	Sys	yellow	master system communication indicator	goes out if there is no communication with the master system
2	D111	Alarm	red	alarm indicator	
3	D112	TxOK	green	transmitter functionality indicator	goes out if fault is detected

3. Receiver

Receiver is a component of the barrier which receives the directional beam of microwaves from the transmitter and measures the beam level. According to the results of the analysis of changes in the signal received a decision is made whether the change in signal level has been caused by natural factors or an intruder who penetrated the protection zone. View of the receiver electronic packages (Rx) is illustrated in Figures 3.1 and 3.2. Detailed characteristics of connection terminals and indicators is included in Tables 3.1 ... 3.6.

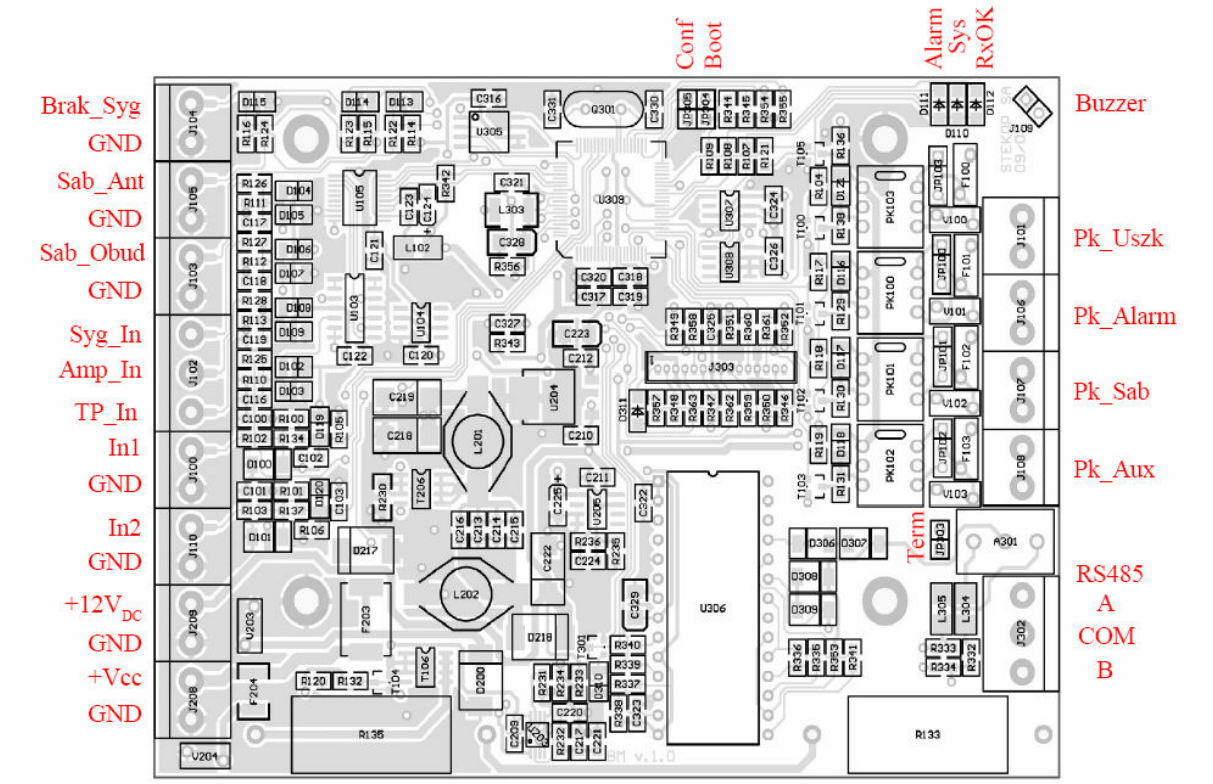

Fig. 3.1 *Motherboard of the electronic components of the receiver of microwave barrier type BM120C, BM200C*

Table 3.1 *Connection terminals of the receiver of microwave barrier type BM120C, BM200C (motherboard)*

Pos.	*Connector*	*Pin*	*Symbol*	*Description*	*Remarks*
1	J208	1	+Vcc	+9V DC ... +15 V DC supply voltage input	
		2	GND	power supply ground	
2	J209	1	+12V DC	analogue circuits board power supply voltage output	internal connection of the motherboard to the analogue circuits board
		2	GND	power supply ground	
3	J100	1	In1	multi-purpose two-state input In1	
		2	GND	ground	
4	J110	1	In2	multi-purpose two-state input In2	
		2	GND	ground	
5	J103	1	Sab_Obud	enclosure opening sensor	internal connection of the motherboard to the analogue circuits board
		2	GND	enclosure opening sensor ground	
6	J105	1	Sab_Ant	antenna orientation change sensor	
		2	GND	ground of antenna orientation change sensor	

Pos.	*Connector*	*Pin*	*Symbol*	*Description*	*Remarks*
7	J102	1	Syg_In	received signal quality measurement	internal connection of the motherboard to the analogue circuits board
		2	Amp_In	received signal amplitude measurement	
		3	TP_In	TestPoint measurement	
8	J104	1	Brak_Syg	transmitter signal fade sensor	internal connection of the motherboard to the analogue circuits board
		2	GND	ground of transmitter signal fade sensor	
9	J101	1,2	Pk_Uszk	FAILURE signal relay output	configuration of relay contacts (NC/NC) selected using JP103 jumper
10	J106	1,2	Pk_Alarm	ALARM signal relay output	configuration of relay contacts (NC/NC) selected using JP100 jumper
11	J107	1,2	Pk_Sab	SABOTAGE signal relay output	configuration of relay contacts (NC/NC) selected using JP101 jumper
12	J108	1,2	Pk_Aux	multi-purpose AUX relay output	configuration of relay contacts (NC/NC)selected using JP102 jumper
13	J302	1	A	A RS485 line	
		2	COM	RS485 ground	
		3	B	B RS485 line	
14	J109	1,2	Buzzer	buzzer socket	

Table 3.2 *Configuration jumpers of the receiver of the microwave barrier BM120C, BM200C (motherboard)*

Pos.	*Symbol*	*Function*	*Remarks*
1	JP305	loading of factory settings	
2	JP304	activation of bootloader function	
3	JP303	activation of RS485 bus terminator	

Table 3.3 *Indicators of the transmitter of microwave barrier BM120C, BM200C*

Pos.	*LED*	*Symbol*	*Colour*	*Function*	*Remarks*
1	D110	Sys	yellow	master system communication indicator	goes out if there is no communication with the master system
2	D111	Alarm	red	alarm indicator	
3	D112	RxOK	green	transmitter functionality indicator	goes out if fault is detected

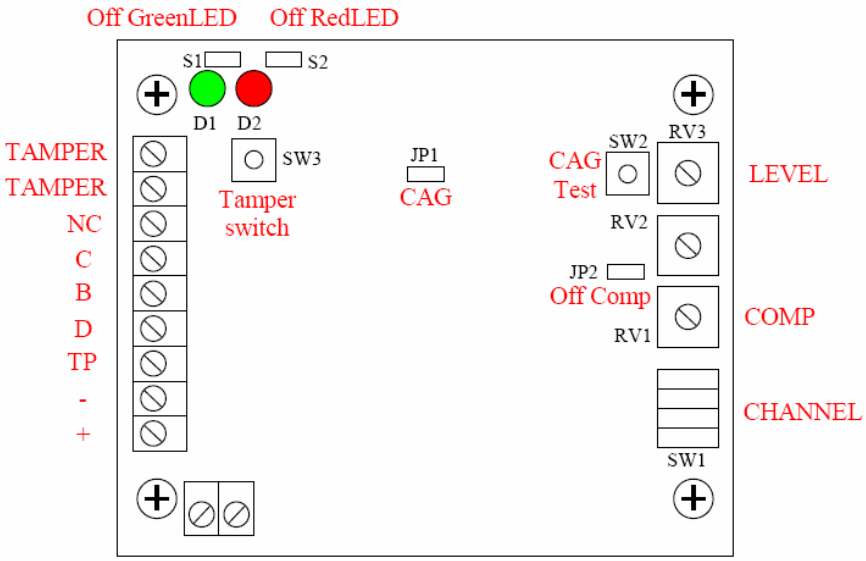

Fig. 3.2 *Board of analogue circuits of the receiver of microwave barrier type BM120C, BM200C*

Table 3.4 *Connection terminals of the receiver of microwave barrier type BM120C, BM200C (analogue circuits board)*

Pos.	*Connector*	*Pin*	*Symbol*	*Description*	*Remarks*
1		1,2	TAMPER	enclosure opening sensor output	internal connection of the motherboard to the analogue circuits board
2		1	D	transmitter signal fade sensor output	internal connection of the motherboard to the analogue circuits board
3		1	TP	antenna orientation measurement - TestPoint	
4		1	-	power supply ground	internal connection of the motherboard to the analogue circuits board
		2	+	analogue circuits board power supply input	

Table 3.5 *Configuration jumpers and controls of the receiver of the microwave barrier BM120C, BM200C (analogue circuits board)*

Pos.	*Symbol*	*Description*	*Function*	*Remarks*
1	S1	OffGreenLED	deactivation of green LED	
2	S2	OffRedLED	deactivation of red LED	
3	JP1	CAG	deactivation of CAG circuit for factory testing	in normal operation CAG jumper must always be installed
4	RV3	LEVEL	gain adjustment	

<table>
<tr><th>Pos.</th><th>Symbol</th><th>Description</th><th>Function</th><th>Remarks</th></tr>
<tr><td>5</td><td>RV1</td><td>COMP</td><td>gain compensation adjustment</td><td></td></tr>
<tr><td>6</td><td>JP2</td><td>Off Comp</td><td>deactivation of gain compensation circuit</td><td></td></tr>
<tr><td>7</td><td>SW1</td><td>CHANNEL</td><td>selection of operating channel
<table>
<tr><th>Channel</th><th>DIP1</th><th>DIP2</th><th>DIP3</th><th>DIP4</th></tr>
<tr><td>K1</td><td>ON</td><td>OFF</td><td>OFF</td><td>OFF</td></tr>
<tr><td>K2</td><td>OFF</td><td>ON</td><td>OFF</td><td>OFF</td></tr>
<tr><td>K3</td><td>OFF</td><td>OFF</td><td>ON</td><td>OFF</td></tr>
<tr><td>K4</td><td>OFF</td><td>OFF</td><td>OFF</td><td>ON</td></tr>
<tr><td>K5</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td></tr>
</table></td><td></td></tr>
<tr><td>8</td><td>SW2</td><td>CAG Test</td><td>antenna orientation test</td><td></td></tr>
</table>

Table 3.6 *Indicators of the receiver of microwave barrier BM120C, BM200C (analogue circuits board)*

Pos.	LED	Symbol	Colour	Function	Remarks
1	D1	Syg	green	received signal quality indicator	
2	D2	Alarm	red	alarm indicator	used only in analogue version of the barrier and as CAG test indicator

4. Characteristics of operation

Transmitter (Tx) and receiver (Rx) of the microwave barrier are installed at the ends of the area to be protected at the height of 1 to 1.2 m. Directional characteristics of both receiving and transmitting antennas result in that the alarm zone between the transmitter and the receiver has a shape of a spheroid and it is broadest halfway between the antennas. Its longitudinal and cross sections and approximate dimensions are presented in Fig. 4.1 and 4.2. Any intruder present within that area will cause a change in the signal level reaching the receiver which is detected and indicated by the barrier as an alarm.

There are "dead zones" near both antennas of the microwave barrier of the length of approx. 3m where the detection of the intruder is not possible. Therefore, the arrangement of microwave barriers must be designed so that the dead zones are not within the zone to be protected. Additionally, attention should be paid to the area directly adjacent to the alarm zone (so-called detection zone) as any large objects occurring in that zone may cause a change in the signal received identical to that caused by small objects present in the alarm zone. This is a frequent cause of false alarms. To avoid it appropriate distance must be kept between the microwave barrier and the objects which might be placed in the detection zone thus interfering the operation of the barrier. The recommended distances between the microwave barriers type BM120C and BM200C and field obstacles are listed in Table 5.1.

5. Microwave barrier installation principles

Proper operation of the microwave barriers is significantly impacted by the environment. Therefore, to achieve high confidence in intruder detection and low false alarm rate particular attention must be paid, as early as in the designing stage, to appropriate location of barriers and the configuration. **The basic principle is not to place a transmitter microwave barrier (Tx) of another set close to the receiver (Rx). Another principle is to select microwave barriers operating channels in such a way that the sets operating in the same channel are located as far as possible from each other.** The optimum selection is when the segments adjacent to each other operate at frequencies (i.e. channels) which are as different from each other as possible, which however is not always possible. The Figures 5.1 ... 5.3 show typical configurations of microwave barriers used in perimeter security systems.

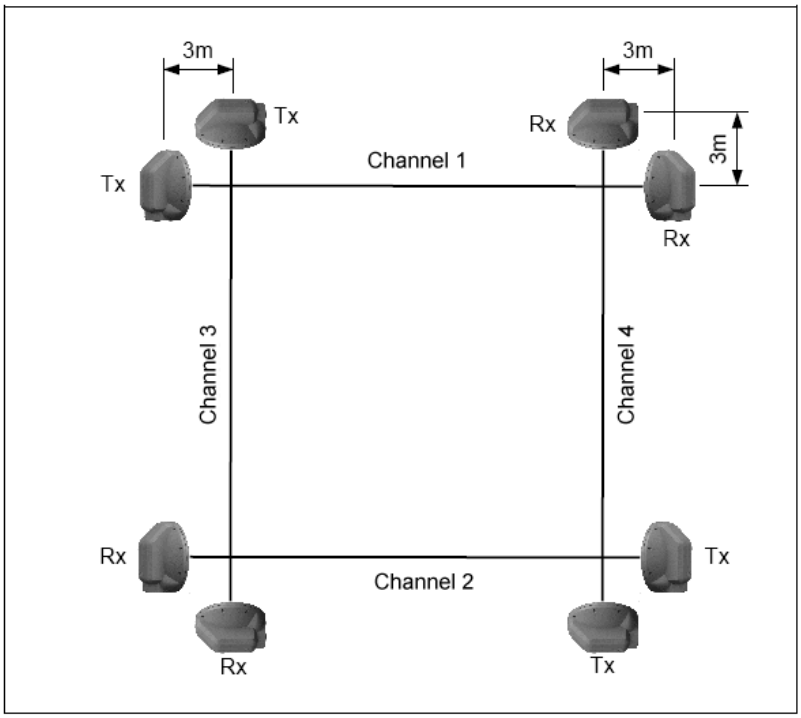

Fig. 5.1 *Standard configuration of the perimeter security system of a closed area*

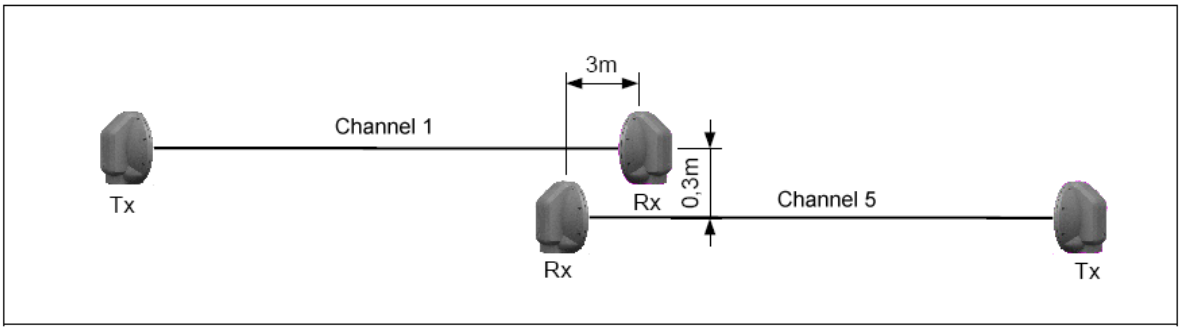

Fig. 5.2 *Method of protecting the border of an area by means of two microwave barriers*

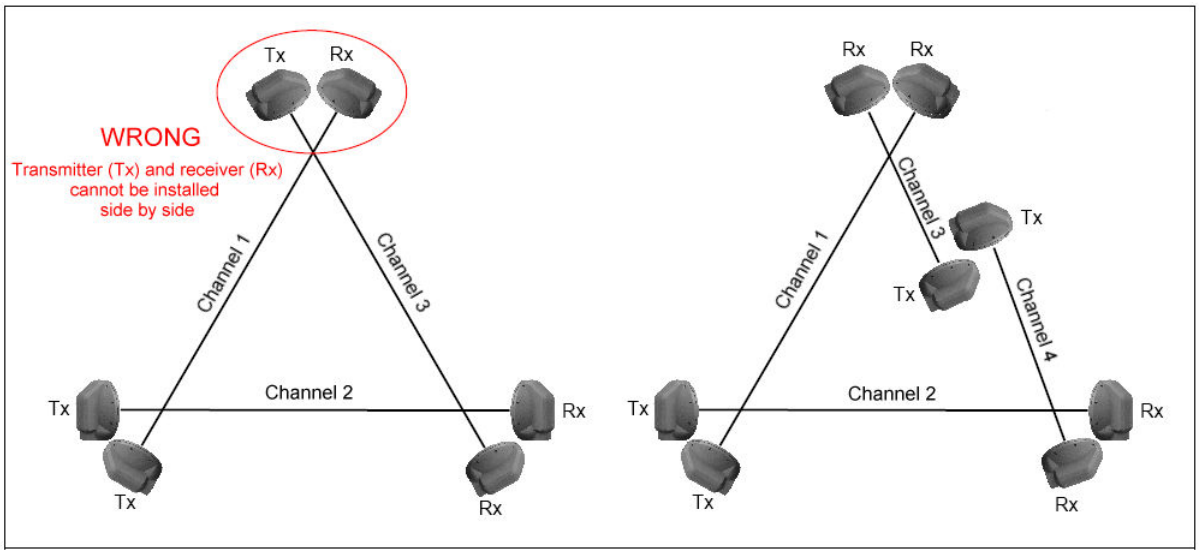

Fig. 5.3 *Wrong and proper configurations of the perimeter security system of a closed area*

If a single segment of the microwave barrier does not provide sufficient height of the alarm zone it is possible to install two or more segments on the same mounting pole. However, the individual segments **must operate at different frequencies (different channels).**

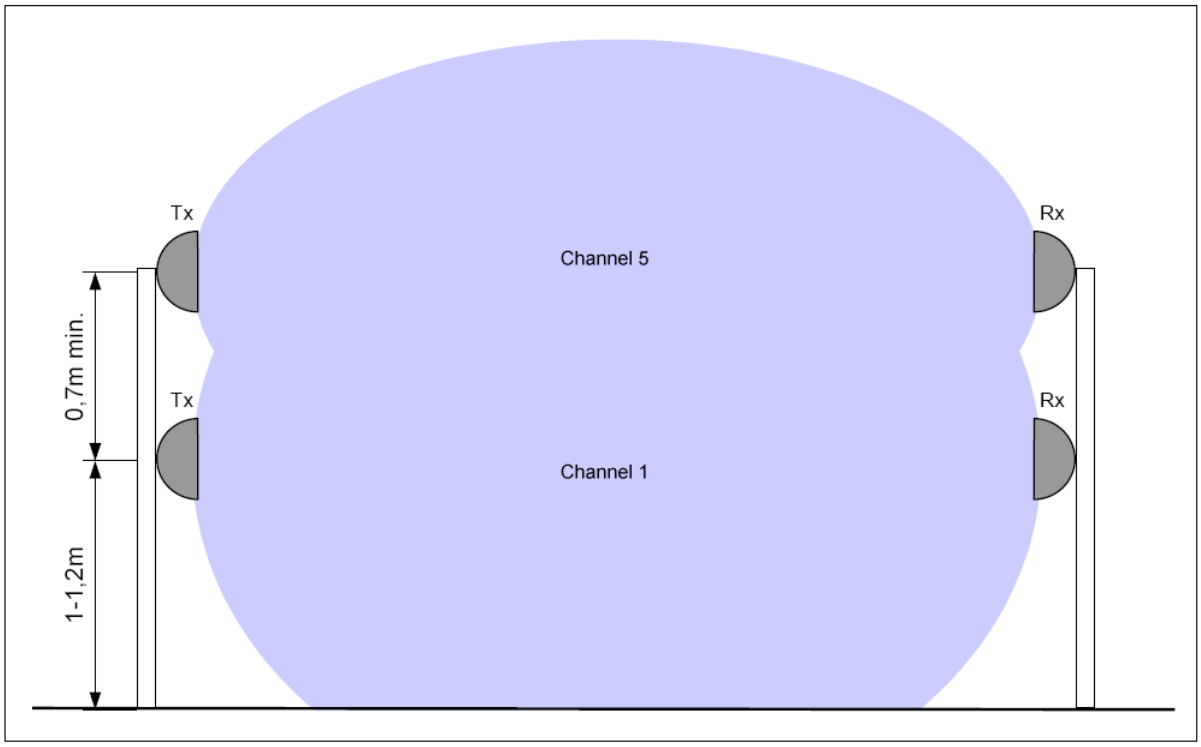

Fig. 5.4 *Method to increase alarm zone height*

Where the microwave barrier beam may come in contact with a fencing or plants or a building wall, safe gap between the beam and the obstacle must be secured. Recommended minimum barrier installation distances from various objects are specified in Table 5.1.

Table 5.1 *Minimum distances between the middle of the microwave barrier type BM120C, BM200C and an obstacle*

Pos.	***Obstacle***	***Minimum distance***
1	Climbing plant fencing or wire fence susceptible to movement	10 m
2	Wall	2 m
3	Rigid metal fencing	5 m
4	Building wall	5 m
5	Street	10 m from the edge of the street and 5 m from a metal fencing
6	Shrubs and trees	Branches moved by the wind should not disturb the microwave beam
7	Land irregularities and obstacles	Land irregularities and obstacles should not be in the way of the microwave beam. Otherwise, the barrier must be tested for the presence of dead fields and increased sensitivity areas.

The operation of the microwave barrier is also affected by weather conditions. If some conditions are specific for the installation site their impact on the operation of the microwave barrier should be taken into account at the design stage. The table 5.2 lists typical impacts of various weather conditions on the operation of microwave barriers.

Table 5.2 *Impact of weather conditions on the operation of the microwave barrier type BM120C, BM200C*

Pos.	***Weather phenomenon***	***Impact on the microwave barrier***
1	Rain	No interference in operation of the barrier. The only possible drawback may be a reduction of the beam power and local increase in the barrier sensitivity close to the ground caused by deflection of the beam by water pools.
2	Snow	No interference in operation of the barrier. Lying snow may however shut out the antennas and thus interfere in or prevent the operation of the barrier.
3	Fog	Damping of the microwave beam (even by 1/3) is present. In regions exposed to frequent occurrences of fogs it is recommended to install the transmitters (Tx) and the receivers (Rx) at a distance not larger than 85% of the maximum barrier coverage.

6. Installation of antennas

Antennas of microwave barriers BM120C, BM200C are intended for mounting on galvanized steel pipe masts 38 to 40 mm in diameter. The clamping holder (Fig. 6.1) is adjustable within 3 steps of the antenna orientation adjustment.

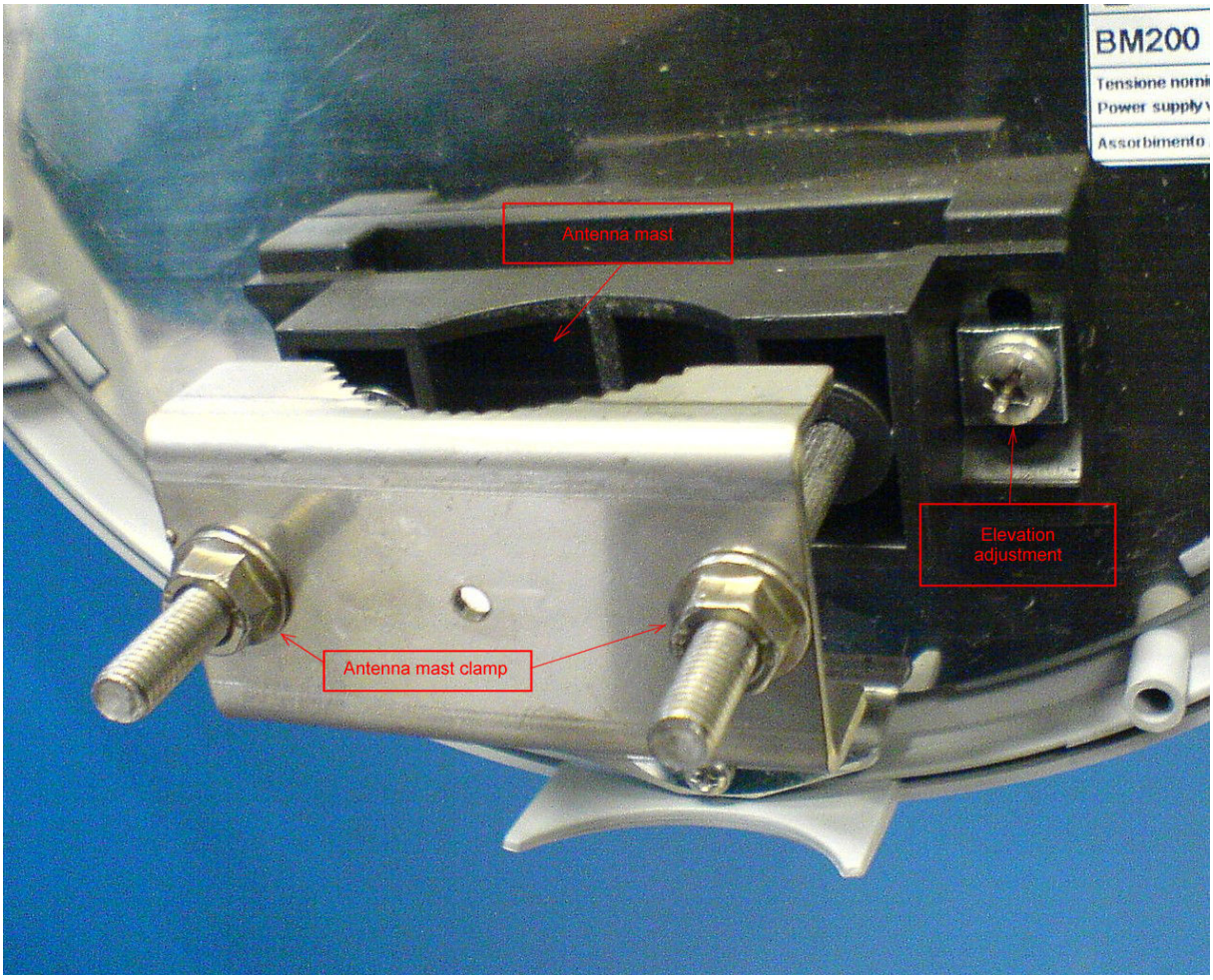

Fig. 6.1 *Antenna mounting holder*

Table 6.1 *Adjustment of orientation of the BM120C, BM200C microwave barrier antenna*

Pos.	***Degree of freedom***	***Adjustment method***
1	Height	Lowering and raising of antenna along the mast.
2	Azimuth	Rotation of antenna around the mast.
3	Elevation	Tilting of antenna using elevation adjustment screws within +/-5°.

It is recommended to test the operation of the barrier and find the optimum locations for the antennas before the final installation of the antenna mast. To this end:

1. Temporarily place the masts at the locations provided for in the perimeter security system design; install the antennas and direct them towards each other.
2. Programme the transmitter and set the receiver to operate at the same frequency channel.
3. Supply power to the transmitter and the receiver of the microwave barrier.
4. Connect the multimeter to TP point of the receiver.
5. Using LEVEL potentiometer of the receiver set voltage at TP point to 7.3V.
6. By adjusting the orientation of both transmitting and receiving antennas (within +/- 50cm up/down, +/-50 cm left/right and +-/5º elevation) achieve maximum voltage at the TP point. If there are problems to achieve the voltage of 7.3V consider relocation of the antenna masts. If the voltage at TP is less than 6.8V with the LEVEL adjustment potentiometer fully counter-clockwise and it will not increase even if the orientations of the antennas are changed, the height of antenna installation must be increased by 10 to 20 cm; should that bring no effect the protection zone must be shortened (i.e. transmitting and receiving antennas must be brought closer to each other).

<u>Attention</u>: If, during the tests, the voltage at TP increases above 7.5V it must be brought down to 7.3V by adjusting the LEVEL potentiometer.

7. Programme the required alarm threshold on the receiver.
8. Test the alarm zone for the presence of dead fields and increased sensitivity areas. Should such places be found consider removal of the land obstacles or relocation of the antenna masts.

The established locations of antennas is the searched optimum position. During the testing attention must be paid to check for the presence of objects (e.g. cars) in the microwave beam area, which might impair the results of the measurements and cause a selection of wrong installation locations for the antennas.

The above procedure allows, in case of any problems in the operation of the microwave barriers, to introduce sufficiently early changes to the design and alter the locations for the antenna masts installation, which might not prove possible after the final installation.

For the connection of microwave barriers BM120C, BM200C screened cables must be used in non-combustible insulation of the cross-sectional areas of 0.75 mm2 (power supply), 0.22mm2 (signal cables) and strand cable of category 5 (RS485 bus). The cables should be introduced into the antennas inside the masts and all cable penetrations should be secured against penetration of water and moisture. Additionally, it is recommended to make securing knots on the cables to prevent water from running down the cables.

7. Optional mounting holders

Three types of mounting holders are available for the microwave barriers B120C and BM200C. They are: SB 20, SB 120 and SB 130. Holders SB 20 (Fig. 7.1) are intended for wall mounting while mounting poles SB 120 and SB 130 are intended for installation on the ground. The pole SB 120 (Fig. 7.2) is screwed to the substrate while the pole SB 130 (Fig. 7.3) is to be concreted.

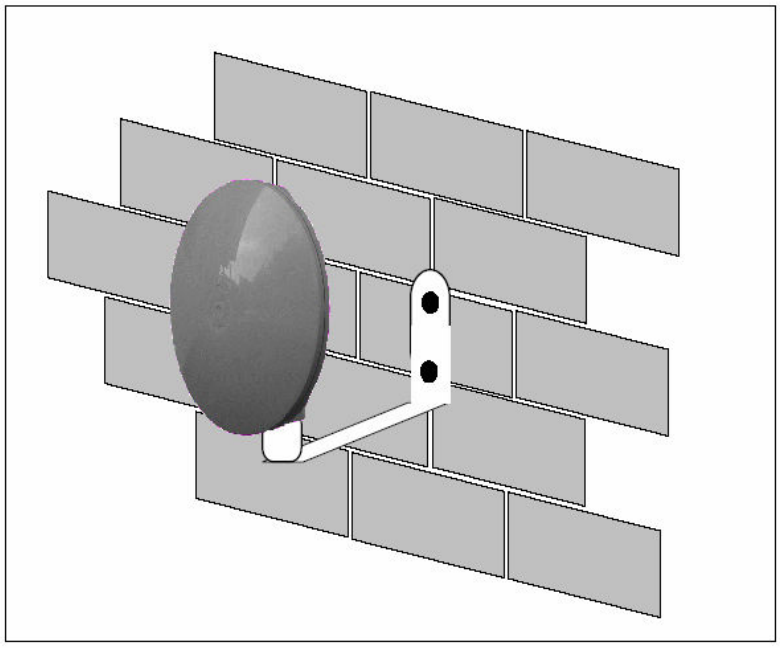

Fig. 7.1 *Mounting holder SB 20*

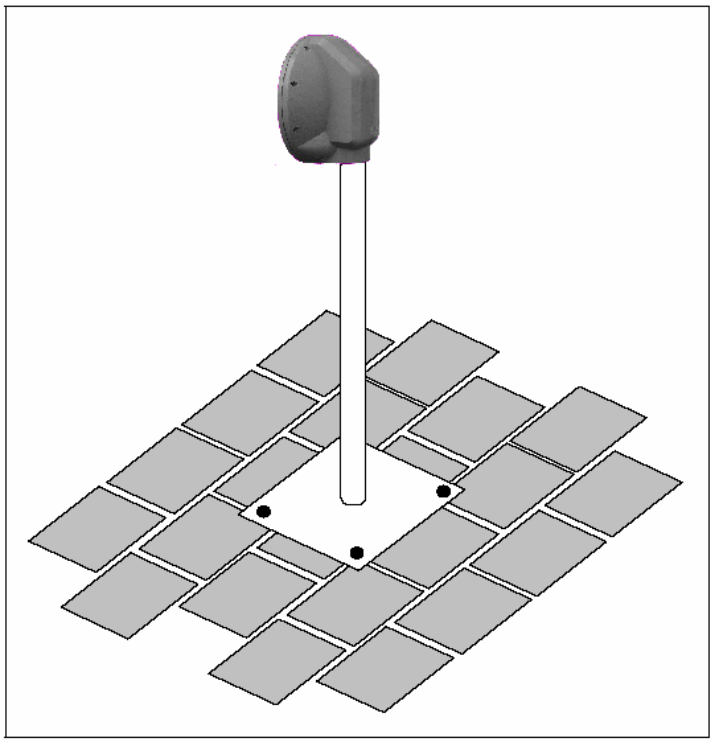

Fig. 7.2 *Mounting pole SB 120*

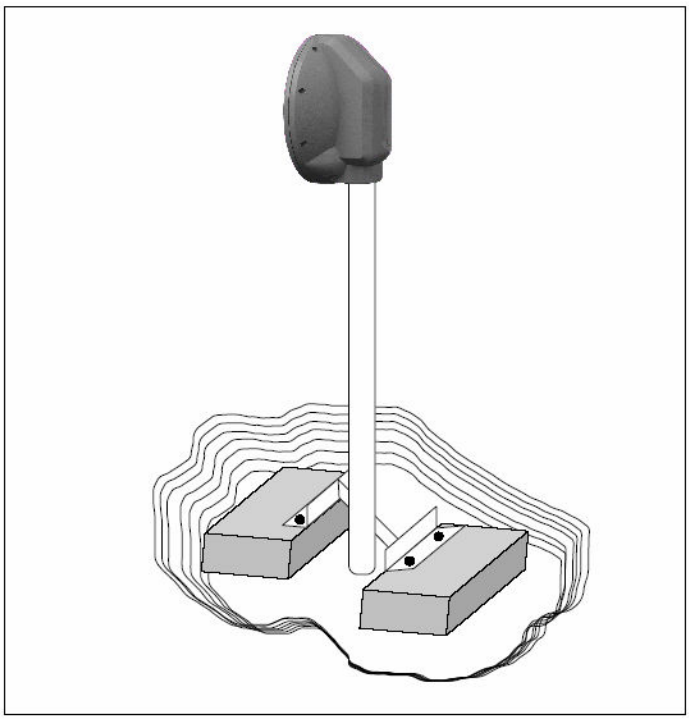

Fig. 7.3 *Mounting pole SB 130*

8. Start-up and calibration

The procedure for start-up and calibration of a microwave barrier is similar to that described in chapter 6 of the initial barrier testing procedure. It is comprised of the following steps:

1. Programming of the receiver's operation channel using the service programme.
2. Setting the receiver's operation channel with SW1 switch (identical to the programmed receiver channel).
3. Optimization of orientation of the receiving and transmitting antennas to achieve the maximum strength of the signal received (according to the procedure described in Chapter 6).
4. Testing the operation of the analogue receiver circuits (when **Test CAG** button is held down on the receiver's analogue circuits board, red **D2** diode should be lit followed by **D1** diode lighting up to indicate proper operation of the receiver. Once the test is completed **Test CAG** button should be released and the lighting of **D1** and **D2** diodes broken using S1 and S2 jumpers).
5. Locking the adjustment of the transmitting and receiving antenna orientation (by tightening the bolts to fix the antenna on the mast and the elevation adjustment bolts – Fig. 6.1).
6. Setting the sensors of antenna orientation in such a position that any change in the orientation of the antenna will cause the triggering of the sensor and sabotage indication (Fig. 8.1).
7. Performing test intrusions into the barrier beam at regular intervals (e.g. every 10m), starting from the transmitting antenna and ending at the receiving antenna, with simultaneous registration by the service programme of the received signal level.,
8. Determination of the optimum alarm threshold on the basis of the records made by the service programme.
9. Testing the actual shape of the detection zone and looking for the presence of dead fields and increased sensitivity fields.

Final testing of the operation of the microwave barrier is supported by a buzzer connected to J109 socket on the motherboard of the receiver, which is always triggered by an alarm. The buzzer releases the tester from the necessity to observe both the diodes which reflect the status of the barrier and the service programme screen.

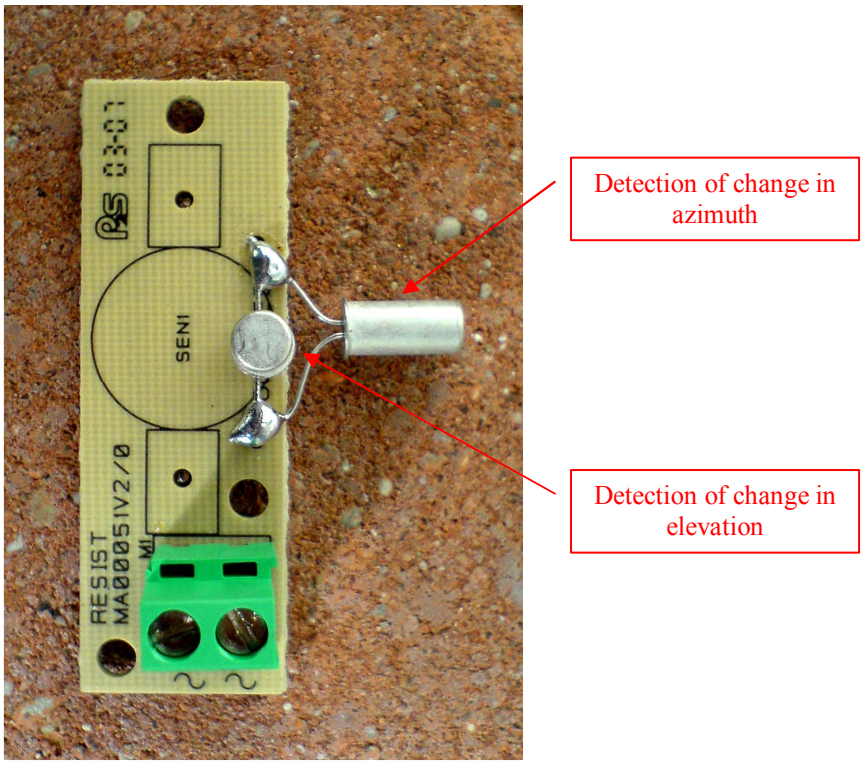

Fig. 8.1 *Antenna orientation change sensor*

9. Operation with master system

The microwave barrier BM120C and BM200C can be connected to a master system in one of two ways. First of them is a coupling with the Anti-Burglary and Anti-Assault Indication System via relay outputs. In order to fully connect one B120C or BM200C barrier, five detector lines (Table 9.1). In case of more developed perimeter security systems the number of detector lines necessary for connecting the microwave barriers is very high which may be a problem. Additionally, such a coupling with the master system ensures the transmission of only few basic data. Therefore, the method of connecting microwave barriers to control units of Anti-Burglary and Anti-Assault Indication Systems via relay outputs is recommended for simple systems only, including a few segments of BM120C and BM200C barriers.

Pos.	***Module BM120C, BM200C***	***Output***	***Signal***
1	Receiver (Rx)	Pk_Alarm	Intruder in the detection zone
2		Pk_Uszk	Fault in the receiver module
3		Pk_Sab	Sabotage of the receiver
4	Transmitter (Tx)	Pk_Uszk	Fault in the transmitter module
5		Pk_Sab	Sabotage of the transmitter

Another method to couple the microwave barriers BM120C and BM200C with the master system is to connect them via RS485 bus (Fig. 9.1). That system coupling method allows full control of the operation of the microwave barriers. The communication protocol implemented in barriers BM120C and BM200C enables to:

- receive messages on the events occurred in the system (i.e. alarms, faults, sabotages etc.)
- read and programme alarm criteria (i.e. alarm threshold, minimum and maximum time of microwave beam disturbance by the intruder etc.)
- test the operation of the barrier
- observe on-line the level of the signal received
- read the runs recorded in the receiver's memory, which fulfilled the alarm criteria
- read and save the configuration
- update the transmitter and receiver module software

Approx. 15 sets of BM120C and BM200C barriers of the max. length of 1,200m (i.e. 30 modules incl. 15 transmitters of BM120C and BM200C and 15 receivers of BM120C and BM200C) plus one master system can be connected to a single RS485 bus. Where the length of the RS485 bus is insufficient it can be extended by means of the so-called repeaters / amplifiers of RS485 (e.g. of ADAM-105 type manufactured by Advantech). Another solution is to switch from RS485 bus to a different transmission medium (e.g. optical fibre, Ethernet) by means of appropriate converters.

When designing RS485 bus all recommendations of TIA/EIA-485-A standard regarding the structure of RS485 buses must be observed and in particular the following:
- use copper strand cable 24AWG of wave impedance of 100 Ohm as a connecting cable
- do not exceed the maximum bus length
- do not use bus branches (except for RS485 repeaters)
- install 100 Ohm terminating resistors at the ends of the bus

End-of-line resistors (Rk) are usually incorporated by the devices with RS485 interface. Connection of such a resistor to the RS485 bus is performed by installation of an appropriate jumper, which is JP03 jumper for transmitters and receivers of BM120C and BM200C (Fig. 2.1 and 3.1).

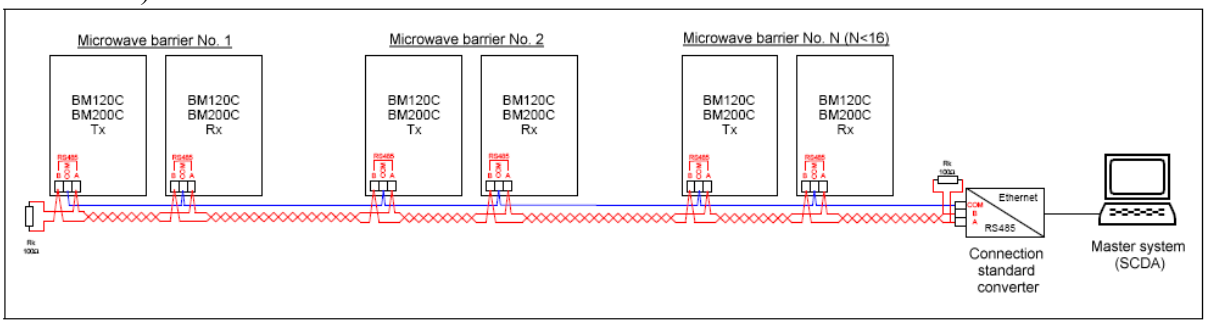

Fig. 9.1 *Diagram of connection BM120C and BM200C microwave barriers to RS485 bus.*

As the RS485 transceivers in the transmitters and receivers of BM120C and BM200C barriers are circuits which provide galvanic isolation of RS485 bus from the barrier electronic circuits, it is necessary to equalize ground potentials on the RS485 bus side. This is performed by means of an additional cable connecting COM points of all the modules connected to the RS485 bus (Fig. 9.1).

<u>Attention</u>: COM point provides grounding of the RS485 transceiver only. It is not a ground of electronic circuits nor of the power supply system. Therefore, the COM point must not be connected to the ground and power supply GND. Such a connection would eliminate the galvanic isolation of the RS485 bus!

10. Service programme

Installation, start-up, testing and maintenance of BM120C and BM200C microwave barriers are supported by *Micro.exe* service programme. The programme communicates with microwave barrier receivers and transmitters connected to RS485 bus to allow:

- reading and configuration of the operating parameters of transmitters and receivers,
- monitoring of on-line signal received by the selected barrier receiver,
- determination of alarm criteria parameters (i.e. signal level, minimum and maximum duration of interference of microwave beam by the intruder and the slope of the interference signal edge),
- reading of events,
- collection of runs recorded in the barrier receiver memory which met the alarm criteria

The service programme of *Micro.exe* operates in MS Windows systems and requires no installation. Once the programme is placed in the selected working folder it is necessary only to define the parameters of the COM serial port in *Settings ->Programme->Port settings* (Fig. 10.1). Indicate a serial port as the operating port, to which RS485 bus is connected. It can be either RS232 physical port with connected RS232/RS485 converter or a virtual serial port, emulated in the system by the driver of the USB/RS485 converter or Ethernet/RS485. In any case the remaining transmission parameters of COM port are identical (i.e. 9600 8N1).

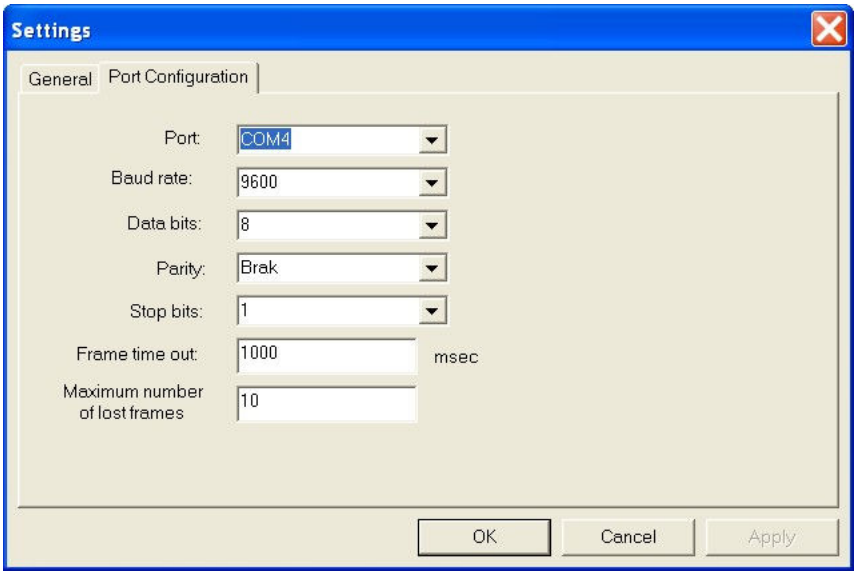

Fig. 10.1 *Serial communication port parameters configuration window*

Working window of *Micro.exe* programme is illustrated in Fig. 10.2. In order to start working with the programme BM120C/BM200C microwave barrier module must be selected by inputting the module type (i.e. transmitter/receiver) and its address on RS485 bus and, subsequently, by logging on to the device. The default login password is *STEKOPSA*. If the login password is unknown you can restore the default settings by shorting *Conf* (JP305) jumper module on the motherboard followed by turning the power on. Correct logging into the device is indicated by a change in the description of the logging button to *Logout*. From that moment on *Micro.exe* programme takes over full control over the operation of the selected BM120C, BM200C barrier module. The operator may, by pressing the function keys, read the recorded runs or collect them from the receiver memory. Those options are also available from the programme menu -> *Actions*.

Function keys in *Micro.exe* programme

- Start on-line displaying of the received signal level
- Stop on-line displaying of the received signal level
- Clean received signal level visualisation window
- Start recording (save the received signal level to a file)
- Stop recording (end of saving the received signal level to a file)
- Start playback from the file (reading of the received signal level from a file)
- Stop playback from the file (end of reading of the received signal level from a file)
- Start reading of the recorded runs from the receiver memory
- Stop reading of the recorded runs from the receiver memory
- Download current configuration from the device
- Device configuration menu
- Menu for recording and saving the levels of signals received from several receivers simultaneously to a file
- Printing the recorded runs
- Info about the programme

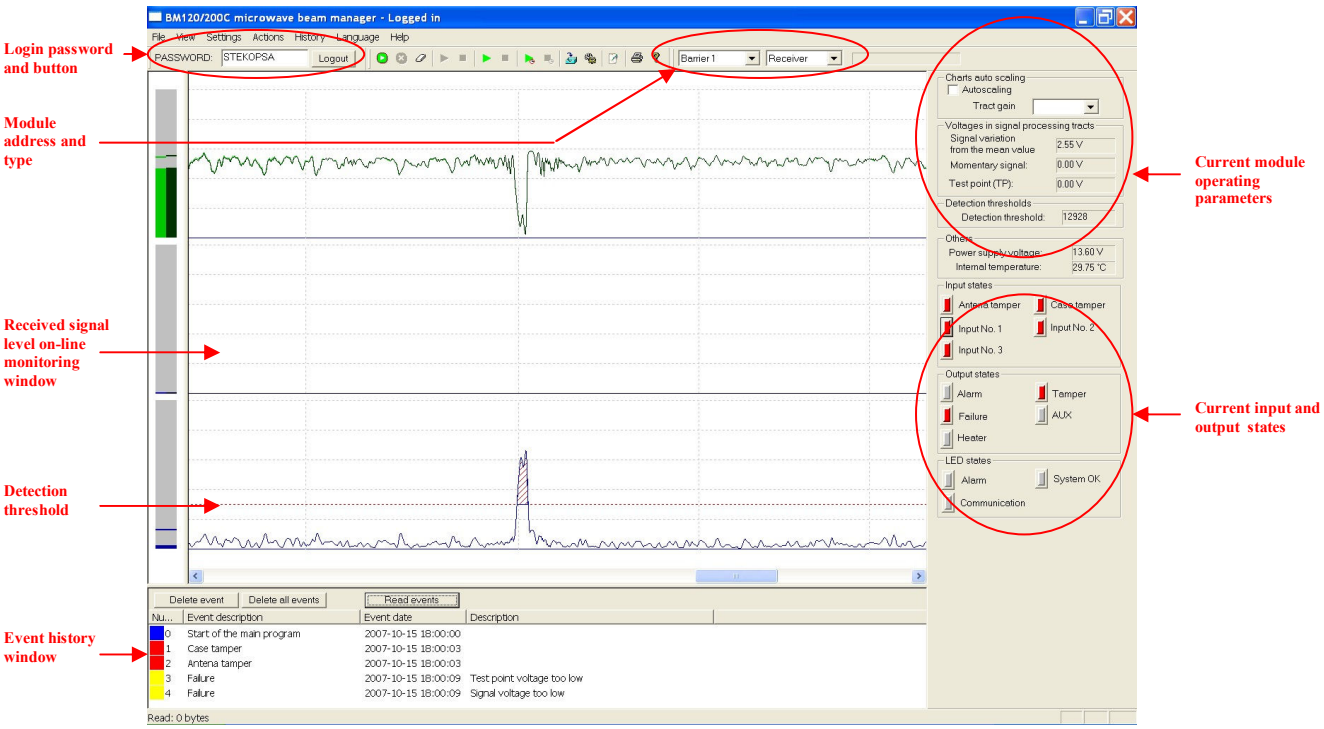

Fig. 10.2 *Main window of the service programme*

The module operating parameters and the current states of inputs and outputs displayed in *Micro.exe* programme are updated each time the button for *Downloading current configuration from the device* is pressed. The refreshing of the selected operating parameter fields can be also performed automatically. The list of parameters which can be refreshed automatically by the programme is definable in *Settings -> Programme -> General* (Fig. 10.3). However, ticking all fields for automatic updating will result in significantly slower operation of the service programme. Therefore, as few as possible fields should be selected.

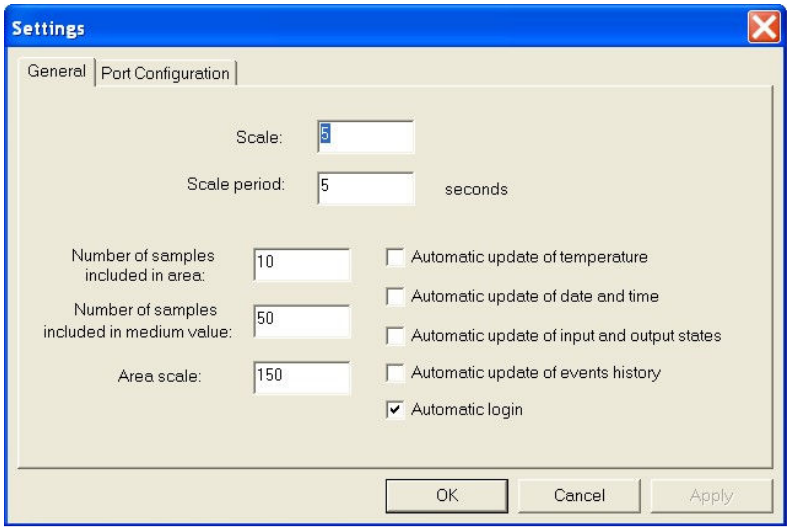

Fig. 10.3 *Micro.exe operating parameters configuration window*

Configuration menu -> *Settings* -> *Device* includes a number of tabs where you can read and modify the settings of the logged-in BM120C/BM200C barrier module. The configuration control is performed by means of 6 function buttons:

Function buttons of *Device Configuration* menu


Update (read from the device) the active tab content


Update (read from the device) the content of all active tabs


Programming in the device of the parameters defined in the active tab


Restart the programme, activate and deactivate bootloader function


Change device address


Save / read the configuration to/from the HDD

The following parameters can be configured in the tabs:

- login password
- detection parameters
- measurement thresholds (of alarm and recording)
- parameters of sampling and calculation of average (reading only)
- date and time
- states of inputs and outputs (reading only)
- transmitter operating channel
- testing the operation of outputs (relays and heater)

Change of device address, restarting of the programme and activation/deactivation of the bootloader function (i.e. loading of new software version) are available from each tab in the menu.

Basic function of *Micro.exe* service programme is visualisation of the level of signal received by the BM120C/BM200C barrier receiver module which allows setting of the optimum alarm threshold. This can be done in either of two ways, by inputting the numerical value of the alarm threshold in the proper tab of *Device Configuration* menu or using the graphic method. The latter method is easier and more intuitional. It consists in moving the straight line designating the detection threshold to the selected level with the right mouse button pressed (Fig. 10.2). On releasing the right mouse button the selected alarm threshold is automatically programmed in the microwave barrier receiver. The section of the curve located above the detection threshold line i.e. those marked red (Fig. 10.2) indicate alarm. The detection threshold must be set in such a way that the peaks of all signal interferences caused by the intruder are located above, while the interference caused by the environment (i.e. noise) should be located below the line. As the shape of the detection zone is non-homogenous the detection threshold should always be set not on the basis of a single intruder signal but using many events of interference in the detection zone comprising the cross-section of the entire microwave beam. This is typically performed by trespassing the detection zone at regular intervals (e.g. every 10 minutes) starting from the transmitting antenna and ending at the receiving antenna.