

# HARKOTECH



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Installation manual

Mamba II

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## 1. GENERAL INFO

### 1.1. DESIGN

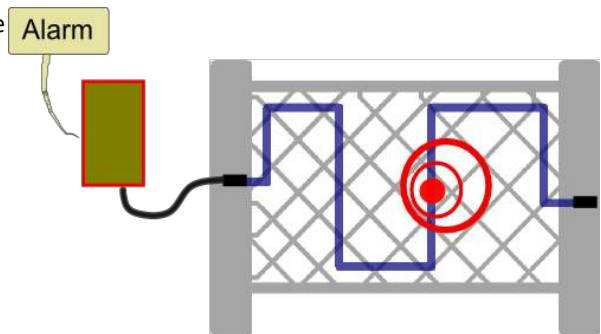
MAMBA perimeter system is primary designed to secure perimeter of the objects, especially fences. It can be used for underground installation, concrete walls, the protection of solid objects such as solar panels etc.

This alarm system generates an alarm when intruder trying to overcome a fence or any attempt of intrusion. System also testing constantly overall integrity of the cable (disconnection, short-circuit).

### 1.2. PRINCIPLE OF OPERATION

The general principle is based on fact that the detection cable generates small triboelectric signal. This signal (static electricity) is due to friction between the dielectric and the copper core of the cable. Deformation of the cable and friction in the cable will generate signal in the moment of the intrusion. If the cable is well connected to the fence all fence working like sensitive intrusion detector.

Whenever the intruder will attempt to handle any fence or cable, the system immediately generates an alarm signal.



The sensor is typically mounted directly to the fence or fence posts (see. Chapter 1.4 Installation requirements and procedure). Sensing cable is securely fastened to the fence using a plastic or metal cable ties. The number of strips is an important parameter for the overall system behaviour and sensitivity. Generally: smaller number of the strips is used to fix the cable it will decrease the sensitivity of the system and it may cause false alarms.

System is proofed a recommended to use with shielded cable category 5 – it means cable “FTP Cat 5E” or “STP Cat 5E”. They can also be used in other types of communication cables that are suitable for its characteristics particularly resistance in an outdoor environment and also their construction. The system also supports a special kind of sensing cable called “vibrocable” which is typically used for fixed concrete fences or underground installations. Vibrocable and other non-recommended cable consult with your supplier.

The system consists of the following components (see. Fig. 1):

- sensor MAMBA (1)
- non sensitive cable (2)
- cable junction box (3)
- sensitive cable (4)
- termination (5)



Fig. 1: Diagram of the system

### 1.3. TECHNICAL SPECIFICATION AND CONDITIONS

Sensor contain two different kind of outputs - Alarm (burglar alarm) and two outputs Tamper (disruption of integrity of the cable, alarm from tilt detector, low voltage etc.).

Power consumption:	Max. 40 mA
Voltage supply:	DC 9-25V
Operating temperature:	-40°C ~ + 80°C
Protective rating:	IP67
Bus type:	RS485 (speed 19 200 baud)
Bus range:	2000m
Tilt detector:	3 axis ±3G
Outputs:	Alarm – NC contact (normally close contact) Tamper I – NC contact (normally close contact) Tamper II – NC contact (normally close contact)
Outputs features:	Impedance 8Ω, 50V /150mA

#### Package content

Mamba sensor	1 pcs
Junction	1 pcs
Termination junction	1 pcs
Terminator	1 pcs
Quick installation guide	1 pcs
CD with software and documentation	1 pcs

### 1.4. CABLE INSTALLATION REQUIRMENT

For mounting on the fence, use plastic or metal straps with UV resistance at a distance of 20-30 cm. Right and stable coaction to the fence is one of the most important parameter of stability of the system. Cable and the fence has to be one compact unit. Important is also Important is a sufficient cable tension and uniform strength of tightening strips. It is advantageous to use a special mounting strips tongs. If the cable is routed through a column or other reinforcement, set higher tension level on the tongs.

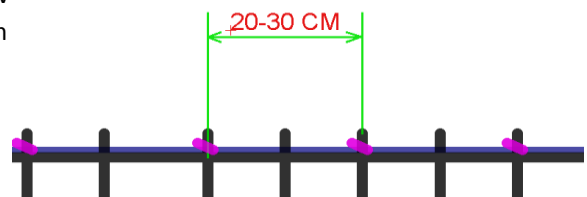


Fig. 2: Strips installation

Do not connect detection cable directly to the Mamba unit, use non-sensitive cable connected in the junction box (see. Figure 1 - Diagram of the system). Non-sensitive cable is typically a coaxial cable type RG59 without aluminium foil shielding. Best non-sensitive cable is the RG59 cox with cooper mesh dielectric shielding.

Do not stress cable when crossing fence posts (see. Fig. 3). In this case, leave the cable non-stressed due to dilatation of the cable and the movement of blocks of the fence.

Make sure that non-sensitive cable RG59 is hidden and possibility of sabotage is eliminated to the minimum.

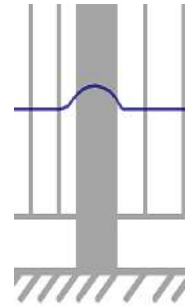


Fig. 3: Crossing the fence post

## 2. FENCES

### 2.1. TYPES OF THE FENCES

System is able to work properly with following types of the fences:

- Knitted wired fence
- Wired fence
- Concrete fence or wall
- Solid metal fence
- Wooden fence
- Barber fence

There is possibility to use standard mounting method in most cases for the wired fences. If you would like to install system to the concrete or other solid fence, please contact producer or distributor to discuss installation method.

### 2.2. INSTALLATION OPTIONS AND TIPS FOR ASSEMBLY

Install the sensor directly to the fence post.

Wired fence has to be strong around the complete perimeter and the strips has to be stressed everywhere in the same tension. Try to keep same installation condition in full length of the fence.

Do not install the sensor on the damaged fence.

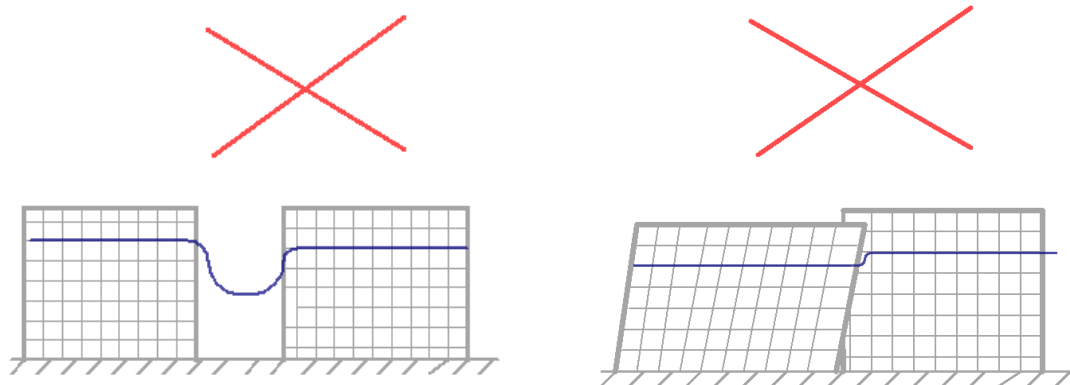


Fig.4: Bad installation conditions

Individual segments of the fence must be stable also between each other. Sensitive cable must never be free - always has to be firmly attached to the fence.

When the system is properly installed, the alarm is generated when the fence is deformed, such as an attempt to overcome or any other attack.

Within elimination of false alarms try to secure the fence to prevent movement in the wind.

### 3. INSTALLATION

#### 3.1. INSTALATION OF THE DEVICE

##### IMPORTANT NOTICE

Please pay attention to the grounding of the sensor. Detector should not be grounded more than once. Please ground the sensor in one place possible shortest cable (minimum diameter of 1 mm) - see. Fig. 5.

Minus pol (-) of power supply IS NOT grounding of the sensor.

Before connecting the sensor to the installed cable, be sure that the impedance between the cable shield and wires is more than 20 MΩ.

Do not install the system in bad weather condition with high humidity (rain and snow). It is very important not to leave the stripped cable in water and is necessary to avoid any penetration of humidity into the cable. In these cases are helpful usage of lubricant, which prevents the penetration of moisture and displaces it.

If you want to increase system robustness against sabotage place sensor in another plastic or metal junction box. It is also possible to fit it into other elements of the system (emergency button, backup power supply, the source backup, security system concentrator, etc.) - see. Fig. 6.

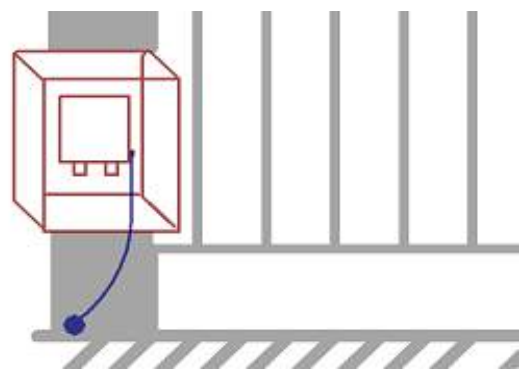
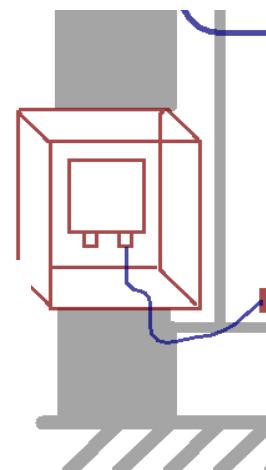


Fig. 6: Another mounting box



Board schematic:

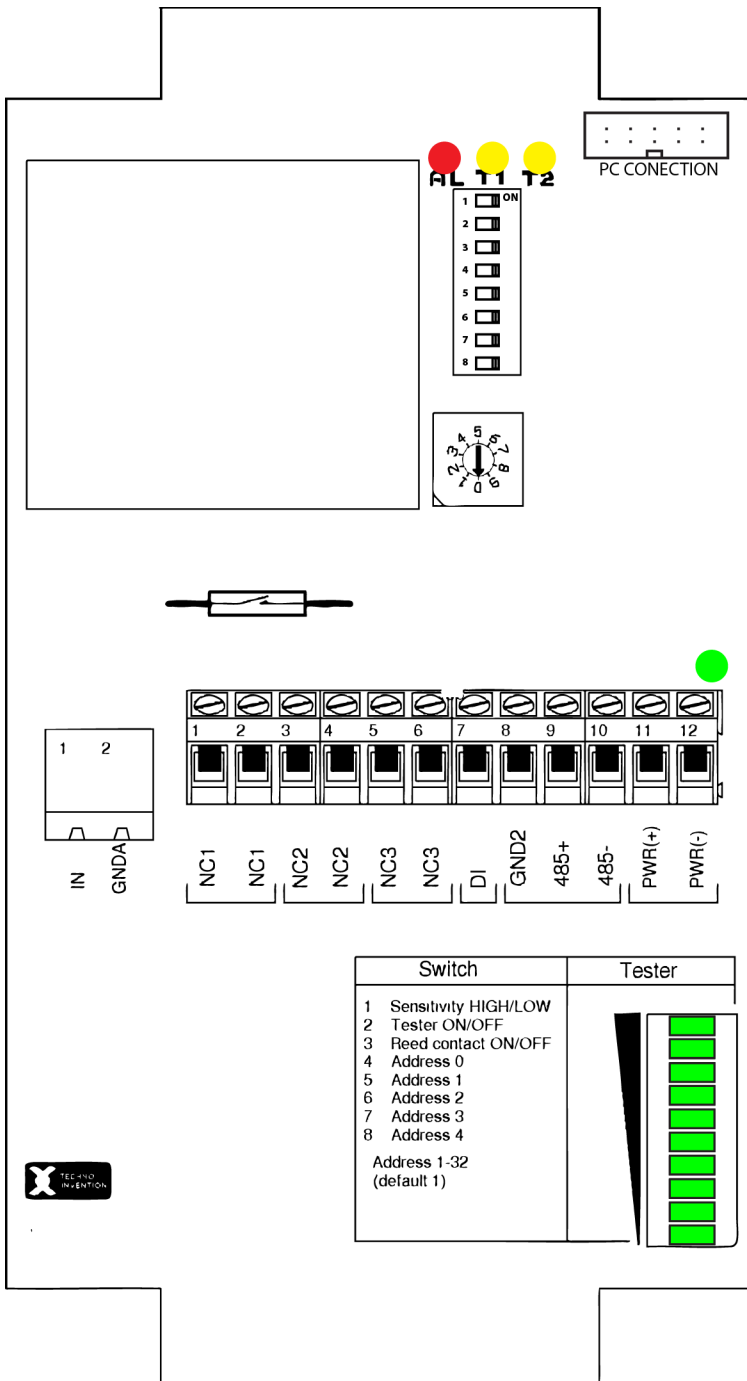


Fig.7. Mainboard MAMBA II -1

DIODY:	
AL	ALARM
T1	TAMPER 1 (reed relay always + cable termination in default)
T2	TAMPER 2 (tilt detector in default + low power – default < 9V)
Green	Power ON – in order
DIP switch:	
1	Extra sensitivity ON / OFF
2	Test mode (activation of tester)
3	Tamper contact – reed relay (ON - active, OFF deactivated reed relay on main board)
4-8	BUS address (binary 1-32) see. Section 3.3 Controls
Rotary switch:	
0-9	Sensitivity (0 - lower, 9 - higher)
Terminals:	
IN	Connection of sensitive detection cable. Terminal IN - wires and GNDA - shield.
GNDA	
NC1	Output ALARM (normally close)
NC1	
NC2	Output TAMPER 1- reed relay always + cable termination in default)
NC2	
NC3	Output TAMPER 2 (Tilt detector in default + low power – default < 9V)
NC3	
DI	Input for decreasing of sensitivity (activation by connection to GND2)
GND2	BUS terminals RS485. Galvanically isolated terminals. Set address on DIP switch before use!
485+	
485-	
PWR(+)	Power 9-25V DC
PWR(-)	

### 3.2. CABELING

For wire fences manufacturer recommends using a standard shielded cable FTP Cat 5E for outdoor use with resistance to UV radiation. For fixed fences and underground installation is necessary to use special VIBRO cable.

#### Connection of the cable and the sensor

Use the special joints for connecting cables and sensor MAMBA.

There are two types of cable connectors. The first is for transform sensitive cable to non-sensitive and the second type is for terminating of cable.

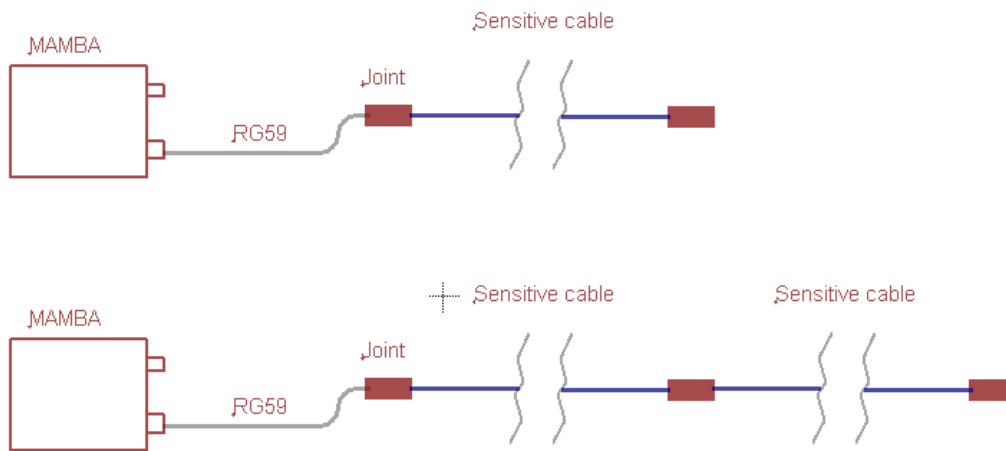


Fig.8: Cable connection

Cable joint (see.Fig.9) is designed to transform sensitive cable (FTP Cat5) to non-sensitive (RG59). It can be also used for repairing a damaged cable.



Fig.9: Cable joint



## PREPARATION OF RG59 CABLE

When preparing the cable RG59 follow Figure 10:

- unscrew the end of the joint;
- put the rubber seal from the cable gland;
- remove the isolation of the cable RG59 at distance 42 to 44 mm;
- split shielding to separate wires;
- wrap the shielding by tinned wire and keep 35-40 mm for connection to a terminal;
- remove the centre cable isolation and keep 15-20 mm;
- fold the centre cable in half due to the amplification of diameter of the cable. Keep about 12 mm because of terminal connection;
- ensure that the length of both ends is at least 6 mm.

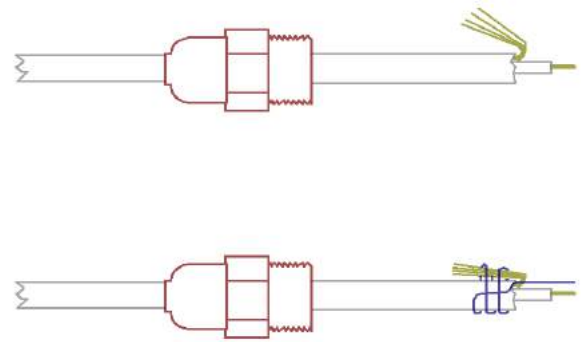


Fig. 10: Preparation of RG59 cable

## PREPARATION OF SENSITIVE CABLE

Preparation of sensoric cable describe following Fig.11):

- unscrew the end of the joint;
- put the rubber seal to the cable from the cable gland;
- remove the isolation from 35 to 40 mm;
- cut off the isolation foil about 9-11 mm from the left edge of isolation;
- cut off the shielding wire about 9-11 mm from the left edge of isolation;
- bend the cable shield (including foil) toward the existing isolation;
- wrap the shielding with tinned wire for a distance of 35-40 mm;
- remove the isolation of all central wires at around 30- 32 mm;
- put all centre wires together;
- ensure that the length of the central wires are at least 6 mm.

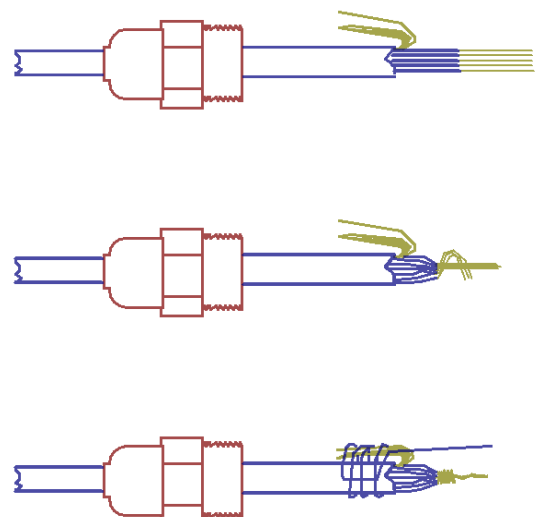


Fig. 11: Preparation of detection cable

## CABLE CONNECTION

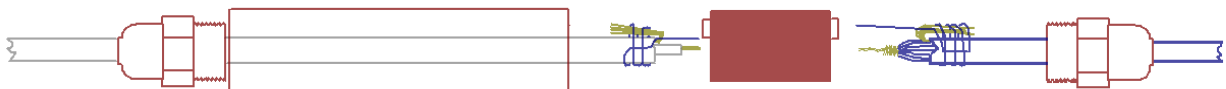


Fig.12: Cable joint for connection of sensitive and non-sensitive cable

## CABLE TERMINATION

Please observe the following instructions for terminating cable

For the termination of the cable, use the provided cable joint. For termination (balancing) use the supplied cable termination element (resistor) and connect it between the shield and the centre wires (signal and ground).

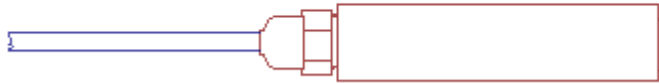


Fig.13: Cable joint for termination of the cable

## 3.3. CONTROLS

### DIP SWITCH

1	Extra sensitivity
2	Activation of test mode (see. Chapter 3.4. Testing mode)
3	Switch ON / OFF reed relay on mainboard
4-8	Address for RS485 BUS

**Switch no. 1** is used for main level of sensitivity. If switch is ON – sensor working in HIGH level of sensitivity. This sensitivity is used mainly for solid fences.

**Switch no. 2** see Chapter 3.4. Testing mode

**Switch no. 3** switching ON / OFF reed relay on mainboard, which is connected in serial with output NC2. Connection of the reed relay is fixed by hardware connection and it is not possible to change it by control software. If you do not need to use reed relay - toggle Switch no.3 to ON position.

**Switch no. 4-8** are used for settings of BUS address. This is described in the following table:

DIP	1	2	3	4	5	6	7	8	DIP	1	2	3	4	5	6	7	8
address 1				•					address 17				•				•
address 2					•				address 18					•			•
address 3				•	•				address 19				•	•			•
address 4						•			address 20						•		•
address 5				•		•			address 21				•		•		•
address 6						•	•		address 22					•	•		•
address 7				•	•	•			address 23				•	•	•		•
address 8							•		address 24							•	•
address 9				•			•		address 25				•			•	•
address 10					•		•		address 26					•		•	•
address 11				•	•		•		address 27				•	•		•	•
address 12						•	•		address 28						•	•	•
address 13				•		•	•		address 29				•		•	•	•
address 14					•	•	•		address 30					•	•	•	•
address 15				•	•	•	•		address 31				•	•	•	•	•
address 16								•									

## ROTARY SWITCH

To accurately sensitivity settings, use the rotary switch 0-9. To set the lowest sensitivity set to 0 and the highest sensitivity in the range, set 9. If you change sensitivity in the control software, system will store this setting up to next change using a rotary switch. The last position is always written into an EPROM - whether hardware or software.

To set the detection methods for different types of fences and installing it is necessary to use the programming software (see. Chapter 4. Programming SW)

### 3.4. TESTING MODE

The device has a built-in alarm signal level, which will be very helpful for set up of the system. To activate it, turn DIP switch no. 2 to the ON position.

1	Extra sensitivity
2	<b>Activation of test mode</b>
3	Switch ON / OFF reed relay on mainboard
4-8	Address for RS485 BUS

In this mode, the following LEDs on the board has different meaning:

<b>AL</b>	<b>Alarm</b>
<b>T1</b>	<b>Prealarm</b>
T2	Not used in test mode
Green	Not used in test mode

When adjusting the sensitivity, proceed as follows:

- Switch ON Test mode
- Turn off extra sensitive mode (DIP switch no. 1).
- Set the rotary switch to the middle sensitivity.
- Check the signal level by mechanical deformation of sensing cable. Signal indicator shows the level of signal - the more green lights on the bar chart means the greater signal level. The yellow LED T1 indicates Prealarm and red AL indicates an alarm signal.
- The sensor needs always 10 seconds after an alarm to regenerate and calibrate the detection algorithm. Therefore, make individual tests always with a slight time spacing!
- Now you can test the sensitivity of the system: throw the object with approximate weight of 2 kg on the fence (not directly on the cable) and the system should not raise the alarm - red LED AL does not light. Is necessary to always watch level on the indicator bar.
- When the fence is loaded by object with weight more than 25 kg system must raise the alarm - red LED AL lights. Is necessary to always watch level on the indicator bar.
- Adjust the sensitivity by rotary switch or use DIP switch no. 2, until you met the previous two terms.

- Resistance to strong winds can be observed in the test mode in windy weather. The signal level indicator should remain spontaneously in the wind at more than 3 pieces of signal. You can check in the windy weather also the stability of the tension mesh fence and stability of all parts of the fence. Remove the mechanical deformation of the cable.

### 3.5. FIRST START

Switch ON the sensor

- When the power supply is connected – first is green LED light, then blink yellow and finally red LED.
- Now is a slight delay (about 1 second) tested the integrity of the sensor and cable.
- If the cable is connected, integrity of the cable is OK and is properly terminated, after a while, the yellow LED goes out.
- If the sensor is working properly, the red LED will also be illuminated for approximately one second.
- Now is system ready for use.
- The described behaviour is valid if the sensor in the factory setting. The control software can change the configuration of fault LEDs. Setting fault diodes is derived from the software settings.

The described behaviour is valid if the sensor in the default factory setting. The control software can change the configuration of trouble LEDs. Software settings can change status of trouble diodes.

## 5. PROGRAMMING SOFTWARE

### 5.1. INSTALATION

Run the installation file "setup.exe" and follow the instructions during installation. After installation, you create a shortcut "Mamba Soft 2" in the Start menu. Start the software.

### 5.2. CONTROL

After starting the main screen appears:

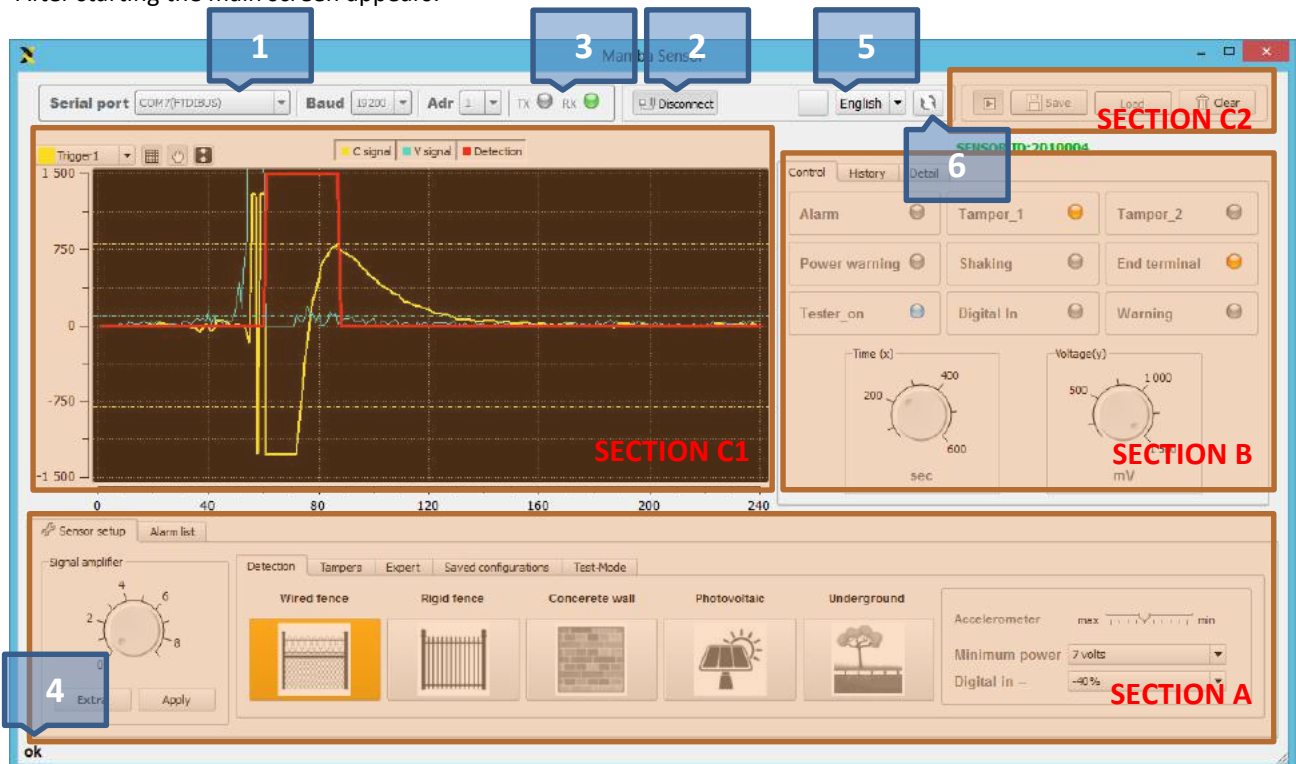


Fig. 14: Main window

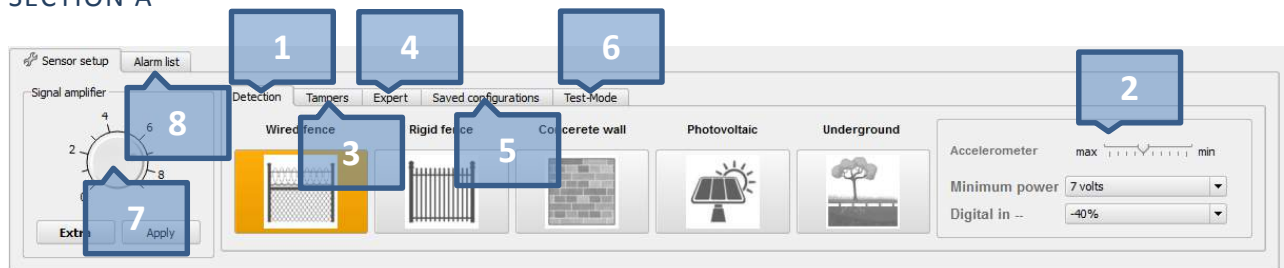
- 1. Connection settings** – you can set the parameters of the serial port for connection in this section. If you connect locally or via RS485, locate the transmitter in the list of loaded devices. The software automatically detect all devices connected to your computer. This procedure working only when the software starting, so your converter has to be connected to a PC before start of the software.  
Setting the address of the sensor is described in chapter 3.3. Controls  
Speed of communication BUS is in default set to 19 200 Baud – do not change this setting. Is necessary to set right address on RS485. This setting has to be realized by hardware DIP switch 4-8.
- 2. Connection to the sensor** – Press **Connect** to connect the sensor and the software automatically retrieves all values from the sensor EPROM memory. After this operation, all settings in the menu start to available and status of the sensor will be displayed.

#### **WARNING!!!**

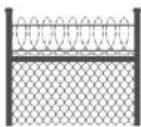
All the values that you set in control software, rewrite manually adjusted values of the rotary switch on the mainboard. And opposite - Each additional manual change on the rotary switch rewrites the software set parameters. The software always reads the last set values from EPROM memory either HW or SW.

3. **Communication signalization** – signalization of RX and TX
4. **Status bar** – displays the current software activity, and displays the results of all activities of the SW.
5. **Language settings** – here it is possible to choose the language setting from the available languages.
6. **Upgrade** – upgrade of existing version to a newer software version. Upgrade procedure is automatic. During this operation, software will be shut down and the last version will start automatically. For this operation, it is necessary to have an Internet connection.

## SECTION A



1. **Detection TAB** – In this section you can set the sensor detection algorithm for the particular type of installation:



WIRED FENCE – this setting is right for most types of the flexible fences.



SOLID FENCE – Sensitive algorithm for fences with minimal cable deformation



CONCRETE FENCE – For use on walls using a special VIBRO cable

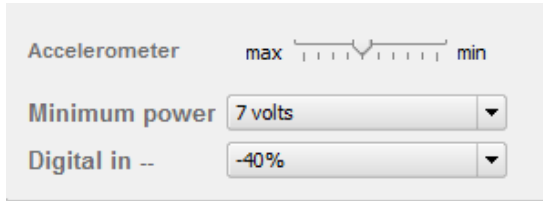


SOLAR PANELS – To protect permanently installed objects - e.g. Solar panels to protect against tampering and disassembling



UNDERGROUND INSTALLATION – This option is suitable for most sensitive installations and making a change to the very sensitive detection algorithm that can detect even minor changes and is therefore suitable for special applications in underground installations. In these types of installations are used extra sensitivity DIP switch no. 1.

2. You can define some features of the sensor in this section:

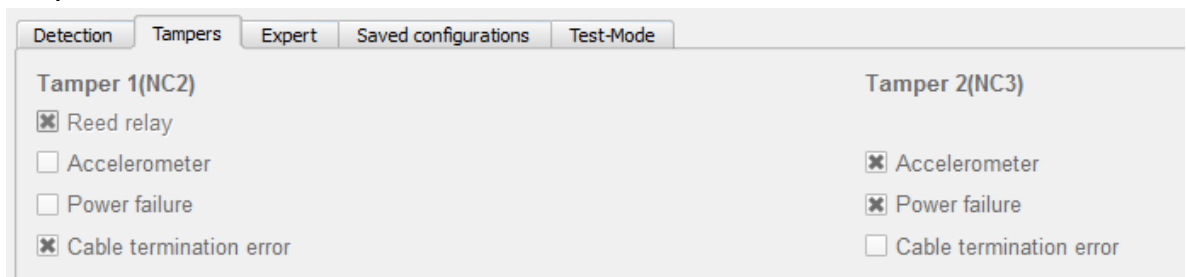


Setting of sensitivity of **tilt detector (accelerometer)** – tilt detector detects the tilt and removal of surface-mounted, for example, in applications where the detector is connected by non-sensitive cable. Sensitivity can be adjusted by moving the slider to the desired position - writing to memory start automatically.

You can adjust **minimal power** in the pop-up menu. You can define low level of power voltage, which activate trouble output. This feature reduce the sensitivity adjust the digital input, the percentage sensor reduces its sensitivity to input activation. Operating voltage range of the sensor is define in section 1.3 TECHNICAL FEATURES AND CONDITIONS – writing to memory start automatically after selecting value in the menu.

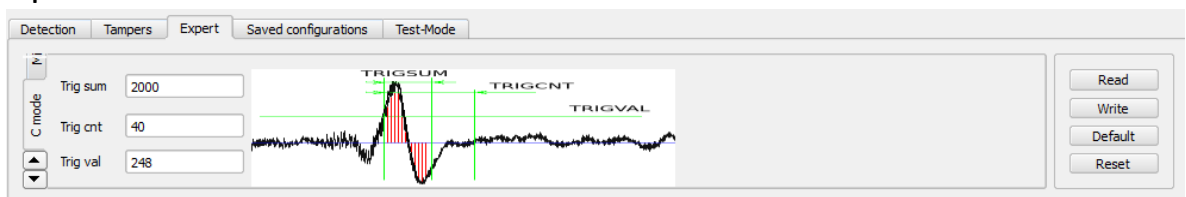
You can adjust reducing of sensitivity in the pop-up menu **digital input**. Activation is performed by connection terminal DI and PWR terminal (-). Writing to memory start automatically after selecting value in the menu.

3. **Tampers TAB:**



There is possibility to define activation events for tamper outputs NC2 and NC3 in this tab. You can split the events for the both outputs or you can use just one output for all trouble events. Reed relay is hardware connected just to the output NC2 and this setting is not possible to change in the software.

4. **Expert TAB:**

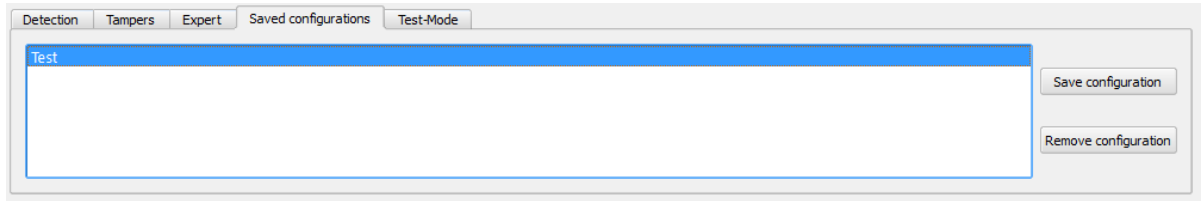


The tab is used for detailed settings of algorithm and advanced sensor report.

**WARNING!!!**

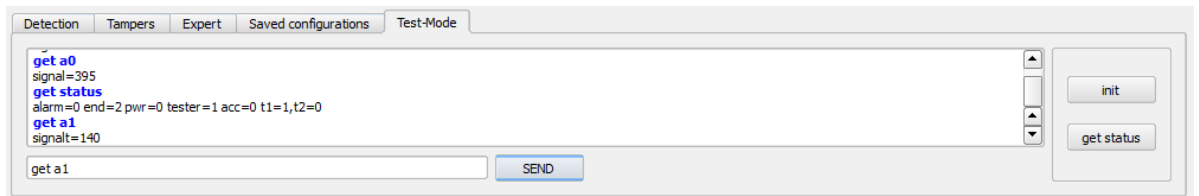
All the values that you set in this menu, can affect the quality of detection and manufacturer cannot guaranteed the full functionality of the product. Any changes in the settings, consult with your supplier.

## 5. Saved configuration:



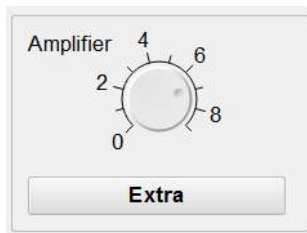
Used to store the current configuration of the connected sensor and re-load from a saved file.

## 6. Test-mode:



This tab is used to diagnose detector as a telnet client for deeper diagnostics and communication with the detector. On the right side are two buttons that are used to initialize the detector (reboot) and a button to retrieve the status of the detector.

## 7. Signal amplifier:



Rotary button adjusts the sensitivity of the detector by analogy with hardware rotary switch on the mainboard of the sensor. When you connect the sensor – software automatically retrieves the current sensitivity setting from EPROM. Writing new settings to memory start automatically after selecting value by rotary button.

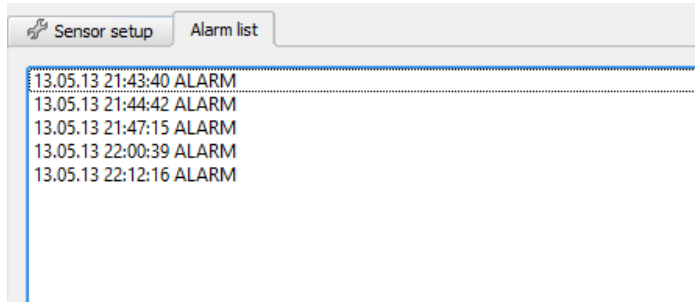
Button **Extra** activate sensitivity in higher range. This sensitivity is mostly used for special installations where is necessary to use high sensitivity of the sensor algorithm.

### **WARNING!!!**

All the values that you set using the control software, rewriting manually adjusted values of the rotary switch on mainboard of the sensor. Each additional manual change by rotary switch in opposite rewrites the software set parameters. The software always reads the last set values from memory either HW or SW.

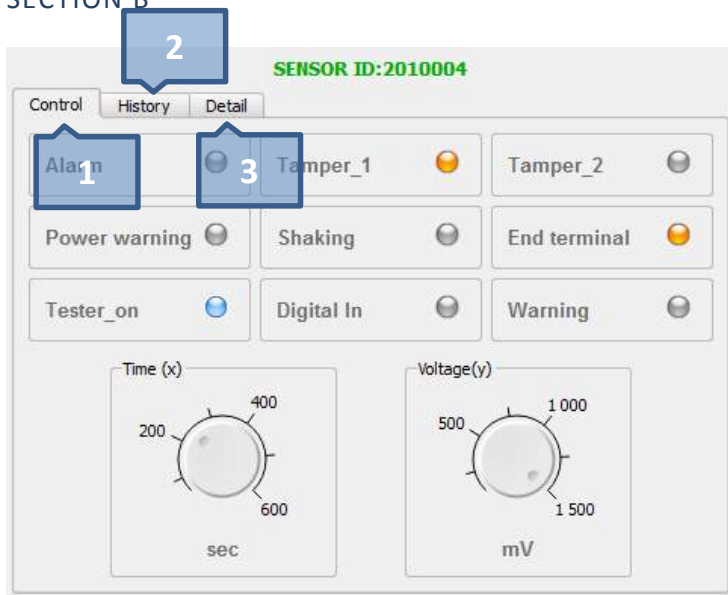


## 8. Alarm list TAB



Used to view alarms. If the software is connected to the unit during alarm conditions, each alarm is automatically loaded into the alarm list. For detailed analysis of alarm waveforms click on the desired alarm displayed in the alarm event list.

## SECTION B



### 1. Control TAB – signalization and control of oscilloscope:

- 1. ALARM** – signalization of alarm
- 2. Tamper\_1** – signalization of activation of output NC2
- 3. Tamper\_2** – signalization of activation of output NC3
- 4. Power warning** – power voltage level is lower than value set in the pop-up menu
- 5. Shaking** – activation of tilt detector
- 6. End terminal** – error of termination – terminator on the cable is not connected or integrity of the cable is not in order
- 7. Tester on** – Tester-mode is activated (DIP no. 2)
- 8. Digital In** – activation of Digital input on terminal DI
- 9. Warning** – prealarm
- 10. Time(x) – [sec]** – rotation of the potentiometer set the time range of the x-axis, i.e. the time that is displayed on the graph. The lower the value means greater resolution of the graph.
- 11. Voltage(y) – [mV]** – rotation of the potentiometer set the time range of the x-axis, i.e. the voltage that is displayed on the graph. The lower the value means greater resolution of the graph.

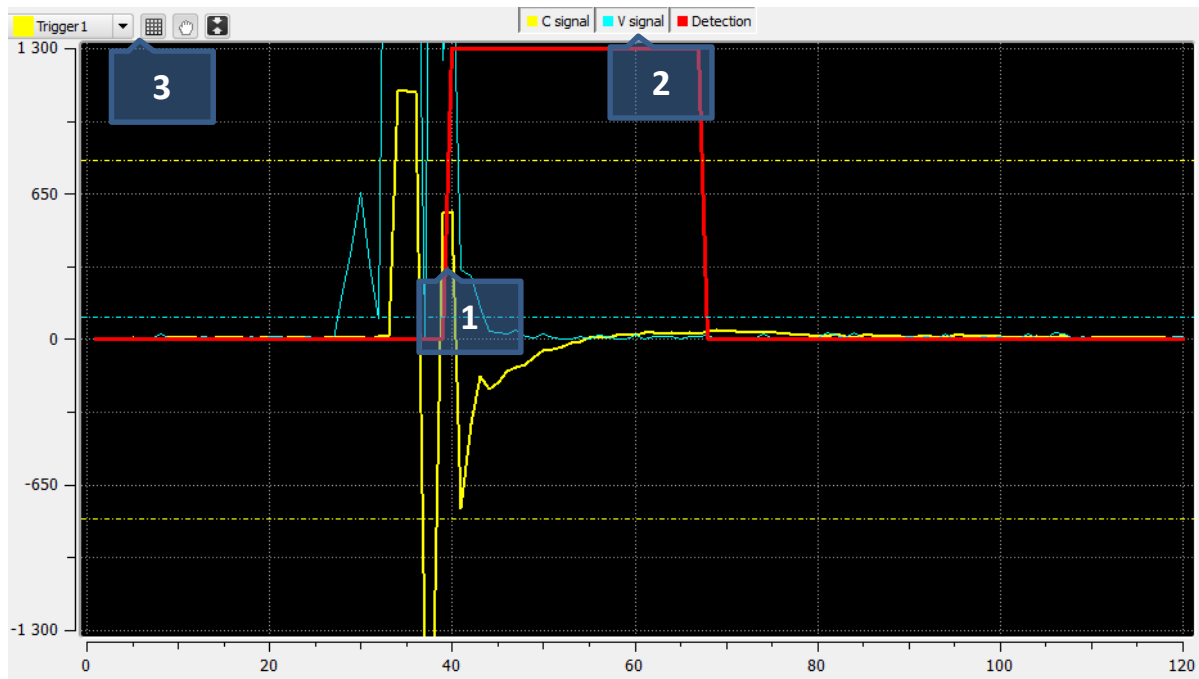
## 2. History TAB:

Here you have an overview of the overall history of the waveform graph and you can use the scroll bar to move faster in time. For moving in the time is also used the hand icon located above the chart - see. SECTION C.

## 3. Detail TAB

This tab provides deeper technical information about the state of the sensor and values. Used to diagnose connection and analyse the status of the unit. For further information please contact your supplier.

## SECTION C




### 1. Graph of signal values from the detector.

The **yellow** curve represents the signal in the range from 0.1 to 4 Hz. The **blue** curve is the result of mathematical analysis for the value of small signal levels. The horizontal dashed lines shows the alarm level. If the signal exceeds a preset threshold, detection algorithm evaluates alarm values - **red** curve shows the alarm status. This condition is followed by activation of the alarm relay - the sensor is in alarm.

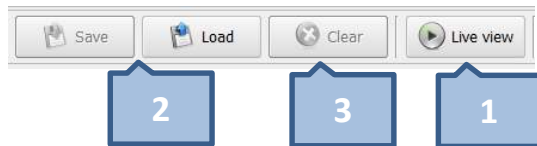
### 2. Enabling of individual curves

Press the appropriate button to activate / deactivate the line on the graph.

### 3. Control of the chart

In the pop-up menu Trigger 1,2 you can set alarm levels for actual graph. If you can change trigger level of the sensor use symbol  in the graph. This level automatically change detection algorithm and has a significant impact on the final sensor sensitivity.

- Hand symbol is used to scroll the chart. To facilitate the work, stop reading the chart, otherwise the chart will automatically move to the end.
- The symbol of the grid can activate / deactivate the grid.



### Control of the graph.

1. **Start retrieving data** – this button will start the communication and retrieving of the values from the sensor. Software show signal waveforms on a graph and display current values on tab detail. If you want to make forensic analysis of the recorded values, stop reading.
2. **Save/Load data** – here it is possible to store the entire graph to a file and then load.
3. **Clear** – erases all recorded readings of signal levels.

## 6. SERVIS

### 6.1. TROUBLESHOOTING

Problem	Cause	Solution
The sensor does not respond to the deformation of the cable.	Very low sensitivity	Raise sensitivity
	The cable is not okay	Replace it with FTP 5E. Sensitive cable must not contain Vaseline inside. The cable should include transparent foil.
AL alarm LED flashes constantly	Some contacts may be moist	Check the connection of the contacts in the joints.
	Contacts are not properly tightened	Tighten contacts in the joints and on the sensor mainboard
	The fence is solid and moves	Make the fence tighter or repair it. Then install the cable again.
	Some contacts are not fully inserted	Check all cable joints. Check all cable connections.
The yellow LED T1 illuminates	Cover of the sensor is open – tamper ( <i>ALLWAYS</i> )	Reed Relay on the main board has not on the other side magnet and the DIP switch no.3 is set to OFF - sensor reports tampering.
	Terminator is broken ( <i>DEFAULT</i> )	Check termination unit.
	Problem of integrity of the cable ( <i>DEFAULT</i> )	Check the ohmic resistance between the signal wire and earth.
The yellow LED T2 illuminates	Tilt detector ( <i>DEFAULT</i> )	Active tilt detector over the allowed limit. After some time the detector sets the value zero.
	Low voltage < 9V ( <i>DEFAULT</i> )	Sensor detected low voltage - check the power supply voltage.
The system does not have sufficient sensitivity	Insufficient number of cable clamps on the fence.	Attach the sensoric cable by clamps every 20-30 cm.
	The cable has low sensitivity.	Replace the cable.