RESEARCH AND PRODUCTION COMPANY "RADIO-SERVICE" JSC

RF Marker Locators
STALKER PM-2 and STALKER PM-3

Operation Manual

RAPM.464419.001 OM

The Operation Manual describes components and the operating principle of marker locators STALKER PM-2 and STALKER PM-3 (hereinafter refer to as locators) and contains information relevant for proper operation, safety and verification procedure.

Operating conditions:

- operating range: -20 ºC to +55 ºC;
- operating humidity: 90% RH at 30 ºC
- atmospheric pressure of 60 to 106.7 kPa (460 to 800 mm Hg).

The protective grade of the casing is IP54 according to GOST14254.

In terms of electromagnetic compatibility marker locators comply with requirements of GOST R 52459.32-2009 and GOST 32134.1-2013.

Due to permanent upgrade of locator, design changes improving their reliability and operation conditions, the items produced and the design described in this Operation Manual may differ to some extent.

⚠ ***Attention! Please read this Manual before operation.***

1 Description and Operation

1.1 The locators are intended for positioning and depth measurements of passive electronic markers of underground utilities. The locator can be connected with GPS / GLONASS module, which allows transferring recorded data and coordinates to PC or Android device.

The locator PM-3 allows writing and reading data from Smart Markers 1400-XR-iD, 1200-XR-iD.

1.2 Main specifications

1.2.1 Main specifications are given in Table 1.2.1.

Table 1.2.1 – Main specifications

1 Compatible Markers

Type	Indication		Color	Operating frequency
	Search mode	Scan mode		
General water	*Gen. purp.*	*Gen. purp.*	purple	66,35 kHz
Cable TV	*CATV*	*CATV*	black / orange	77 kHz
Gas	*Gas*	*Gas*	yellow	83 kHz
FOC	*FOC*	*FOC*	yellow / black	92 kHz
Telephone	*Telecom*	*Tel.*	orange	101,4 kHz
Sanitary	*Sanitary*	*Sanitary*	green	121,6 kHz
Power EU	*Power EU*	*Power EU*	red / blue (3M Scotchmark-red)	134,0 kHz
Water	Water	Water	blue	145,7 kHz
Power	Power	Power	red	169,8 kHz

2 Marker read depth *(when markers are buried in accordance with a manufacturer's instructions*)

Marker dimensions		Common burial depth	Maximum burial depth
Near-surface:	20 mm (0,8')	0,6 m	0,9 m
Ball marker:	114 mm (4,5')	1,5 m	1,8 m
	104 mm (4,1')	1,5 m	1,8 m
	138 mm (5,4')	1,8 m	2,0 m
Disk marker:	133 mm (5,2')	1,5 m	1,8 m
	213 mm (8,4')	1,8 m	2,1 m
Full-range:	380 mm (15')	2,5 m	2,8 m
	225 mm (8,9')	2,3 m	2,5 m

3 Maximum read / write depth of ID markers (for STALKER PM-3 only)

Type	Read	Write
1400-XR-ID series ball markers, except for power markers	1,5 m	0,3 m
power markers	1 m	0,2 m
1200-XR-ID series full-range markers	2,4 m	0,8 m

4 Depth readings accuracy	±(15 %+5 cm)
5 Minimum continues operation time with fully charged storage battery, at the temperature range of +15 ºC to 25 ºC , hours	9
6 Maximum dimensions, mm	700×300×140
7 Maximum weight, kg	2,0

1.2.2 The locator has step-by-step regulation of the input signal gain with a 6 dB step (each step doubles the signal gain).

1.2.3 The power supply voltage range is 9 to 12.5V. The locator is powered with a lithium-ion (Li-ion) storage battery of 10.8 V rated voltage and 4000-4200 mA/h capacity, or with eight replaceable AA batteries placed in battery compartment.

1.2.4 The locator has indication of battery status and auto off to avoid overdischarge.

1.2.5 The locator provides battery charging and overcharge protection.

1.2.6 Lifetime is 6 years at least.

1.3 The delivery set is given in Table 1.3.

Table 1.3 – Delivery set

Item	**Quantity**
Marker locator STALKER PM-2 or STALKER PM-3	1
Power unit (12 V/1 A)	1
2∗4 AA battery compartment	1
Bluetooth-USB adapter	1
Operation Manual	1
Carry bag	1
Sun-protective cover	1
Package	1
Headphones	to be ordered separately

1.4 Design and operation

1.4.1 Locator appearance is shown in Figure 1.4 a.

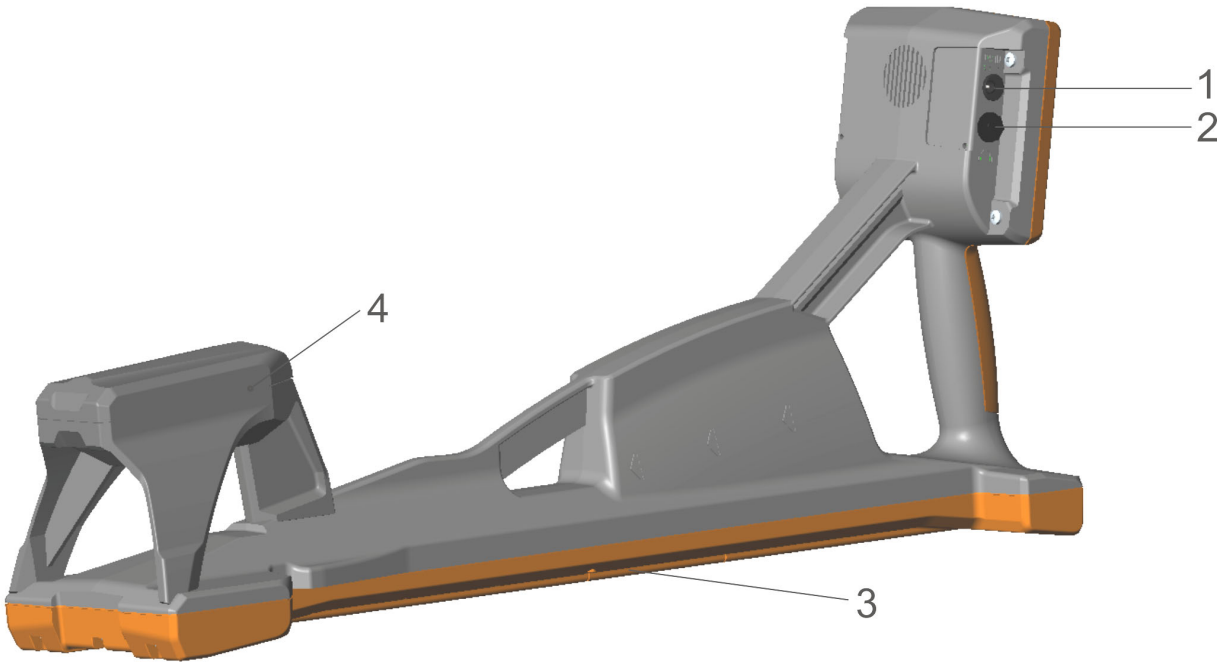


Figure1.4 a – Locator appearance.

On the figure: 1 – power unit jack, ⊕—◉—⊖;

2 – headphones jack 6,3 mm;

3 – power compartment cover;

4 – receiving antenna unit The sun-protective cover facilitates operation in sunny weather. The cover is attached with two sticker bands to the locator handle. A standard casing with sun-protective cover is shown in the figure.

1.4.2 The front panel is shown in the Figure 1.4 b.

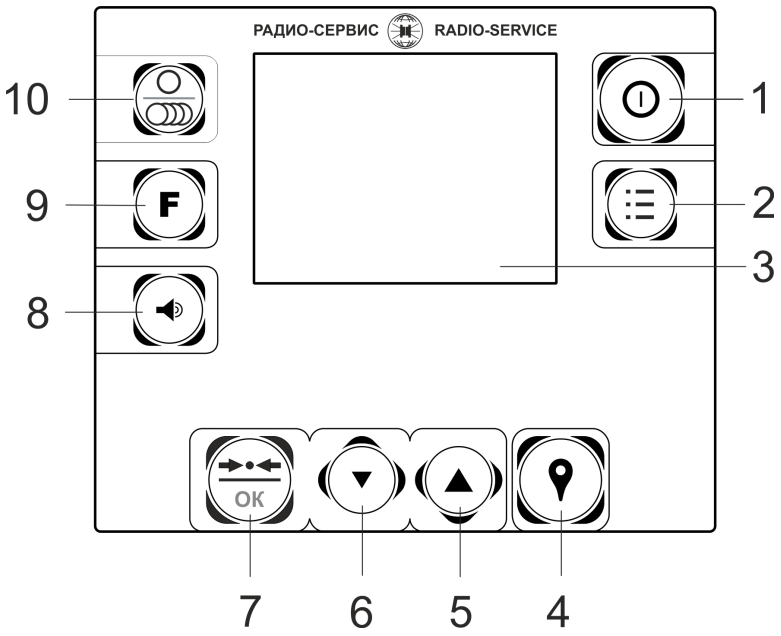


Figure 1.4 b – Front panel:

1 – is power on / off key;

2 – is key to enter or exit the MENU;

3 – LCD;

4 – is key to record the displayed parameters and GPS coordinates for following transfer to PC;

5, 6 – keys to increase or decrease signal gain and to move up and down in the MENU list;

7 – is key for PM-2 is key for PM-3 to set up the optimal gain for a given signal and to enable/disable the selected item in the MENU; Additionally PM-3 – Smart markers data readings.

8 – Volume key;

9 – is key to switch the marker type mode;

10 – is key to switch the scanner mode or the single type marker search mode.

1.4.3 Operation principle of the marker locator

The transmitting antenna of the locator emits electromagnetic field pulses at the operating frequency of certain types of markers. These pulses excite the RLC circuit of markers and it generates magnetic field, which is received by receiving antenna of the locator. Then signal is amplified and processed with a digital signaling processor. After that, strength these signals are displayed on the screen as bar graphs and digital values in "dB". Readings of bar graphs may be duplicated with an audio signal.

2 Intended Use

2.1 Preliminary Procedures

Take the locator from the bag and verify serviceability of protective covers, fasteners, absence of mechanical damages on the receiver body and on the power unit.

If the locator was exposed to a temperature differing from the operating one, first it shall be held under the operating temperature for 30 minutes.

2.2 Charging the Storage Battery

The locator is powered by a lithium-ion storage battery “3S1P RAPM.436224.013” 10.8 V, of 4000 or 4200 mA/h rated capacity.

ATTENTION! Before charging, make sure that storage battery rather than non-rechargeable batteries are in the battery compartment. Ignoring this rule may lead to damage of the locator.

Charge the battery when the ambient temperature is between plus 5 ºC and plus 55 ºC, otherwise charging is blocked. However, in order to prolong the battery life, it is recommended to charge it at the temperature from plus 15ºC to plus 35ºC.

The battery's state of charge is shown on the screen as a symbol  .

To charge the battery, connect the power supply plug from the instrument delivery set to the corresponding socket of the instrument. Plug the power supply unit into the mains "220 V". The battery charging process is displayed on the receiver's display as the symbol  . When charging is complete, the symbol  will display full. It takes 5 to 6 hours to charge a fully discharged battery.

Using the "5/12 Adapter" RAPM.436431.005 it is possible to charge the receiver from an external 5 V power source with a 2 A USB output, for example, from a portable external battery pack (Powerbank). In this case the charging current will be limited and the charging time will increase up to 10-12 h. To charge, plug the adapter's output connector into the receiver's power socket, and plug the adapter's input connector into the USB socket of the external source and turn it on.

If you do not use the receiver for a long time, it is recommended that you recharge the battery once every three months to 40-50% of its capacity, it is not recommended to store a fully charged or fully discharged battery for a long time.

3 Operation

Press ⏻ key to switch on the locator. After that the locator will switch to0 the last operation mode.

The battery level is shown by miniature battery in the upper left corner of the display as the symbol 🔋. The level of supply voltage is proportional to the level of the miniature battery fullness. When the voltage supply is lower than 9 V, the message “Storage battery discharged” appears on the LCD and the locator switches off automatically. Charge the storage battery in accordance with p. 2.2 or replace non-rechargeable batteries in battery compartment in accordance with p. 5.3.

3.1 Menu

Press ☰ key to enter or exit the main menu (Figure 3.1a). Scroll the menu up and down using ▼▲ keys. To edit selected menu item (selected item has an inverse color) and to confirm the action, press the OK key.

In “**Set of markers**” submenu (Figure 3.1a), you may add or exclude marker types available for search. The added marker types are marked with «☑» and may be selected in search mode by pressing F key.

To add or delete the marker from your set, select the item and press OK key.

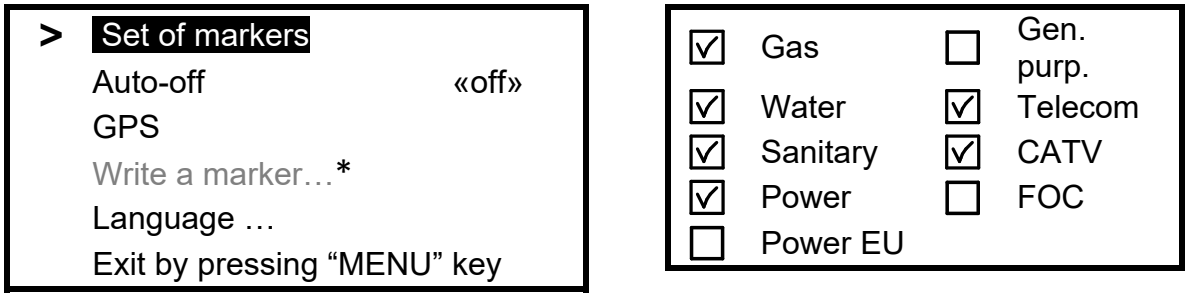


Figure 3.1a – “Set of markers” submenu (Note: * – for PM-3 only)

In “Auto-off” sub menu you may set the auto-off time after the last button pressed (Figure 3.1b). The auto-off time may be set in range of 10 to 90 minutes in 10-minute increments. The auto-off time is 30 minutes by default.

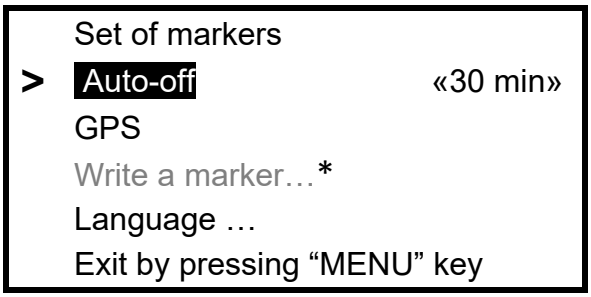


Figure 3.1b – Setting auto-off time (Note: * – for PM-3 only)

In the **«GPS»** submenu (available only in search mode), you may establish a connection to GPS “Bluetooth” logger or to PC, configure operation with GPS logger or edit the log of tracks saved in the locator memory. 5.

In the **«Write marker»** submenu (available only for PM-3) you may write data to Smart Markers 1400-XR-iD, 1200-XR-iD. Detailed description is given in item 4.2.

In the **«Language**» submenu you may select the language.

3.2 Locating RF Markers and Measuring their Depth

Note. All methods of RF Markers detection are based on analysis of relative variations in signal values and require certain practical skills from the operator.

3.2.1 Single Type Marker Search Mode and Depth Measurement

The view of the search mode with simultaneous depth measurement is shown in the Figure 3.2a.

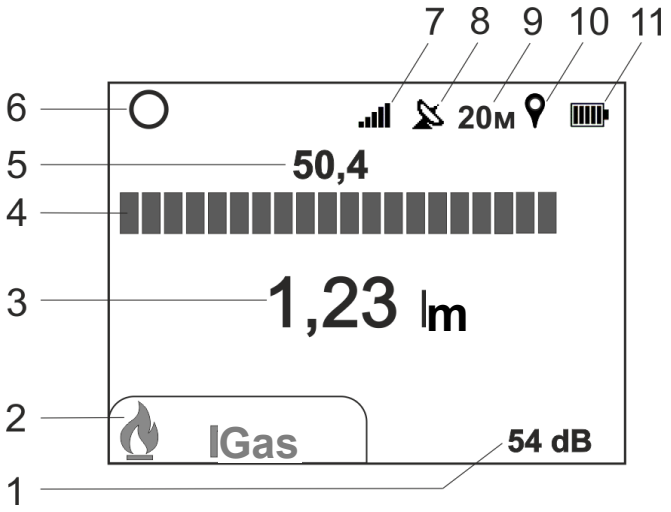


Figure 3.2a – search mode:

1 – gain;

2 – marker type;

3 – depth of the marker;

4 – input signal bar graph;

5 – level of the input signal in «dB»;

6 – icon of the single type marker search mode;

7 – volume indicator;

8 – icons of the state of connection to the GPS module, «» or «» (item 4.1);

9 – distance covered (item 4.3);

10 – icon of recording to track «», displayed during recording (item 4.2);

11 – icon of power unit voltage level.

Switch the search mode «O» by pressing key and select the desired marker type by pressing F key.

Hold the locator in vertical position. Set the gain to make 1/3 of the bar graph illuminate using keys. Then survey the area at low speed, moving the locator from side to side. When locating marker in unknown territory, walk according to zigzag pattern, with a pitch of no more 1 m.

When the marker is located, the bar graph readings and signal strength will increase; volume and tone of sound indication will change as well (Figure 3.2b). Upon approaching the marker, the signal strength will be growing and the bar graph will get overloaded. To avoid that, set the signal gain to make 3/4 of the scale illuminate by pressing key. The optimum signal gain can be set by pressing OK key.

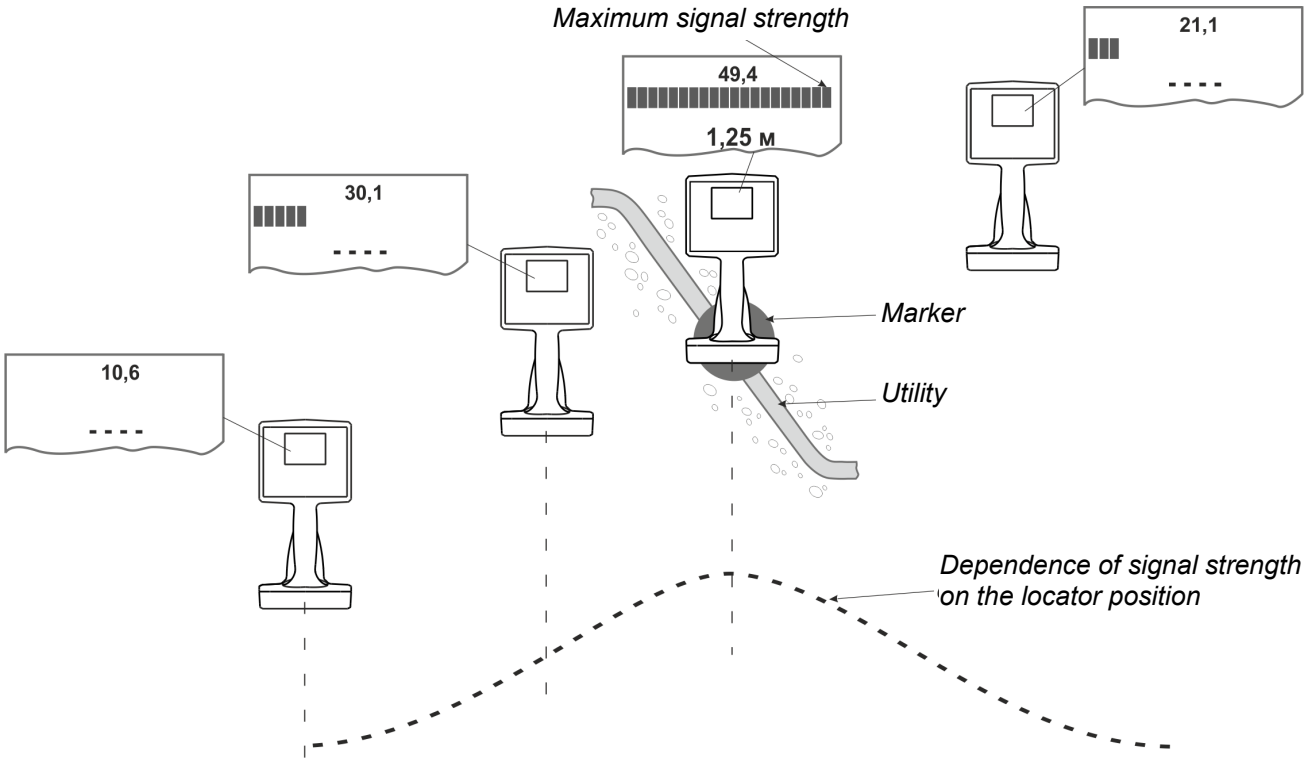


Figure 3.2b – Dependence of signal strength on the locator position

To specify the marker position, move the locator in all directions. When the locator is directly above the marker, the input signal strength will be maximum. Shifting the locator away from the marker will lead to reducing of signal.

Note. Search signal of the locator can be received and reflected by markers of another type. When the marker of another type is located closer to the surface than the target marker, its signals may not differ from the signals of the target one. Therefore when operating on the territory with different types of markers, it is recommended to check the input signal at other frequencies (by switching marker type mode) or switch the locator into the scan mode (item 3.2.2).

Attention! Some RFID LF tags, e.g. contactless smart card keeping in operator's pocket, may influence the strength of received signal and falcify marker depth readings.

Hold the locator directly above the marker for **not less than 3 seconds** (Figure 3.2c) in order to determine marker depth. Depth readings are displayed automatically. Only depth readings of green color may be considered accurate. Deepth readings of red color mean that input signal strength is weak and the depth measurement is likely incorrect. If the input signal strength is too weak, the indicator « **- - -** » appears instead. It means that maker depth is too high or the locator is at the considerable distance from the marker.

Attention! The depth value is found from the bottom edge of the receiver to the marker's centre.

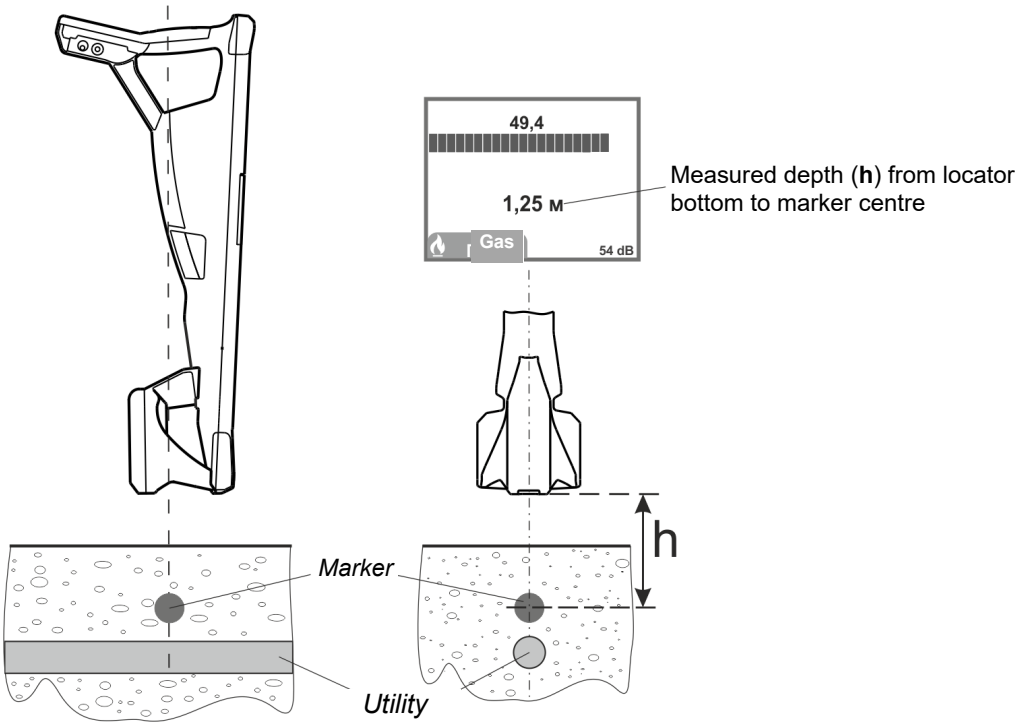


Figure 3.2c – Depth measurement

Note. Upon moving the locator away from the marker for a short distance the reading of marker depth is increasing. Therefore only the minimum depth value may be considered reliable.

Error in depth measurements may be caused by magnetic field distortion from the neighboring markers and close metal subjects.

Accuracy of the measured depth may be verified by raising the locator to the high of 0.2 m. The reading shall increase by 0.2 m as well.

3.2.2 Locating Several Types of Markers at the Same Time (scan mode)

The marker locator is able to determine the presence and expected location of up to four marker types. View of scan mode is given in Figure 3.2d.

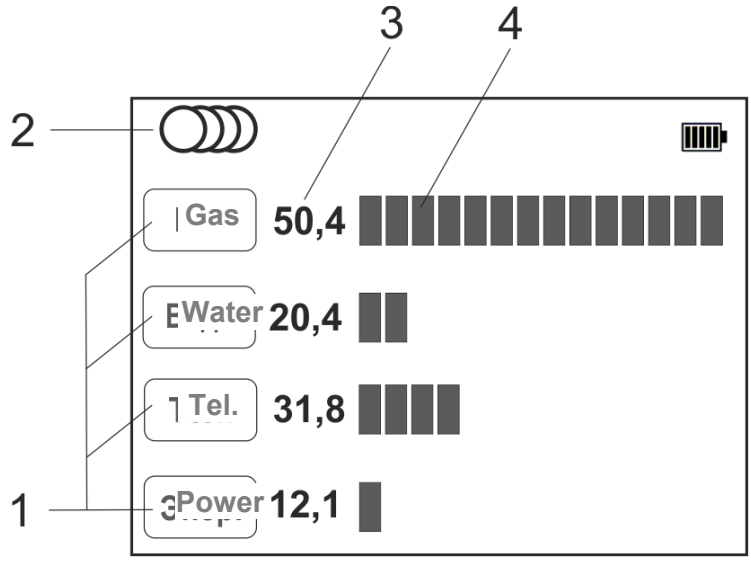


Figure 3.2d – Scan mode view:

1 – marker type;

2 – scan mode indicator;

3 – strength of input signal from markers in dB;

4 – bar graph of the input signal from marker.

Switch the scan mode « » by pressing key. In the “Set of markers” (item 3.1) submenu, select up to four marker types, which presence and location you desire to determine.

Set the signal gain to make 1/3 of any bar graph illuminate by keys. Then survey the territory with expected markers at low speed, moving the locator from side to side.

When the locator appears in the coverage area of any markers, the scale and input signal level of that marker increase, as it shown in the Figure 3.2d.

Then specify the location and depth of certain type of marks by switching the search mode and continue as described in item 3.2.1.

Note. With active scan mode the scale respond on the changing position of the locator is more abrupt and slow. It also less sensitive to markers on the high depth, which may be considered as disadvantage of scan mode comparing with the search mode.

4 Reading and writing ID (Smart) markers (only for STALKER PM-3)

4.1 Data reading from ID markers.

STALKER PM-3 marker locator can review data stored in RFID markers 1400-XR-ID and 1200-XR-ID series. Maximum read depth of each type is stated in item 1.2.1.

Switch the marker locator into search mode (Figure 3.2c) and then push and hold  key for 2 seconds while keeping the locator right above the burried marker. After that the data stored in marker and its ID number will be shown on the display.

Note. Due to high frequency interferaces the reading depth may differ from the maximum limit. In this cases reduce the distance between locator and marker, e.g. by digging up the ground above the marker, or try to read out the data stored in marker again after a while.

4.2 Data writing to ID markers

STALKER PM-3 marker locator can write data to RFID markers 1400-XR-ID and 1200-XR-ID series.

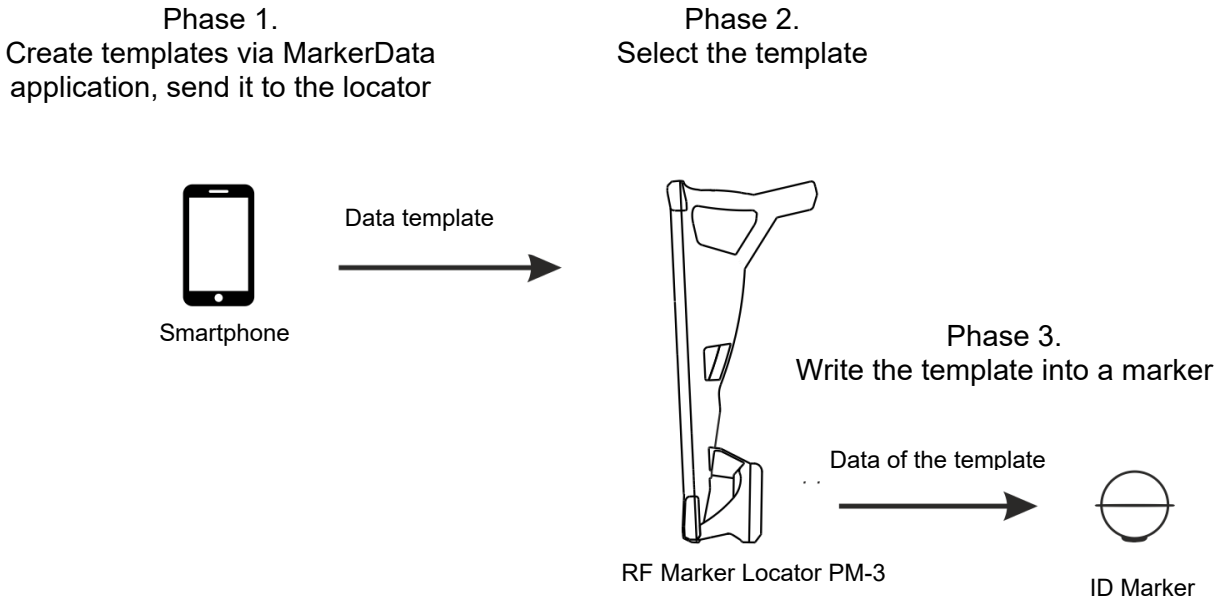
The data is written to the marker in the form of 6 lines, each of which consists of two fields. The first field contains no more than 8 characters, the second contains no more than 14 characters (Figure 4.2.1 c).

The process is divided into several phases:

Phase one – create a template via MarkerData application, enter the data (text) planned to be written to a marker. Then the templates are sent to the locator. The locator may store up to 20 templates.

Phase two – select the needed template in the locator menu.

Phase three – write the date of selected template into a marker with subsequent control of the written content.



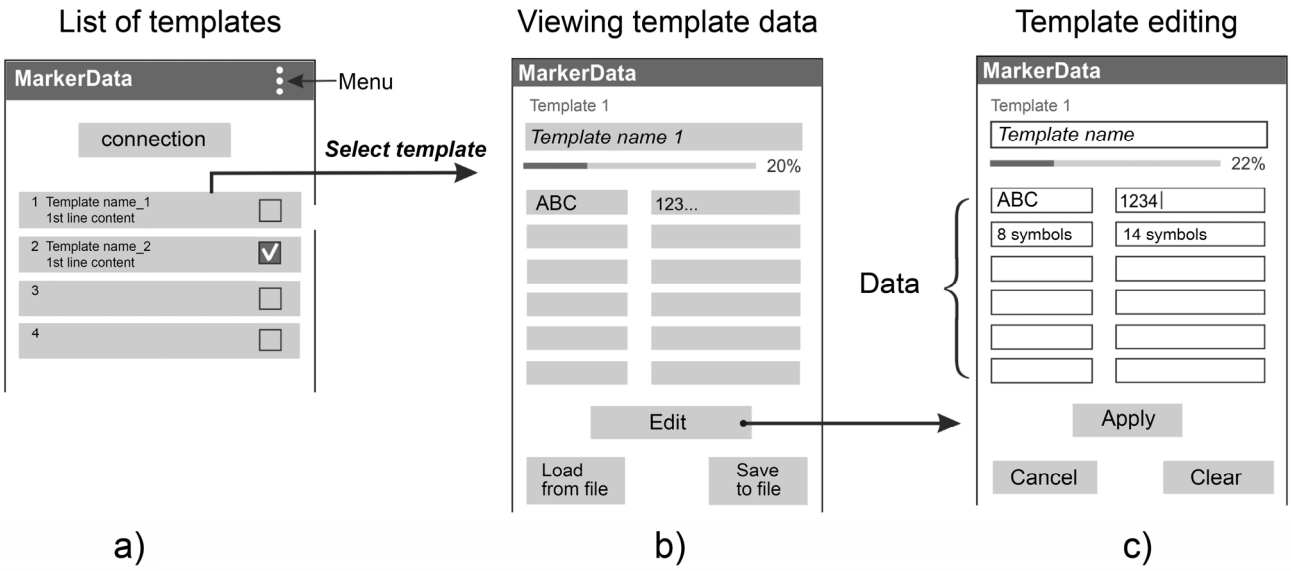
4.2.1 Creating and editing templates in the «MarkerData» application

You may create and edit the template for writing data (text) into a marker via MarkerData application using smartphone running with Android ver. 8.0 or higher. It allows to store up to 20 templates.

Download and install MarkerData application from official website www.radio-service.ru/en. Make sure that you have allowed installation of application downloaded from third-parties sources.

Run the application.

From the list of templates, select the needed template for viewing or editing (Figure 4.2.1. a), the template data will be available for viewing (Figure 4.2.1. b). To import data or edit it, press the “EDIT” button. In the appeared window (Figure 4.2.1 c) assign a name to the template, which will later be displayed in the list of templates, and enter the required data to write to a marker. Since the amount of ID markers memory is limited, the information about the occupied memory will be displayed when entering data. In order to save space in the marker’s memory, some standard designations and names are provided, which will be suggested automatically when inputting text if the first letters match. After completing data entry, press the “APPLY” button. To cancel the changes made, click the "CANCEL" button. To clear all the contents of the template, press the “CLEAR” button.



Frigure 4.2.1 – Viewing and editing templates in MarkerData

Additionally, in the template data viewing mode (Figure 4.2.1 b), it is possible to:

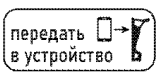
- save the template in the smartphone memory for future use or for sharing with other users. To do so, press the “SAVE TO FILE” button and select the path to save file. The file will be saved in the .pm3 format;

- insert data from a previously saved template. To do so, press the “LOAD FROM FILE” button and select the desired template;

It is also possible to copy one template on the list to another. To do so, select ☑ the template you need to copy in the main application window (Figure 4.2.1 a), open the application menu ⋮ and select “Copy”. Tick ☑ one or more templates, open the application menu ⋮ and select “Past”.

4.2.2. Transferring templates to the locator. Viewing templates.

Communication of the locator with smartphone is performed via Bluetooth connection. To transfer templates to the locator, select “Write a marker” > “Working with MarkerData” (Figure 4.2.2 a).

Open MarkerData application on smartphone, enable Bluetooth and geolocation, enter the PIN code 5106 in query window. In the list of templates in the MarkerData application (Figure 4.2.2 b) press the “CONNECTION” button and wait for the connection message. Tick ☑ the templates you need to transfer to the locator and press the button that appears 

(send to a device).

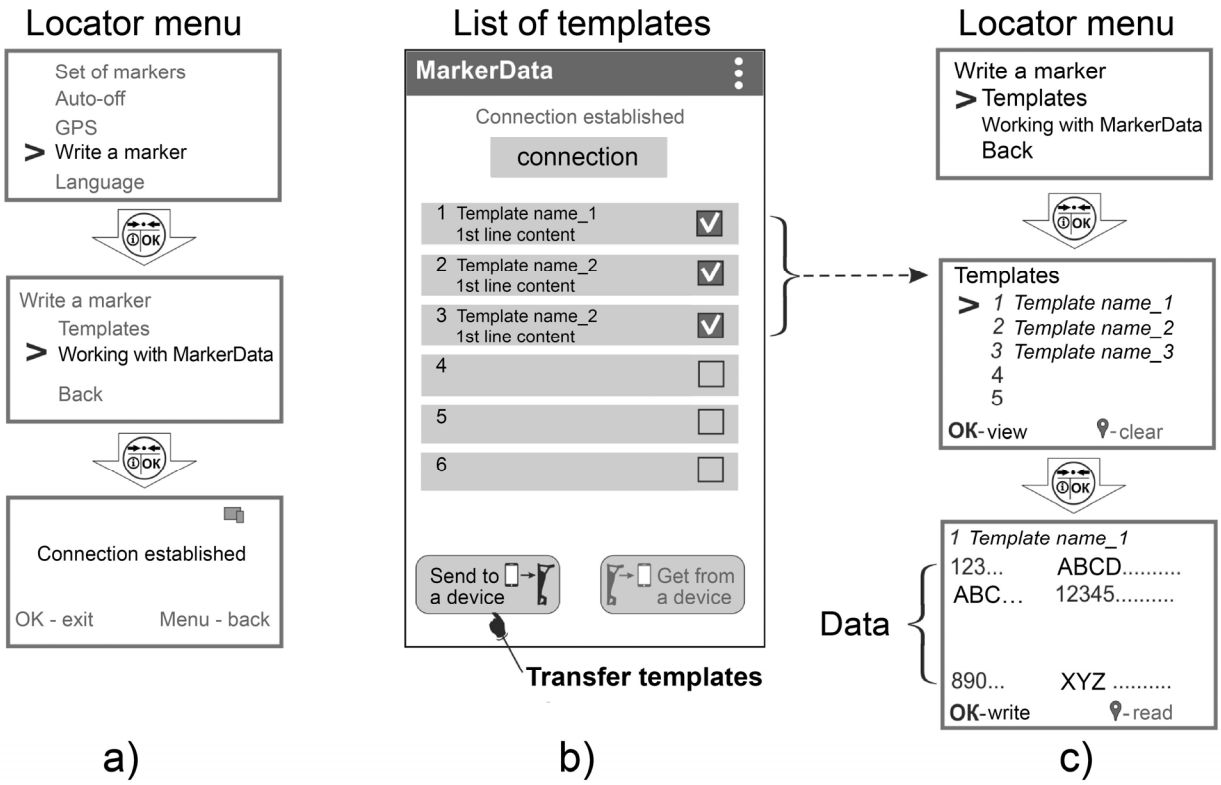


Figure 4.2.2 – Transferring templates

Also the function of transferring templates to the locator is available in the viewing template data window (Figure 4.2.1 b), provided that the connection with the locator is established.

Later you may view the templates on the locator display. To do so, open “Menu” > “Write a marker” > “Templates”, select the needed template and press key (Figure 4.2.2 c). To clear the template content press key.

4.2.3 Write a marker

To write data to the marker, set the appropriate marker type on the locator, place the marker as it is shown in Figure 4.2.3 a. Make sure that the signal level reading on the locator is 70 dB minimum. Select “Write a marker” > “Templates” in the main menu, open the needed template and press key. The process will be shown on the display.

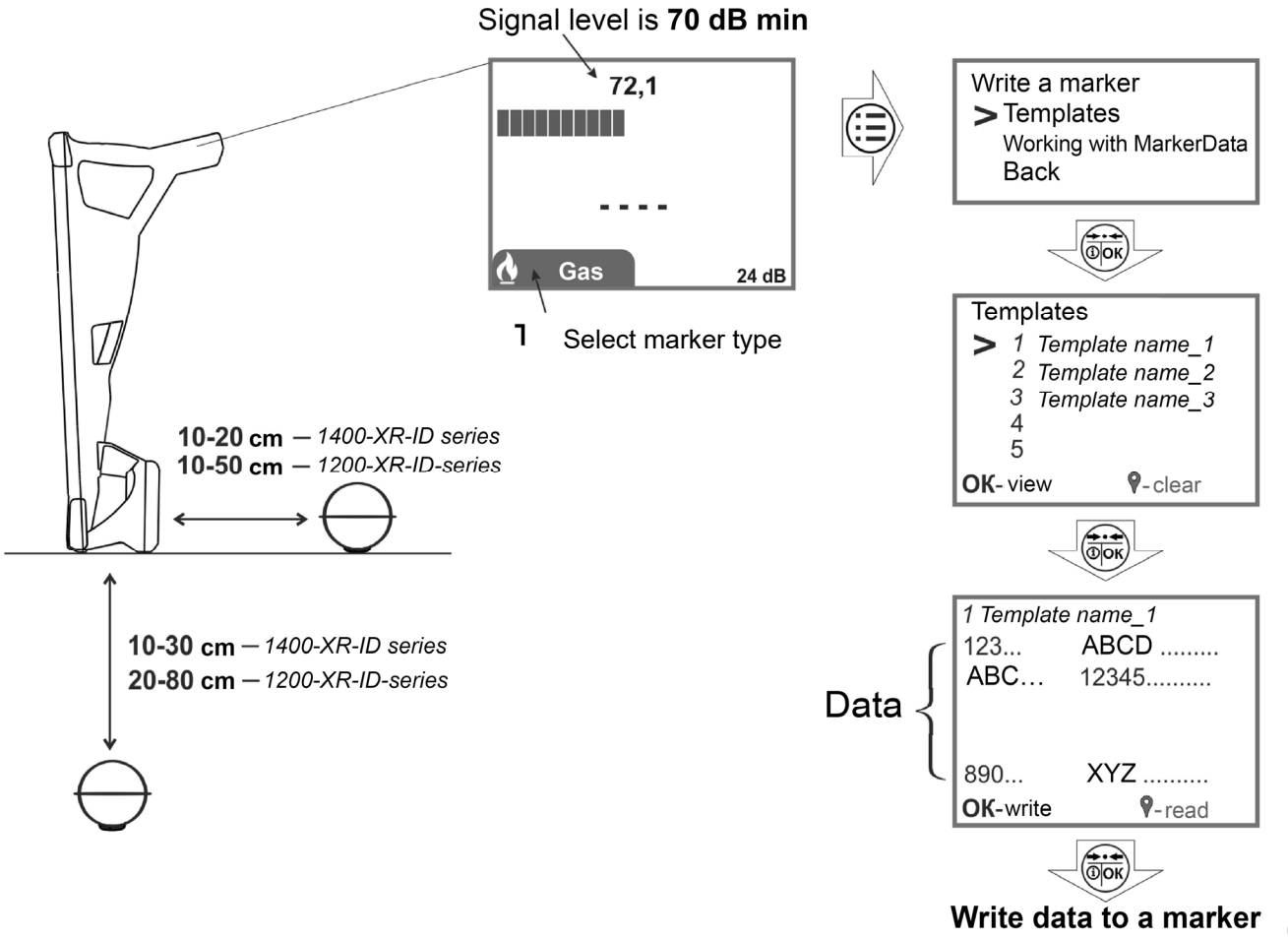
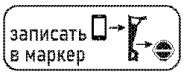


Figure 4.2.3 a – Write a marker

Upon completion, the locator will perform a control reading of the written data from the marker and show them on the display.

Also the function of writing markers is available in MarkerData application. To do so, select “Write a marker” > “Working with MarkerData” (Figure 4.2.3 b) in the locator menu.

Open MarkerData application on smartphone, enable Bluetooth and geolocation, enter the PIN code 5106 in query window. In the list of templates in the MarkerData application press the “CONNECTION” button and wait for the connection message (Figure 4.2.3 c). In the application, select the needed template from the list of templates. In the viewing template data window that appears press 

button (write to a marker).

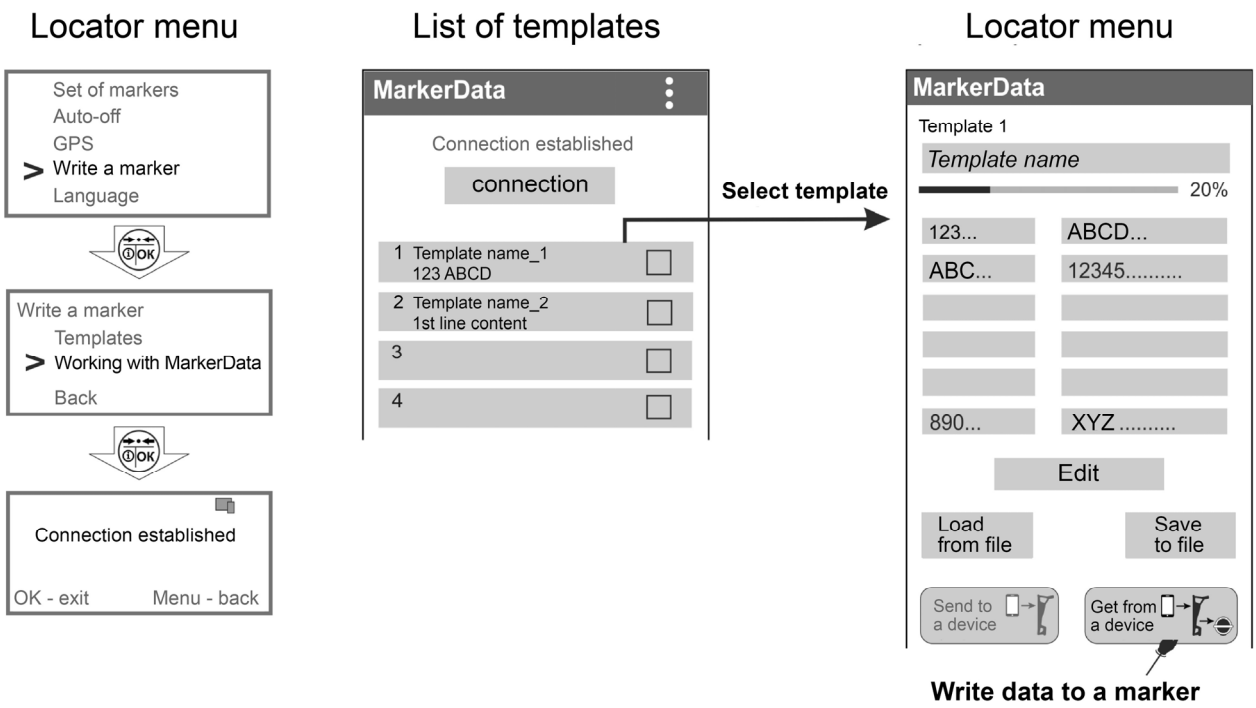


Figure 4.2.3 b, c – Write a marker

4.2.4 Reading data from a marker into a template

Using the locator you may read data from a marker and save it as a template, for example, to edit it later or write this data to other markers.

Place the locator above the marker as it is described in item 4.1 or sideways as it is shown in Figure 4.2.3. Set the appropriate marker type on the locator. Select “Write a marker” > “Templates” in the locator menu, open the needed template and press the key. After the reading is completed, the data from the marker will be shown on the display. To save the received data to the selected template press key. The name of the template will be assigned the name of the marker type and sequence number of the template, the old template data will be lost. To leave the old template data unchanged, press key.

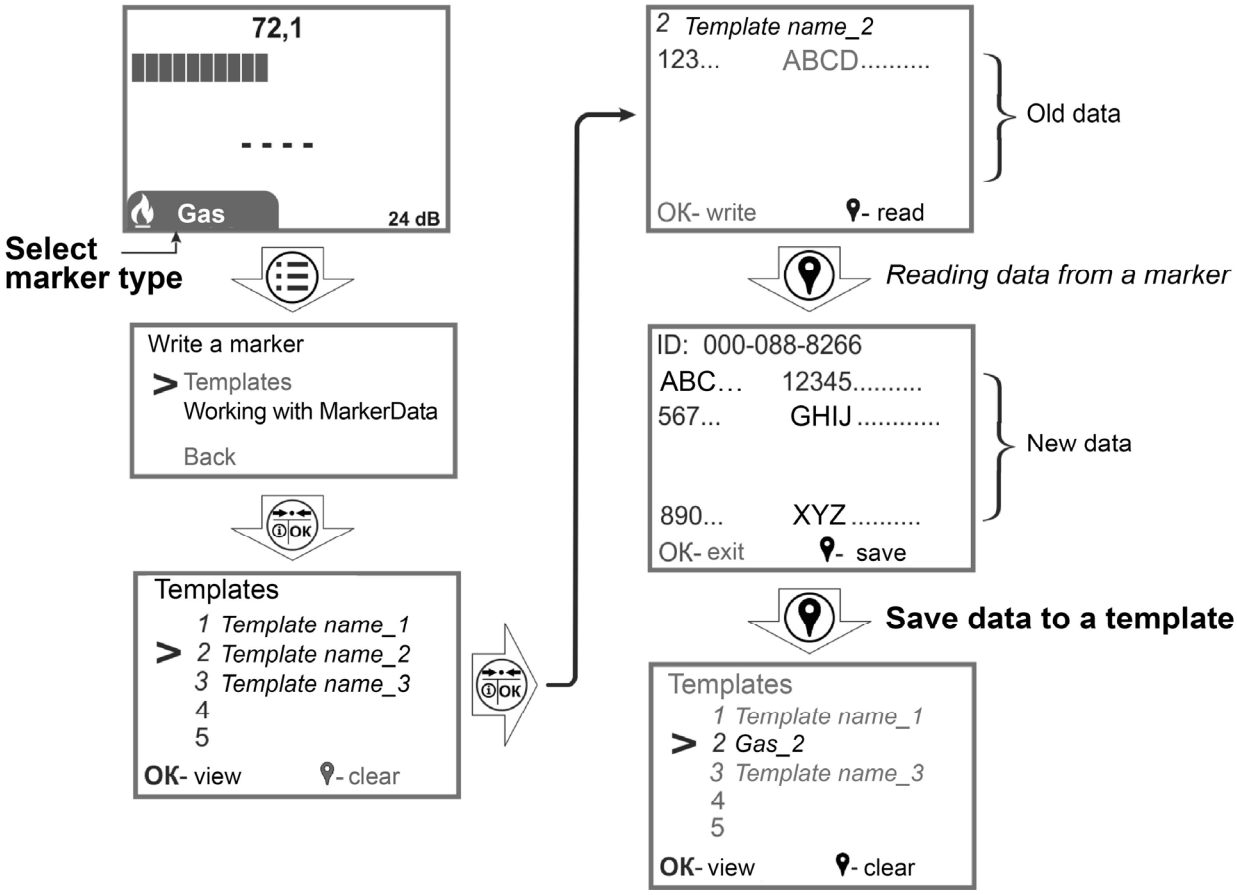
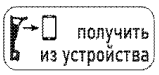


Figure 4.2.4 – Reading data from a marker into a template

The template can be used to write to other markers or transfer for editing to the MarkerData application (item 4.2.5).

4.2.5 Transferring templates from the locator to the MarkerData application

To transfer templates from the locator to the MarkerData application, select “Write a marker” > “Working with MarkerData” in the locator menu (Figure 4.2.5 a).

Open MarkerData application on smartphone, enable Bluetooth and geolocation, enter the PIN code 5106 in query window. In the list of templates in the MarkerData application press the “CONNECTION” button and wait for the connection message (Figure 4.2.5 b). Tick ☑ the templates you need to transfer from the locator and press the button that appears 

(get from a device).

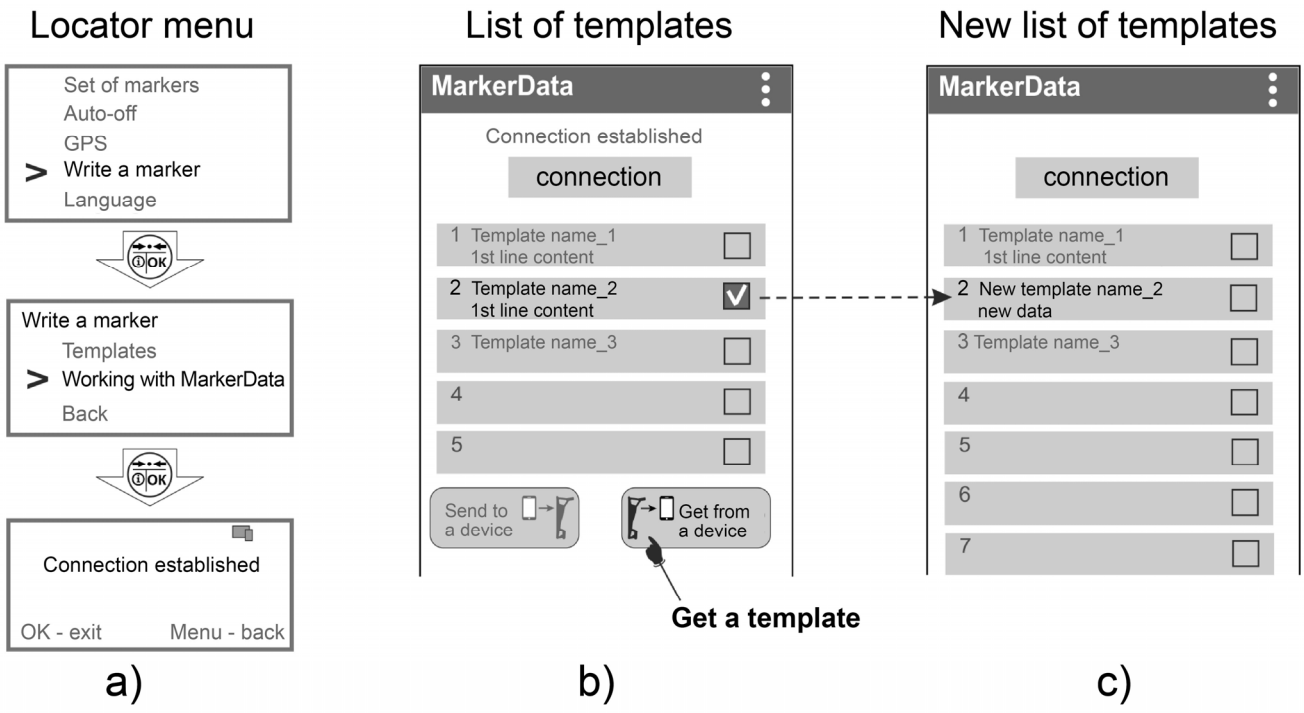


Figure 4.2.5 – Transferring templates from the locator to the MarkerData application

After transferring the templates from the locator an updated list of templates will appear on the main application window, taking into account the received transferred ones, the previous template name and its data will be lost (Figure 4.2.5 c).

5 Storing and viewing tracks

The locator ensures saving of measurements readings in a non-volatile memory, signal level, depth and data from ID (Smart) markers, including references to the coordinates received from an external GPS/GLONAS-*Bluetooth logger* (hereinafter GPS-logger) or from GPS-module of smartphone (tablet). Communication with an external GPS "Bluetooth" logger versions 2.0, 2.1 or 3.0 (support SPP profile) is performed via Bluetooth connection.

The coordinate accuracy depends on many factors, including quantity of available satellites, satellites location, presence of reflected signals, influence of ionosphere, satellite clock error, specifications of GPS/GLONASS logger or GPS-module of smartphone.

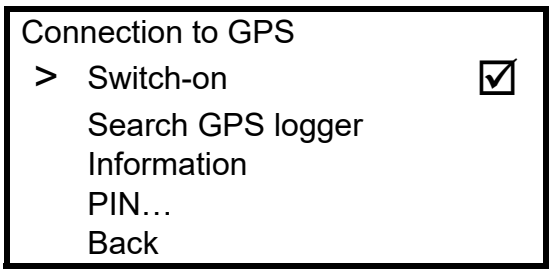
Note! Using other GPS receivers enabling coordinate transmission via Bluetooth and, for example, having high accuracy characteristics, make sure that the GPS receiver send the data in NMEA 0183 RMC and GGA formats with refresh rate of 1 second.

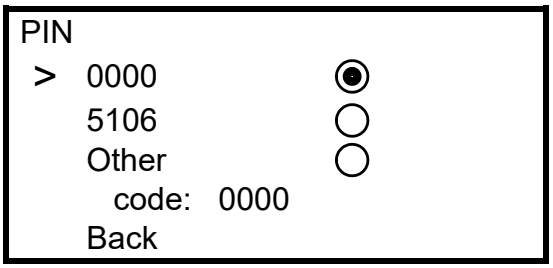
5.1 Settings for Operation with a GPS Module

5.1.1 Locator settings for operation with an external GPS-Bluetooth logger.

Place the GPS module so that it can receive signals from maximum available satellite.

To connect the locator to GPS logger, at the first connection select «GPS» > «Connection to GPS» > «PIN» in the main menu. Set PIN code of GPS module. Usually, a standard PIN code is «**0000**». If the code differs and includes a random combination, enter the code using ▼▲ keys.





Then in the main menu of the locator, select "GPS" > "Connection to GPS" > "Search GPS module". After the search is finished, select the GPS module from the list of identified devices. Confirm the selection by pressing OK key. Name or address of the GPS logger, number of available satellites, coordinates and times it finds are available in "Menu" > "GPS" > "Connection to GPS" > "Information".

Status of connection to the GPS module is indicated with «» or «» icons (item 8 in Figure 3.2a) and given in table 5.1

Table 5.1 – Status to connection the GPS module

Icon	Description
none	No connection to the GPS module
yellow	Connecting to the GPS module 1 minute max.
yellow	Connection to the GPS module is established but there are no GPS coordinates (cold start of the GPS module, bad conditions of GPS signals reception)
green	Connection to the GPS module is established, receiving the coordinates. The number of satellites used to determine the coordinates is shown to the right of the icon.
red	Connection to the GPS module is lost

Further the locator will connect to the GPS module automatically by pressing key and selecting the track for record (item 5.2) or by selecting «GPS» > «Connection to GPS» > «Switch on» in the main menu.

Note. Cold start (for example, switching on for the first time after being not used for a long time), depending on the GPS module model and number of available satellites, may reach 20 minutes. In this case,«» icon on the display is yellow. Next hot starts will take several seconds.

5.1.2 Settings of locator with GPS-module of smartphone (tablet)

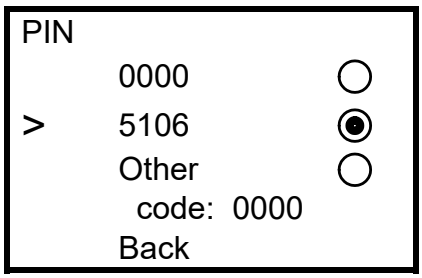
Instead of external Bluetooth-GPS logger, the marker locator can communicate with smartphone (tablet) that has a built-in GPS module in order to receive GPS coordinates.

Smartphone shall run Android 6.0 or higher.

Download Stalker-terminal App from our official website www.radio-service.ru/en and install it on smartphone. Make sure that you have allowed your smartphone to install Apps downloaded from unknown sources.

Keep the smartphone near to the marker locator, so it could receive signals from maximum available satellites.

During first pairing between locator and smartphone, enter the "Menu" on marker locator and select "GPS" > "GPS connection" > "PIN code" > «**5106**».



After that proceed as follows:

- run Stalker terminal App on smartphone;

- on App main window select "Transmit GPS coordinates". Wait until the number of available satellites appears on the display and select "Establish connection";

- during the first pairing between smartphone and marker locator, enter the Menu of the locator and select "GPS" > "GPS connection" > "Search of GPS module". When the search is over, select your phone from the list of available GPS modules. Next connection between paired locator and smartphone will be established automatically by pressing key on the locator and selecting track record (item 5.2).

- enter the PIN code 5106 in query window that will appear on smartphone display;

If the smartphone is connected to the Internet it will display your current position on Google Maps. Otherwise the map will not be displayed.

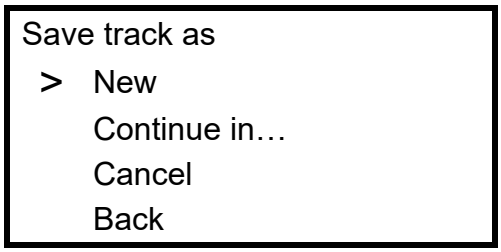
The indication of the status of communication with the GPS module is similar to item 5.1.1. Additionally, the number of visible satellites will be displayed next to the green «» icon.

5.2 Recording tracks

ATTENTION! Track recording is only available in search mode. This option is unavailable with scan mode on.

To record the information on the input signal level and marker depth, press the key holding the locator above the marker.

The first pressing of the key after the locator is switched on opens submenu «Menu» > «Save track as», where one should select whether create a new track (“New”) or continue recording in the existing track (“Continue in…”). When selection is done, the locator establishes connection to the GPS logger, which has already been connected before (item 5.1).



Next pressing of the key will record the data in selected track. During recording, the «» icon shortly appears on the display (item 10 in the Figure 3.2 a). The icon is green if the point saved in the track contains GPS coordinates and red if no reference to coordinates has been saved.

To create points marked specifically, for example, for marking pipeline branches or cable coupling boxes, press and hold the for 2 seconds (a long sound will follow). When browsing the saved data in "Stalker-terminal" software, this point in "Mark" column will be marked with the «**!**» or green symbol on smartphone track.

5.3 Distance

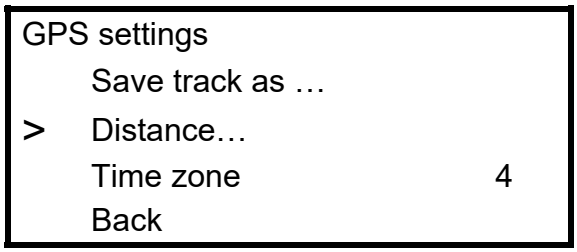
Basing on coordinates received from the external GPS module, the locator calculates and displays the distance covered on the display (item 9 in Figure 3.2 a):

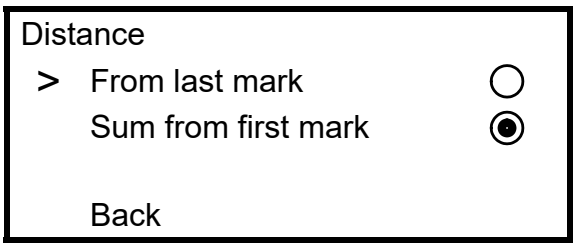
- «From last mark» – as the distance of the straight line from the last point marked by pressing key to the current location;

- «Sum from first mark» – as a sum of distances between points marked with key, starting from the first point, plus the distance from the last point to the current

location. It allows displaying the distance covered not only for straight lines but also for parts consisting of broken lines. To make it, press key each time the direction of movement is changed.

Any option is selected via "Menu" > "GPS"> "GPS settings" > "Distance".

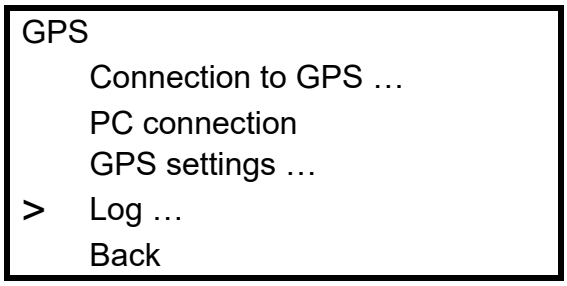




The distance value is not saved in the non-volatile memory and is deleted as the locator is switched off.

5.4 Log

List of tracks saved in the receiver memory may be browsed via "Menu" > "GPS" > "Log" > "View".



Every track has information on its number, date and time of the first saved point (optional) and total number of points per track. To select track use keys, to delete a track press the key.

5.5 Transmission and View of Tracks to PC or Smartphone

The marker locator supports transmission of survey data to PC or smartphone. The data from locator memory is transmitted over Bluetooth connection and saved as files containing tracks.

A special software Stalker-terminal is required for handling the data. This software shall be used for receiving data from locator memory, editing and saving tracks.

5.5.1 Transmission of Tracks to PC

The locator is compatible with PCs running with Microsoft Windows (Vista, 7,8,10). The PC shall be fitted with a Bluetooth device or equipped with external Bluetooth-USB adapter. In later case make sure that drivers for Bluetooth-USB adapter are installed on PC.

Download software Stalker-terminal (version 2.4. or higher) from our official website: www.radio-service.ru/en and install it. Prior to downloading check with system administrators that your computer allows downloading and installation of third-party software.

In order to transmit the data to the computer proceed as follows:

- run "Stalker-terminal" on PC;
- place the marker locator close to the PC;
- on the locator , establish the connection to PC: "Menu" > "GPS" > "PC connection";
- to read the track from locator, select "Load track from locator" in "Stalker-terminal";
- select track from the list that will appear on the PC and click "OK". Wait until track reading is finished.

Stalker-terminal allows applying track on maps of "Yandex.maps", "Google.Maps" and "OpenStreetMap". It requires internet connection. If the Internet is accessed via a proxy server, set its parameters in "Stalker-terminal" settings. If connection to the Internet is not available, the map will not be displayed but the software will work in all other aspects.

The track can be saved in .kml format for further uploading in Google Earth or in .csv format for uploading in other software programs. Select "Export table" in "File" tab while track is open in program. Then select the save path, track name and format.

Note.

In certain cases operation system of your PC may fail to establish connection with some Bluetooth-USB adapters. In this case make sure that:

- there is a Bluetooth symbol on task panel and that the Bluetooth-USB adapter is identified as Bluetooth devise;
- marker locator is shown in list of available Bluetooth devices.

Otherwise:

- connect Bluetooth-USB adapter to another USB-port of PC;
- Install drivers for Bluetooth-USB adapter;
- Replace Bluetooth-USB adapter and try again.

5.5.2 Transmission of Tracks to Smartphone (tablet)

For viewing tracks received from marker locators your smartphone must run with Android ver. 6.0 or higher.

Download and install Stalker-terminal application from official website www.radio-service.ru/en . Make sure that you have allowed installation of application downloaded from third-parties sources.

Proceed as follows in order to transmit data:

- On marker locator, activate PC connection via Menu > GPS > PC Connection;
- On smartphone, run "Stalker-terminal" application;
- On application window select "Download and view track", then select "Download track from locator";
- Enter PIN code 5106;
- Select track / tracks from the list and press Download. Wait for the download to finish;
- the appeared "Saved tracks" window select the required track and press "Open".

"Stalker-terminal" allows applying track on maps of "Google Maps". It requires internet connection. If connection to the Internet is not available, the map will not be displayed but the software will work in all other aspects.

The track could be saved in ".track" format for further operation in "Stalker-terminal" program on PC. To do so in "Saved tracks" window select the track to export and click "Export to PC". Then the track will be saved in the internal memory of the smartphone in the "Stalker-terminal" file.

Program options in details are shown in training films that placed on official website www.radio-service.ru/en.

6 Potential Failures and Troubleshooting

Potential failures and troubleshooting procedure are provided in Table 6.

Table 6 – Potential failures and troubleshooting

Failure symptoms	Probable cause	Troubleshooting procedure
The locator does not switch on or switches off spontaneously	The storage battery is discharged or failed	Charge or replace the storage battery or install the batteries
The charging process is not displayed on the indicator (the storage battery is not charging)	Power supply failure	Check the power supply unit
	Storage battery failure	Replace the storage battery (item 7.3)
	Storage battery is out of tolerance	Charge at a temperature of +5 ºC to +50 ºC
	Storage battery is not set up	-
No sound can be heard in headphones, though the locator speaker operates normally.	No contact in headphones connector	Replace the headphone jack
	Headphones failure	Replace or repair the headphones
Error of depth measuring exceeds the limit	Parameter drift of the measurement duct	Setting by the manufacturer is required

7 Maintenance and Repair

7.1 Maintenance includes compliance with the rules of storage battery operation, storage, charging, regular checks and troubleshooting.

7.2 Repair of the locator is only allowed at the manufacturer’s site or in special repair agencies.

7.3 Replacement of storage batteries or non-rechargeable batteries

7.3.1 Replacement of a storage battery

To replace the storage battery it is necessary to (Figure 7.3 a):

- remove the screws fixing the battery compartment cover and remove the cover;
- disconnect the connector (pos. 1) of the battery (battery compartment);
- remove the battery (pos. 3);
- replace the battery, restore the connection;
- lay the wires and connector as shown in Fig. 7.3 a;
- install and fix the battery compartment cover with screws;
- charge the battery.

7.3.2 Changing the replaceable batteries (batteries)

To change the batteries it is necessary (Figure 7.3 a):

- remove the screws fixing the battery compartment cover and remove the cover;
- Remove the cover gasket (pos. 2);
- disconnect the connector (pos. 1) of the battery (battery compartment);
- take out the battery (pos. 3);
- remove the battery gasket (pos. 4).

Next (Figure 7.3 b):

- install the batteries (8 x AA) in the battery compartment (pos. 5);
- install the battery compartment as shown in Figure 7.3 b;
- restore the connection;
- lay the wires and connector as shown in Figure 7.3 b;
- install and screw on the battery compartment cover.

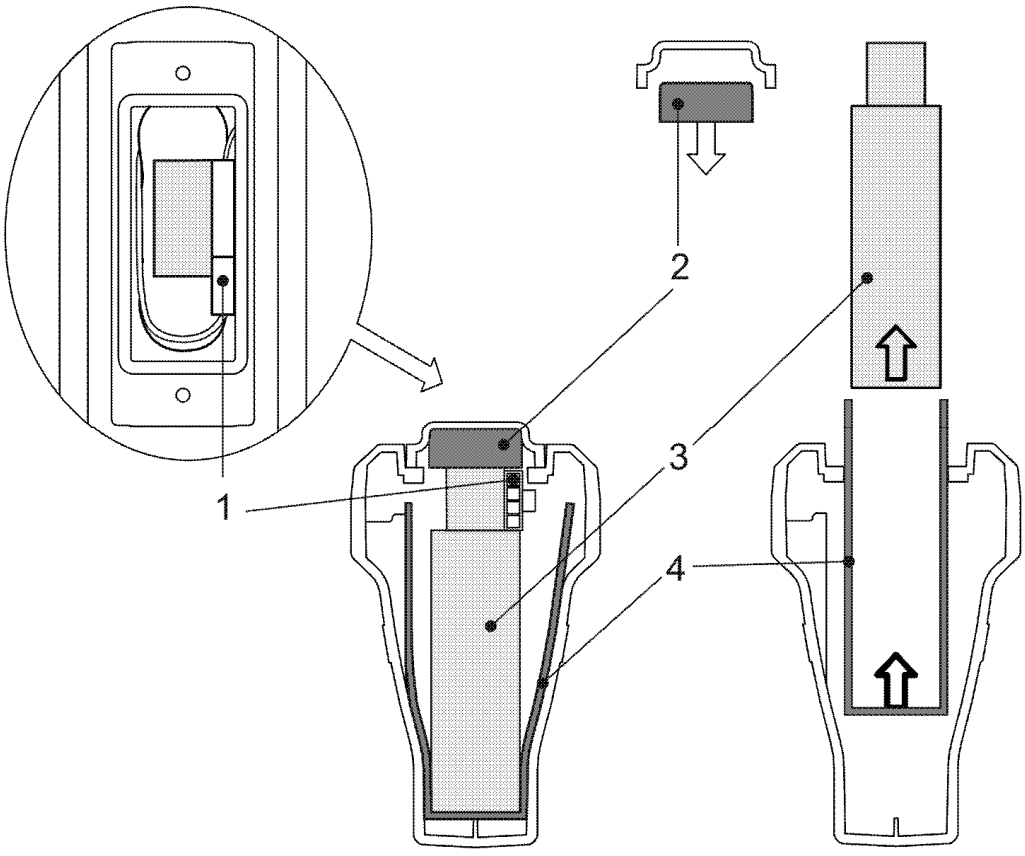


Figure 7.3 a

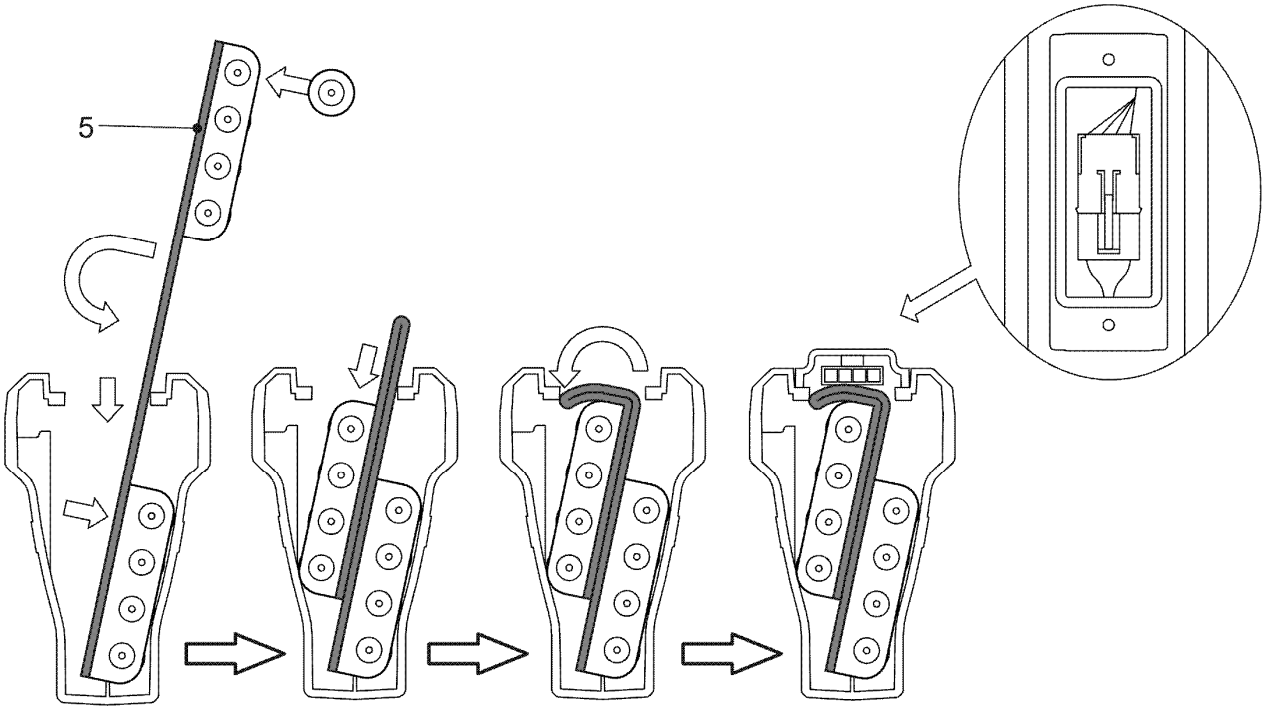


Figure 7.3 b

8 Transportation and Storage

The locator packed in a standard package allows transportation by all transport means, excluding unpressurized and unheated aircraft compartments.

Transportation conditions:

– ambient air temperature of minus 50 to plus 70 ºC;

– relative humidity of 95 % at the temperature of plus 30 ºC;

– transportation vibration up to 120 impacts per minute with 30 m/s2 acceleration, for not longer than 1 hour;

– atmospheric pressure of 60 to 106,7 kPa (460 to 800 mm Hg).

9 Disposal

Disposal shall be performed by an operating organization in compliance with standards and rules applicable in the country.

The locator does not include any environmentally hazardous elements.

10 Acceptance Certificate

RF Marker Locator PM-2 PM-3 № _____

delete as appropriate **Reg. No.**

complies with technical specifications RAPM.464419.001TS and has been found fit for operation.

QCD HEAD

Stamp here _____ _____

personal signature **full name**

_____

date

10 Manufacturer's Warranty

The manufacturer guarantees that the locator meets the specification requirements provided that operation, transportation and storage rules are observed.

The guaranteed service life of locator is 18 months from the date of manufacture or sate of sale (if a note on sale is available), but not more than 24 months from the date of manufacture.

The guaranteed service life is prolonged through the period from claim presentation till elimination of failures.

The guaranteed service does not cover the storage buttery.

Manufacturer's details:

268, Pushkinskaya street, 426000 Izhevsk, Russia,

Radio-Service, JSC

Phone. (3412) 43-91-44. Fax. (3412) 43-92-63.

E-mail: office@radio-service.ru Website: www.radio-service.ru

To be filled in by the seller:

Date of sale _____

Seller _____

Seller’s address _____

Seller’s phone _____

Stamp here

11 In-service Transfer Record

11.1 The in-service transfer record is given in Table 11.1.

Table 11.1 – in-service transfer record

Date of installation	Place of installation	Date of removal	Operating time		Cause of removal	Signature of person in charge of installation (removal)
			Since the beginning of operation	Since the last repair		

11.2 Data on acceptance and handover is given in Table 11.2.

Table 11.2 – Data on acceptance and handover

Date	Instrument status	Base (document title, number and date)	Enterprise, position and signature of person in charge of		Note
			handover	acceptance	