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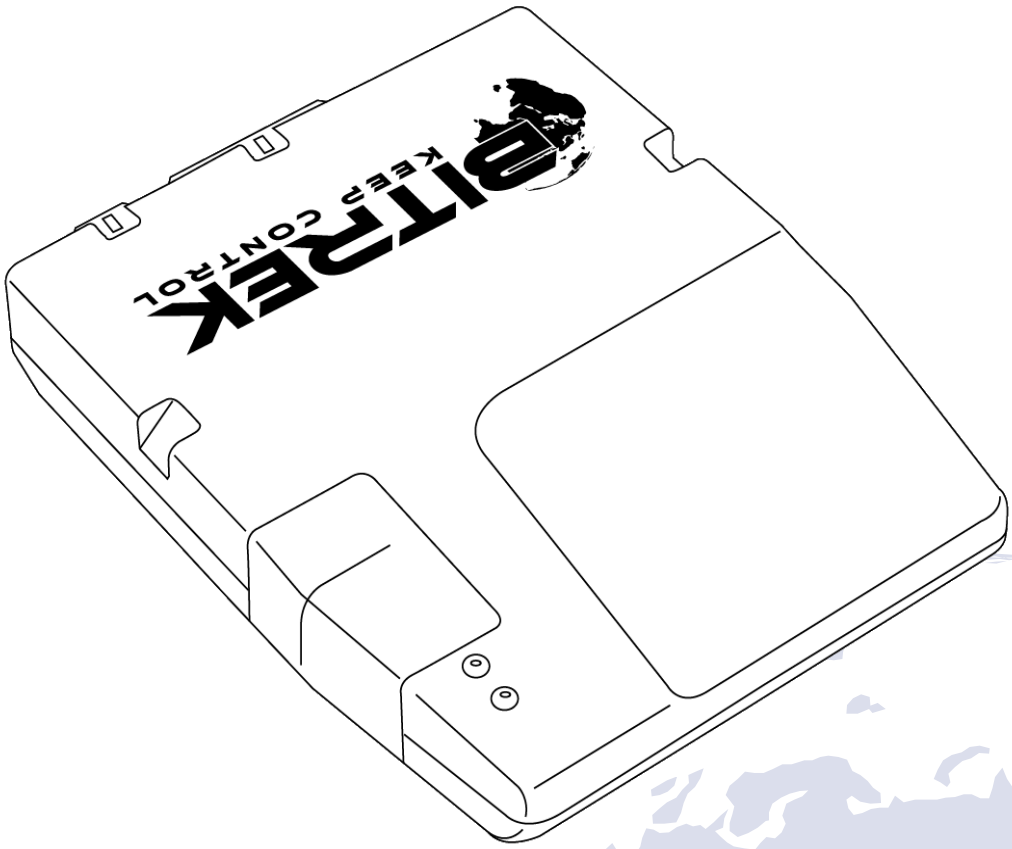
Tracking device for moving objects

BI 530R TREK



Operating manual

Version 2017.03.1

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Content

Introduction

Safety requirements within installation and maintenance of "BI 530R TREK" tracking device

Technical staff involved in installation of tracking device is in charge for compliance with security measures, as well as the staff responsible for equipment at the work area.

Work area shall be in conformity with the fire safety regulations in accordance with GOST 12.1.004 and electrical safety in accordance with GOST 12.1.019.

Vehicles at the work area shall comply with the occupational safety and health rules in accordance with the DNAOP (State regulations on labor protection) 0.00-1.28-97.

To prevent damage, device shall be stored in a shock-proof packaging. Before using, place the device so that you can see the indication display elements. Before connecting/disconnecting the power socket and inputs/outputs, turn off the power supply.

Transportation and storage

Transportation of tracking device in the transport packaging of the manufacturer is allowed by all kinds of enclosed land and sea transport (rail cars, containers, vehicles of closed type, bilges, etc.). Transportation in pressurized heated compartments of the aircraft is allowed. Transportation and storage shall be carried out under conditions in compliance with storage conditions 3 according to GOST 15150-69.

Transportation and storage shall comply with requirements specified by the signs on the packages.

Warranty

Warranty period of operation of tracking device is 12 months from the date of sale of the device.

The warranty obligations of the manufacturer are valid if the consumer observes the requirements of this manual. In case of their violation, or at any mechanical or electrical damages caused by factors other than specified by this manual, the warranty shall be considered null and void.

Device

Purpose

Tracking device "BI 530R TREK" shall be applied to solve issues of navigation, remote control and monitoring of a vehicle or other remote object.

The tracking device is designed to be installed on any mobile or remote stationary object in order to:

- determine the geographical coordinates, speed and direction of movement;
- ensure data collection from external devices;
- control actuating mechanisms;
- transmit data to the control dispatching center.

Data communication channel is the network of mobile communication operator with GSM standard 900/1800. LBS, GPS or LBS, GPS/GLONASS are used to determine the coordinates.

Device shall be installed out of reach of the driver.

The device is not designed to run on water transport.

Operation principles

In real time mode the tracking device:

- determines location and movement parameters of the object (time, geographical coordinates, speed, and direction).
- collects and processes information from the analog, digital, and discrete sensors
- ensures control over actuating mechanisms upon command from the control dispatching panel.

Received data are recorded and stored in an internal log, which is implemented on microchip of nonvolatile memory. At specified intervals or according to event entries from this log are sent to the server of the dispatcher via the GSM network. Exchange of information is carried out by means of GPRS and SMS channels.

Operation of the device in "on-line" mode is possible only at presence of the network coverage of cellular transmission by GSM 900/1800 standard. Outside GSM network coverage, the tracking unit operates in the "black box" mode, i.e., it records all information in the nonvolatile memory and sends it when the vehicle is entering a GSM coverage area.

Technical specifications

Table 1 - Technical specifications

No.	Name	Technical specification
1	Data transmission standard	GSM 900/1800
2	GSM network communication channel	GPRS, SMS
3	SIM-cards quantity	1
4	SIM-card format	Micro-SIM
5	GPRS class	10
6	Type of navigation system	LBS, GPS or LBS, GPS/GLONASS
7	GSM and GPS antennas	Internal
8	Auxiliary digital interfaces	RS-485
9	Motion sensor	Accelerometer
10	Number of discrete inputs with active "0"	1
11	Number of discrete inputs with active "1"	2
12	Number of discrete outputs	2
13	Type of power supply	Direct current
14	Accumulator battery capacity	130 mAh
15	Supply voltage	From 6 V to 36 V
16	Average consumption current (12 V)	60 mA
17	Range of voltages of discrete inputs	From 0 V to 40 V
18	Type of discrete outputs	Open collector
19	Maximum current of discrete outputs	0.5 A
20	Number of analog inputs	2
21	Range of voltage of analog inputs	From 0 V to 27 V
22	Volume of nonvolatile memory	2 MB (or 50 000 records)
23	Operating temperature	From -30 °C to +80 °C
24	Relative humidity of air	(80±15) %
25	Dimensions (L x W x H)	(96 x 77 x 14) mm
26	Weight of the device	75 g
27	Housing protection class	IP54
28	Housing material	Plastic ABS UL94V0

Design of tracking device

Appearance and dimensions of the tracking device "BI 530R TREK" are shown in Figure 1.

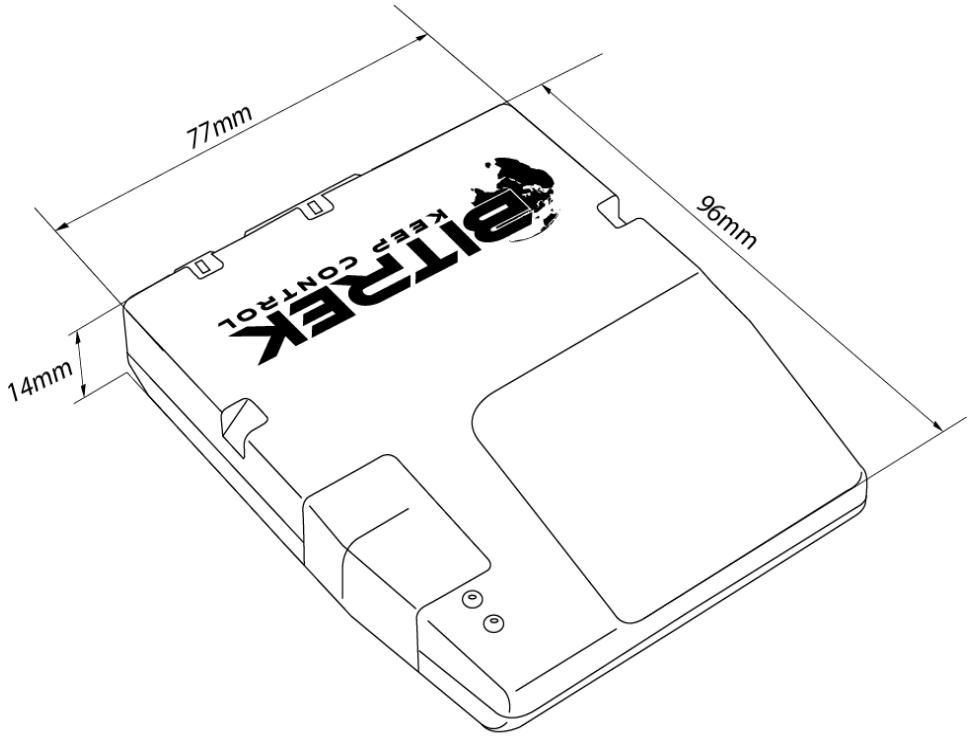

Figure 1 - Appearance and design of the device.

Supply package

The tracking device "BI 530R TREK" is provided with the following set:

1. Tracking device "BI 530R TREK" - 1 piece.
2. Connection cable - 1 piece.
3. Technical data sheet - 1 piece.
4. Warranty card - 1 piece.

Preparation for operation, commissioning

SIM-card installation

To operate in GSM network device shall contain installed SIM-card of Micro-SIM format. Phone book of SIM-card shall remain empty, PIN-code shall be removed (use of SIM-card with PIN-code can be allowed subject to entering the PIN-code to the device settings).

To install the SIM-card disconnect the power socket from the device, remove the side cover and install the SIM-card into the slot (see Figure 2).

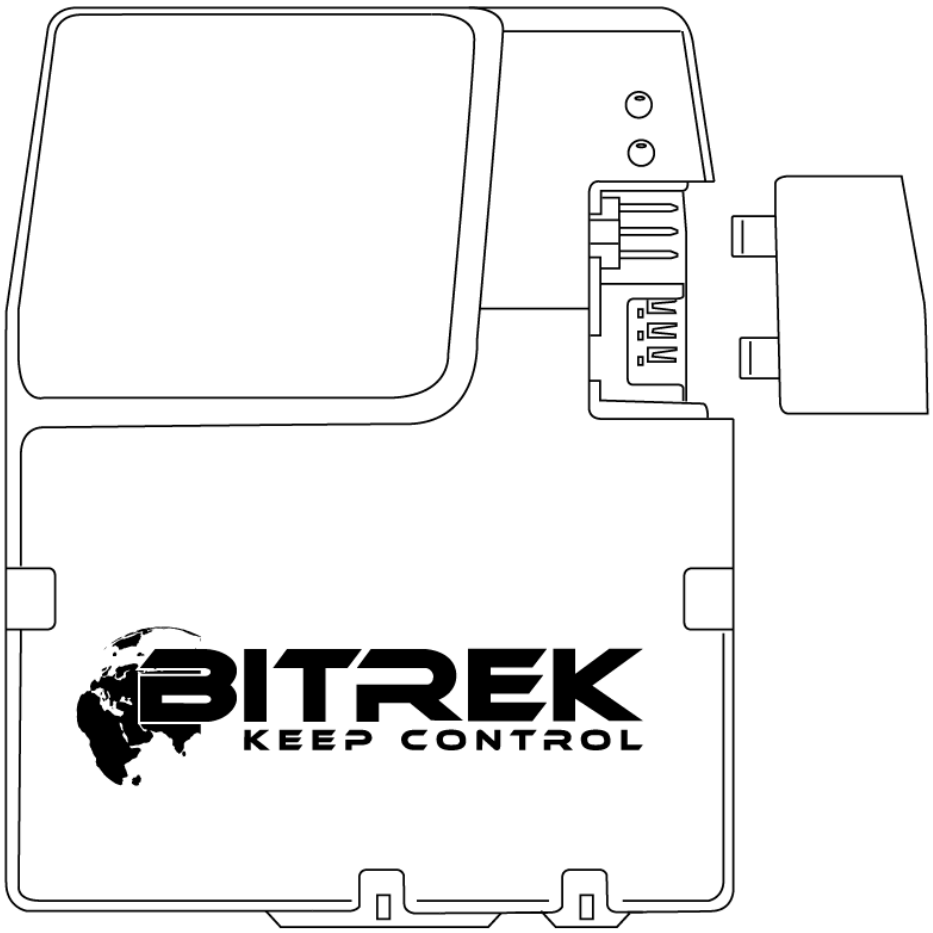

Figure 2 - Installation of SIM-card into the device.

Connectors for power supply and peripherals

The rear panel of the tracking device contains sockets for connecting cables. Connecting cables in turn have outlets for power, analog, digital, discrete sensors and actuating mechanisms. Location of sockets and numbering of contacts are shown in Figure 3.

Marking of connector pins for power supply, sensors and peripherals is shown in Table 2.

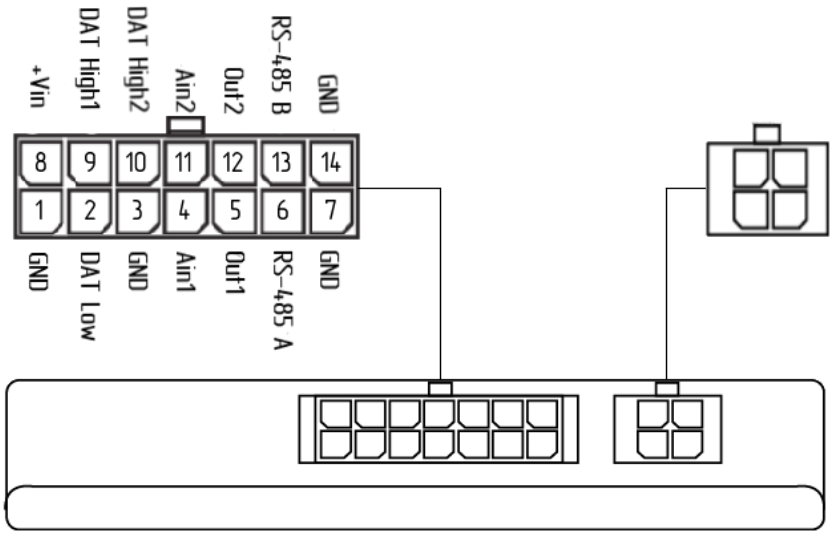

Figure 3 - Location of sockets and numbering of contact elements.

Table 2 - Designation of contact elements

No.	Colour	Name of contact	Type of signal	Contact element assignment
1	Black	GND	Power supply	Common wire (ground)
2	Brown	DAT low	Input	Discrete input with active "0" (1-20 kHz frequency input, pulse counter)
3	Black	GND	Power supply	Common wire (ground)
4	White	AN in 1	Input	Analog input No. 1
5	Violet	Out 1	Output	Discrete output No. 1
6	Orange	RS-485 A	Input/output	Data signal interface RS-485
7	Black	GND	Power supply	Common wire (ground)
8	Red	+ V in	Power supply	"+" of on-board power supply (rated voltage of 12 V or 24 V)
9	Blue	DAThigh 1	Input	Discrete input with active "1" No. 1
10	Yellow	DAThigh 2	Input	Discrete input with active "1" No. 2
11	Grey	AN in 2	Input	Analog input No. 2
12	Pink	Out 2	Output	Discrete output No. 2
13	Green	RS-485 B	Input/output	Data signal interface RS-485
14	Black	GND	Power supply	Common wire (ground)

Assembly, commissioning

Assembly recommendations

Zone of installation of tracking device shall enable the connecting of the pin to it and disable the possibility of accidental damage to the device, moisture, impact of high temperature. Recommended location for installation in the vehicle is an empty space under the dashboard inside the vehicle; in addition, the device shall be placed in a way ensuring the upper side with LEDs to face up.

The body of the device contains grooves for easy fastening with plastic ties.

Electrical connections

Power supply wires are laid through the maintenance holes in the body of the vehicle from the regular battery location to the place of installation of the tracking device. Power wires are connected to the corresponding battery terminals.

Carrying out welding work during the repair of the vehicle necessarily requires disabling of power socket and peripherals.

The active state for discrete input with active "0" is a connection of this input with the negative of the power (ground). The passive state for this input is the lack of connection ("in the air" input).

The active state for the discrete inputs with active "1" is to supply to these inputs the voltage exceeding + 8 V. The passive state for these inputs is the lack of connection ("in the air" input).

Analog input voltage can range from 0 V to 27 V.

The discrete outputs of the device are made according to the scheme such as "Open collector". The load shall be connected to the gap between the discrete output and "+" power of the on-board network. When activated, the output gets ground switching. Maximum current of the discrete output load shall not exceed 0.5 A. If it is needed to switch higher currents, connect digital outputs via additional relay.

The voltage on the discrete inputs shall not exceed 40 V. The voltage on the analog inputs shall not exceed 27 V. The power supply voltage of the device shall not exceed 36 V. Otherwise, the device may be disabled.

Device to computer connection

The tracking device can be connected to a PC, in order to configure the device, as well as to perform maintenance works. For this purpose, the device is equipped with a service UART output. To connect to a computer,

use an additional USB-UART converter, which can be purchased from a dealer for an additional fee.

UART service output socket is located on the board of the device next to the SIM-card slot. To access the socket, remove the side cover of the device. Procedure of connection of USB-UART converter cable is shown in Figure 4.

Connect the cable of USB-UART converter to the tracking device so that the arrow on the cable socket to be located closer to the SIM-card slot (see Figure 4).

To work with the USB-UART converter, install the appropriate device drivers. They can be downloaded from the official website: http://www.ftdichip.com

To exchange data with the device, use a terminal program. Settings of the terminal: speed - 115200 bit/second, data bit - 8, stop bit - 1, no parity check, no flow control.

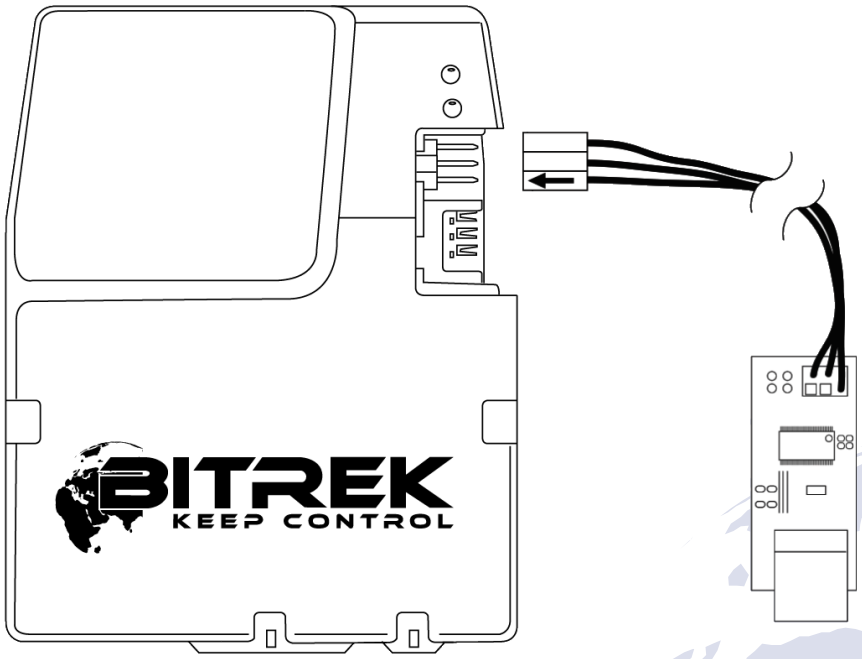

Figure 4 - Connection of the cable of USB-UART converter to the device "BI 530R TREK".

Once connected, the device will transmit data about its state to the terminal. In addition, the user is able to use a terminal program to send commands to a device and receive response to them. Send preliminary to device the password to access the terminal in the following format:

TPASS: password;

, where *password* is a password for access to the device terminal (default value is 11111).

Lifetime of access password after sending is 60 seconds. After this time, re-send the password to exchange data with the device.

Description of display bodies

Top panel of the tracking device contains two LEDs that indicate the current status of the device.

LED "STATUS" (**red**) is on for 0.5 seconds and is off for 0.5 seconds when GPRS connection is inactive; is constantly on when GPRS connection is active and the device is connected to a remote server; LED slowly flashes for 0.2 seconds when GPRS connection is not active, and the modem is in sleep mode.

LED "GNSS" (**green**) flashes (or lights) when the device is receiving correct position coordinates and is off when the device is not receiving the coordinates, or the signal is too weak, and the data are not correct.

Adjustment of "BI 530R TREK" device

Basic information

The tracking device "BI 530R TREK" can be configured in following ways:

1. With a direct connection of the device to a computer.
2. Remotely, using SMS commands.
3. Remotely, using the configuration server.

Setting of the device through any of the available methods is limited with the setting of the required values of the device parameters. Each parameter has its own unique ID. Special commands are used to read/record the values of selected parameter.

At remote configuration via SMS take into consideration that the total length of the SMS shall not exceed 160 Latin characters. Number of commands in SMS is limited to a maximum length of SMS.

All commands for the device are divided into control and information commands.

List of information commands to operate the device

Table 3 - List of information commands to operate the device "BI 530R TREK"

No.	Command	Description	Availability of response
1	*getstatus*	Information about current state of the device	yes
2	*getgps*	Current GPS coordinates and time of device.	yes
3	*getmap*	Request of device coordinates	yes
4	*getver*	Request of the version of the device software	yes

5	*getio*	Read the value of the device's internal sensors	yes
6	*flush*	Request of device profile parameters	yes
7	*getparam ####*	Read the value of the parameter by its ID	yes

Notes to Table 3.

Information about current state of the device
Command to be send - *getstatus;*

Example of response:
«Data Link: 1 GPRS: 1 IP: xxx.xxx.xxx.xxx GSM: 4 Roaming: 0»

, where:
Data link – current connection status (0 - not connected to the server, 1 - connected to the server);
GPRS - status GPRS (0 - not active, 1 - active);
IP – IP address of the device. With an active GPRS connection it is assigned by the operator (not to be confused with the IP address of the server);
GSM - level of GSM signal (1 - minimum, 5 - maximum);
Roaming - SIM-card in roaming (0 - home network, 1 - roaming).

Current GPS coordinates and time of device.
Command to be send - *getgps;*

Example of response:
"GPS: 1 Sat: 7 Lat: 50.2345 Long: 30.1652 Alt: 123 Speed: 0, Dir: 77 Date: 2016/2/15 Time: 14:37:32"

, where:
GPS – status of GPS data (1– valid, 0 – invalid);
Sat – number of satellites visible for the device;
Lat - latitude (last known latitude);
Long - longitude (last known longitude);
Alt - altitude, height above sea level;
Speed - speed (km/hour);
Dir - direction of motion (degrees);
Date – current date (1980/1/6 is transmitted in the absence of GPS-signal);
Time – current GMT time (in the absence of a GPS signal there is transmitted 00:00:00).

Request of device coordinates.
Command to be send - *getmap;*

Example of response:
«www.biakom.com/maps/q=50.420209,30.428448,12,0»

Request of the version of the device software
Command to be send - *getver;*

Example of response:
«BI-520R Ver: 3.92»

Read the values of the device's sensors.
Command to be send - *getio;*

Example of response:
«DL1: 1 DH1: 0 DH2: 0 DO1: 0 DO2: 0 VPSV: 12996mV VBAT: 4290mV AIN1: 37mV AIN2: 38mV»

, where:
DL1: 1 DH1: 0 DH2: 0 - current state of the discrete inputs;
DO1: 0 DO2: 0 - current state of the discrete outputs;
VPSV - external power supply, millivolts;
VBAT – power supply of device accumulator battery, millivolts;
AIN1: 37mV AIN2: 38mV - analog inputs voltage, millivolts.

Request of device profile parameters.
Command to be send - *flush;*

Example of response:
«xxxxxxxxxxxxxxx, gps.utel.ua, none, none, xxx.xxx.xxx.xxx, xxxxx 0»

, where:
IMEI (xxxxxxxxxxxxxxx) - identification number (IMEI) of the device;
APN (gps.utel.ua) – access point for GPRS connection (to be specified by the operator);
Login (none) – access login to GPRS (to be specified by the operator, usually, it is not required);
Password (none) – access password to GPRS (to be specified by the operator, usually, it is not required);
IP (xxx.xxx.xxx.xxx) – Server IP address for data transmission;
PORT (xxxxx) - PORT of server for data transmission;
MODE (0) - mode of device operation (0 - TCP/IP connection).

Read the value of the parameter by its ID
Command to be send - *getparam ####;*
Parameter ID (####) consists of four digits and indicates the number of the parameter. All configurable parameters are specified in the list of device parameters (see Appendix 1 and Appendix 2).

Example of response:
«Param ID #### Val: #»

, where:
Param ID – ID of requested parameters;
Val – current value of parameter.

Example of the command to request APN of the device (a parameter that contains the APN device has ID 0242) - *getparam 0242;*

Example of response:
«Param ID 0242 Val: gps.utel.ua».

List of control commands to operate the device

Table 4 - List of control commands to operate the device

No.	Command	Description	Availability of response
1	*cpureset*	Reload of device processor	no
2	*rstallprof*	Restoring of original state of profile settings	no
3	*deleterecords*	Deletion of all saved records	no
4	*setparam ####*	Set the value of the parameter by ID	yes
5	*boot #,#,#*	Update of device software	yes
6	*setdigout ##*	Set the mode of operation of digital outputs Out 1 and Out 2.	yes
7	*ignitionoff*	Activation of the safety locking of ignition	yes
8	*ignitionon*	Deactivation of the safety locking of ignition	yes

Notes to Table 4.

Reload of device processor.
Command to be send - *cpureset;*
No response is returned for this command. Receipt of the command initiates a complete restart of all device processes.

Restoring of original state of profile settings.
Command to be send - *rstallprof;*
No response is returned for this command. Receipt of this command initiates reset of profile parameters to default ones.

Deletion of all saved records.
Command to be send - *deleterecords;*
No response is returned for this command. Receipt of the command deletes all the data packets from the device memory.

Set the value of the parameter by ID
Command to be send - *setparam ####;*
Parameter ID (####) consists of four digits and indicates the number of the parameter. All configurable parameters are specified in the list of device parameters (see Appendix 1 and Appendix 2).

Example of response:
«Param ID #### New Val: #»

, where:
Param ID – ID of parameter to be set up;
New Val – assigned value of parameter.
Example of the command to set APN of the device (a parameter that contains the APN device has ID 0242) - *setparam 0242 gps.utel.ua;*

Example of response:
"Param ID 0242 New Val: gps.utel.ua».

Update of device software.
Command to be send - *BOOT #,#,#;*
Example of command to update the software:
«BOOT biakom.com,80,pr/.bin;»*

, where:

«HOST» - (biakom.com,) is address of server locating the update files;
«PORT» – (80,) - port of server locating the update files;
«PATH» - (pr/) – location of update files on server;
«Firmware» - *(*.bin;)* – binary update file, where * is the firmware version, .bin is the file extension.

This command allows remote software update of the device via GPRS channel.

Note: Enable "download" for the SIM-card, and set the session timeout not less than 10 seconds.

There are following responses at attempt to update the device software:
«BOOT: UPDATE DOWNLOAD OK» - successful update;
«BOOT: WAITE ERROR» – exceeded timeout at downloading software update;
«BOOT: HOST CONNECT ERROR» – failure to connect to SW server;
«BOOT: PAGE LOAD ERROR» – failure to load the file;
«BOOT: UPDATE DOWNLOAD ERROR» – failure to update the file.

Set the mode of operation of digital inputs Out 1 and Out 2.
Command to be send - *setdigout ##;*
Example of command for the activation of the output Out 1: *setdigout 10;*
Example of command for the activation of the output Out 2: *setdigout 01;*

The first digit in the command is Out 1 output state, the second digit is Out 2 output state.
When it is necessary to activate the output, set the output value must to "1". When it is necessary to deactivate the output, set the value to "0".

Activate/deactivate the safety locking of ignition.
Command to activate safe locking – *ignitionon;*
Command to deactivate safe locking – *ignitionoff;*

In case of activation of secure locking the discrete output Out 1 will be activated if the speed according to GPS is less than 5 km/h.

Examples of response:
«Set RQS To Ignition On» - ignition switch on;
«Set RQS To Ignition Off» - ignition switch off;

Basic configuration

After installing the SIM-card of the mobile operator and connection of the power supply, the device shall be configured to transmit data to the server.

All adjustable parameters of the device are divided into groups:

- Server and GPRS.
- Tracking.
- Security.
- Service.
- Voice communication.
- Roaming.

Setting required for basic operation of the device include data transmission and tracking. They are grouped in "Server and GPRS" and "Tracking". After setting up the necessary parameters the device will transmit data about its current location to the server.

All parameters available for configuration are specified in Appendix 1.

Security settings

To meet the safety conditions, access to the configuration of the device can be limited.

At connection your device to the PC using USB-UART converter, every time you send a command, the device requires the access password. Standard access code is 11111. Lifetime of password is 60 seconds. After this timeout the password shall be re-entered. Access password can be changed by the user (ID 0910, see Appendix 1).

Format of sending a standard password to the device is *TPASS: 11111;*

Examples of response:

«TASK COM TERM: PASSWORD OK» – correct password is entered;
«TASK COM TERM: INCORRECT PASSWORD» – incorrect password is entered;

When sending commands via SMS, set the login and password of SMS access. To set the login use ID 0252 parameter, to set the password use ID 0253.

To set the login and password, any SMS command shall have the following structure to be sent:

<Login><Password><Command1>;<Command2>;<Command3>;

Example of the command to be sent: *abcd 1234 getgps; getstatus;*

In addition to the login and password, use the authorized phone numbers. To record the telephone numbers in the memory device use the parameters ID 0261 - ID 0269 (Appendix 1). Total up to 8 phone numbers can be applied. When using this function, the device will respond to SMS from the stored in the memory authorized phone numbers only.

If the login and password are set by SMS, they shall be specified in each SMS with commands.

Adjustment of I/O elements

The tracking device "BI 530R TREK" is able to collect, process and send to the server the data received from various sensors. Each sensor is an I/O element and has a group consisting of 6 parameters for setting. For example, to set the value of power supply voltage level to the server, use group of parameters of ID 0410/0411/0412/0413/0414/0415. These options have the following structure:

0410/0411/0412/0413/0414/0415

First 3 numbers (green) refer to parameter group number to configure the I/O element.

Last number (grey) is a parameter number. 6 parameters (from 0 to 5) are available for a single I/O element. Possible values of these parameters are presented in Table 5.

Table 5 - List of parameters of I/O elements

Parameter number	Description	Possible values
0	Enable/disable I/O element	0 - disabled; 1 - enabled
1	Priority of I/O element at transmission	0 - low; 1 - high
2	Upper limit	(depending on the type of I/O element)
3	Lower limit	(depending on the type of I/O element)
4	Setting of the type of the generated event	0 - entering the range; 1 - leaving the range; 2 - returning/leaving to/of the range; 3 - monitoring;

		4 - monitoring + entering the range; 5 - monitoring + leaving the range; 6 - monitoring + return to/leaving the range; 7 - generation of the event to change the input value to a predetermined value; 8 - generation of the event to change the input value to a predetermined value + monitoring
5	Averaging constant	From 0 and higher

Notes to Table 5:

Parameter 0 - on/off of transmission of I/O element to the server.

Parameter 1 - Priority: low/high. While selecting "Priority: low" - data of the sensor will be sent to the server with the following data packet. While selecting "Priority: high" data of the sensor will be sent to the server at the earliest possible opportunity.

Parameter 2 - Upper limit - set the upper limit of the I/O element.

Parameter 3 - Lower limit - set the lower limit of the I/O element.

Parameter 4 - Set the type of the generated event:

0 - Returning to the range.

At a specific range of sensor values (range of values is specified as follows - lower limit of the range is recorded to the corresponding parameter - "Lower limit", upper limit of the range is recorded to the corresponding parameter "Upper limit"), the event will be generated when the actual value of the sensor gets within the specified range. In other cases, the event will not be created and the information will not be sent to the server.

Example: The lower voltage limit is set to 0, the upper limit is set to 10 V (10 000 mV). Lowering the voltage below 10 V will generate the event (see Figure 5).

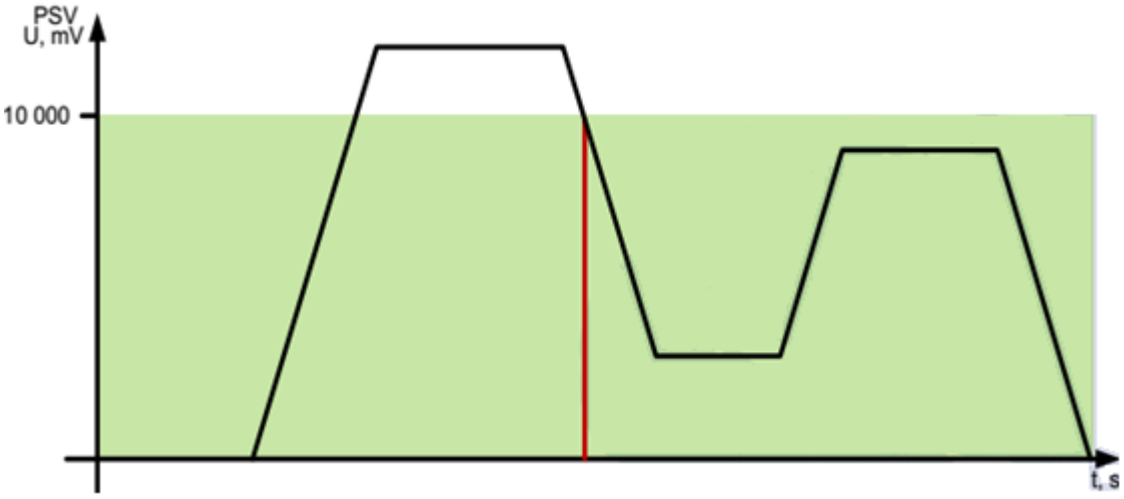

Figure 5 - Generation of event by returning to the range.

1 - Leaving the range.
The event will be generated if the actual sensor value is outside the predetermined range.

Example: The lower voltage limit is set to 0, the upper limit is set to 10 V (10 000 mV). Rising of the voltage above 10 V will generate the event (see Figure 6).

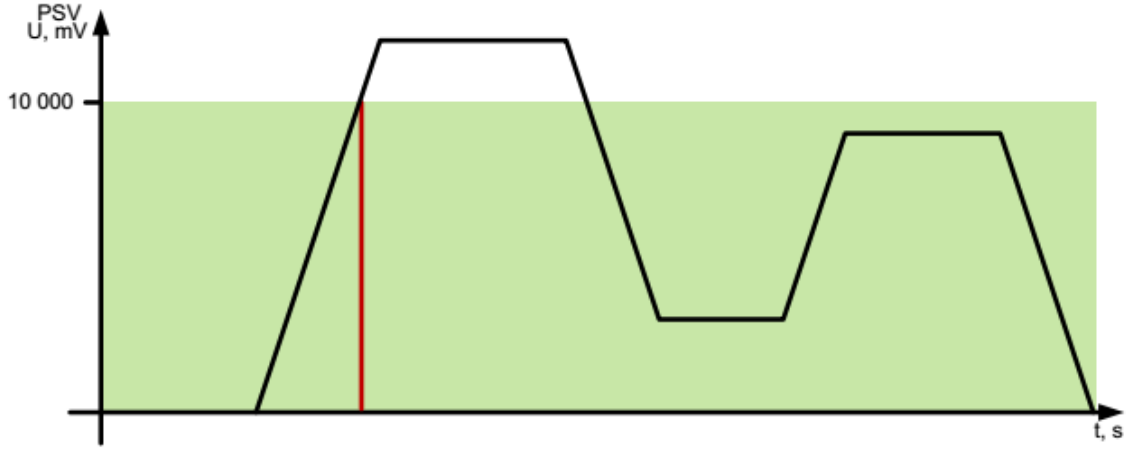

Figure 6 - Generation of event by leaving the range.

2 - Returning/leaving to/of the range.
Event is generated every time when the actual value of the sensor is out of the limits of the predetermined range.

Example: The lower voltage limit is set to 5 V (5 000 mV), the upper limit is set to 10 V (10 000 mV). When the actual voltage crosses limits of the specified range, then event is generated (see Figure 7).

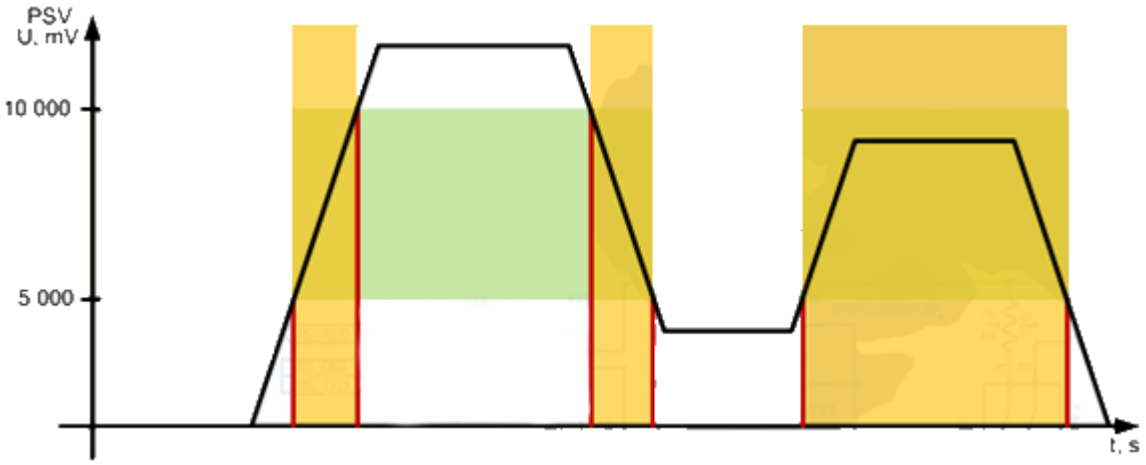

Figure 7 - Generation of event by returning/leaving to/of the range.

3 - Monitoring.
When this mode is selected, data will be transmitted continuously, the events will not be generated.

4 - Monitoring + entering the range.
When there is generated the event after entering the range, the actual value of the sensor starts to be transmitted to the server in the monitoring mode.

5 - Monitoring + leaving the range.
When there is generated the event after leaving the range, the actual value of the sensor starts to be transmitted to the server in the monitoring mode.

6 - Monitoring + returning/leaving to/of the range.
When one of the events is generated, the actual value of the sensor starts to be transmitted to the server.

7 - Change of the input value to a predetermined value.
Changing of the input value to the predetermined value in either direction will cause the event generation. The value is recorded to the parameter "Upper limit".

8 - Monitoring + change of the input value to a predetermined value.
When the event is generated, the actual value of the sensor starts to be transmitted to the server.

Parameter 5 - Averaging constant.

It is time required for I/O to be in a certain state in order to generate an event. It is measured in milliseconds (X*50 ms, i.e., while setting 10, the constant will be equal to 10*50=500 ms).

List of all I/O components of the device, available for configuration, is provided Appendix 2.

Notifications

Device can be configured to perform an outgoing voice call at occurrence of certain conditions.
Such a condition is a triggering of predetermined I/O element. Voice calls shall be enabled in the general settings of the device. I/O element shall be enabled, configured for one of the events (entry to the range, exit out of the range, entry/exit in/out of the range), its ID shall be defined as a trigger of outgoing call; Phone0 authorized phone number shall be defined.

An additional condition includes finding of the device in the coverage area of GSM-operator and sufficient funds in the account. At the absence of coverage the pursuant outgoing call will be postponed until the moment when the device gets into the coverage area. The device performs one attempt to make a voice call, per each trigger.

Setting to configure alerts are provided in the "Security" section in Appendix 1. Authorized phone number Phone0 is recorded in the parameter ID 0261.

In addition to a voice call, the device can send SMS to the authorized phone number when the events occur. ID of I/O element,
which is used to send SMS, shall be defined as a trigger for outgoing SMS messages. In addition to the SMS message you can add customized text, where the text length shall not exceed 30 characters in the Latin alphabet.

Roaming options

The tracking device "BI 530R TREK" is able to operate in two modes: in the home network mode and in the operating mode with a predetermined list of authorized operators. Operation mode is set with ID 0917 parameter.

In the home network mode (ID 0917 = 0), the device makes attempts to register in a home network of installed SIM-card. List of authorized operators is not used.

Operating with a predetermined list of operators (ID 0917 = 1), the device checks the list of approved operators.
If the list is empty, the device acts like in a mode of operation in a home network. If the list is not empty, the device scans for available networks. If there are any networks, included in the list of authorized ones, the device makes an attempt to register in one of the authorized networks. After successful registration, the device will be connected to the selected network until it is available. At the loss of network signal the process will be repeated. If the device does not detect the allowed networks enabled in the list, or it is not able to register within the network, device module will go to sleep mode within a certain timeout, after which the process will be repeated.

Configuring the device to work with the RFID reader by RCS SOVA protocol on RS-485 bus

"BI 530R TREK" tracking device enables work with RFID reader using RCS SOVA protocol via RS-485 bus.
By default, the device is programmed to poll RFID reader at the 9th address. To correctly configure the reader, please first familiarize with the device technical documentation.

To transfer the number of approached card to the server, configure I/O element of RFID Ekey (see Appendix 2), and set for RFID Ena parameter (ID 0915, see Appendix 1) value 10.

In addition to the transmission of card number, there is an ability to manage the discrete outputs Out 1 and Out 2 depending on the approached cards. For this purpose, the device has the ability to store in the nonvolatile memory up to 20 card numbers. If the number of the approached card coincides with the number of one of the cards stored in the memory, the device activates one of the discrete outputs. Selection of specific discrete output to be activated depends on the value of ID 0915 parameter.

ID 0920 – 0939 are used for the storage of valid card numbers (Appendix 1).

Line with electronic card value shall contain exactly 10 characters - numbers 0-9 or uppercase A-F. Each pair of symbols encodes one byte in ASCII representation. The lowest byte of the electronic card is recorded first, and so on in ascending order. In the pair of characters, the first character is the senior, the second is the younger half-byte.

Sample of setting:

At approaching RFID-card the device transfers its number (ID 157 at the transmission) to the server - 8597874069. Then we convert this number into the HEX and get 200792595.

Further record the card number into the memory of the device from the high-order byte to the low-order byte. The command will be as follows:

setparam 0920 9525790002;

Configuring the device for working with fuel level sensors by RS-485

"BI 530R TREK" tracking device enables work with fuel level sensors via RS-485. Up to four fuel level sensors can be connected in total.

To work with fuel level sensors, enable in the device settings the corresponding I/O element (see Appendix 2). In this case the fuel level sensors shall be preset. Information on configuration of fuel level sensors can be found in sensor relevant documentation.

The tracking device is able to transmit unprocessed ("raw") data from level sensors, as well as data processed by Kalman software filter.

Filtered and unfiltered values are passed by different I/O elements (see Appendix 2).

In addition, if fuel level sensors are equipped with a built-in temperature sensor, it is possible to obtain these data and transfer them to the server (see Appendix 2).

Appendix 1 - Device parameters

Name of parameter	ID at configuration	Grade of parameter	Parameter purpose	Measurement unit	Default value
Server and GPRS					
ipsHost0	0245	string	IP or DNS of primary server	-	31.28.163.20
ipsPort0	0246	2 byte	PORT of primary server	-	20127
ipsPass	0211	string	Password IPS of primary server	-	1111
ipsHost1	0188	string	IP address of backup server	-	31.28.163.20
ipsPort1	0189	2 byte	PORT of backup server	-	20127
ConfServEna	0908	1 byte	Operation with the configuration server (0 - disabled, 1 - enabled)	-	1
settingsHost	0220	string	IP or DNS of WEB configuration server	-	configurator.bitrek.com.ua
settingsPort	0221	2 byte	PORT of WEB configuration server	-	55755
settingsTimeOut	0222	2 byte	Period of connection to WEB configuration server	second	900
settingsPass	0223	string	Access password to WEB configuration server	-	11111
APN	0242	string	Access point of GPRS	-	gps.utel.ua
Usname	0243	string	Access login of GPRS	-	none
Uspass	0244	string	Access password of GPRS	-	none
Connect Try Amount	0904	1 byte	Number of attempts in the series of connection to the server	pcs	3
Name of parameter	**ID at configuration**	**Grade of parameter**	**Parameter purpose**	**Measurement unit**	**Default value**

Connect Try Interval	0905	2 byte	Waiting period between the attempts in the series	second	60
Connect Serial Interval	906	2 byte	Period to wait between attempts series	second	300
Switching Host 2 Port 2	196	1 byte	Permission to use backup server	-	0
ProtokolType	241	1 byte	Type of data transfer protocol to the server (0 - Teltonika; 1 - IPS)	-	0
Tracking					
Enable Time Period	0900	1 byte	Permission to record by time	-	1
Enable Dist Period	901	1 byte	Permission to record by distance	-	1
Enable Angle Period	902	1 byte	Permission to record by azimuth	-	1
Day Period	903	2 byte	Period of readout by time at ignition on	second	30
Night Period	0011	2 byte	Period of readout by time at ignition off	second	30
Dist Period	0012	2 byte	Period of readout by distance	m	500
Angle Period	0013	2 byte	Period of readout by azimuth	degree	10
Send Period	0270	2 byte	Period of data transfer to the server	second	35
Record Amount	0232	1 byte	Number of entries in the package	pcs	0
Name of parameter	**ID at configuration**	**Grade of parameter**	**Parameter purpose**	**Measurement unit**	**Default value**

Send Amount Del	0356	1 byte	Number of attempts to send data to the server before deletion	pcs	3
Send Confirm Time	0357	1 byte	Time to wait for a response from the server	second	60
Delta X	0281	1 byte	Angle of deviation of the accelerometer by X axis	degree	3
Delta Y	0282	1 byte	Angle of deviation of the accelerometer by Y axis	degree	3
Delta Z	0283	1 byte	Angle of deviation of the accelerometer by Z axis	degree	3
Start Move Timeout	0284	2 byte	Timeout of movement start according to the accelerometer	0.1 * sec	50
Stop Move Timeout	0285	2 byte	Timeout of movement stop according to the accelerometer	0.1 * sec	200
Min_GPS_Speed	0918	1 byte	Minimum GPS speed for motion detection	km/hour	5
Axel Sleep Enable	0911	1 byte	Sleep mode by accelerometer (0 - disabled; 1 - enabled)	-	0
Wait_sleep_ timeout	4007	2 byte	Timeout to go to sleep mode by accelerometer	min	15
Sleep timeout	4008	2 byte	Timeout of sleep mode by accelerometer	min	720
GNSS_select	4016	1 byte	Selection of positioning system	-	3
Name of parameter	**ID at configuration**	**Grade of parameter**	**Parameter purpose**	**Measurement unit**	**Default value**

Security					
Phone0	0261	string	Authorized telephone number 0	-	-
Phone1	0262	string	Authorized telephone number 1	-	-
Phone2	0263	string	Authorized telephone number 2	-	-
Phone3	0264	string	Authorized telephone number 3	-	-
Phone4	0265	string	Authorized telephone number 4	-	-
Phone5	0266	string	Authorized telephone number 5	-	-
Phone6	0267	string	Authorized telephone number 6	-	-
Phone7	0268	string	Authorized telephone number 7	-	-
Phone8	0269	string	Authorized telephone number 8	-	-
SMS Login	0252	string	Access login by SMS	-	-
SMS Password	0253	string	Access password by SMS	-	-
Device_PIN	0910	string	Access password to the device	-	11111
SIM_PIN	0818	1 byte	Installation of PIN-code of SIM-card operator	-	-
Name of parameter	**ID at configuration**	**Grade of parameter**	**Parameter purpose**	**Measurement unit**	**Default value**

Jamming					
Jamming Level	0806	1 byte	Level of detection of jamming event	c.u.	80
JammingEna	0807	1 byte	Permission to send SMS about jamming (0 - disabled, 1 - enabled)	-	0
Service					
Reboot Per	0186	1 byte	Period of the regular reboot of the device	hour	24
Reboot Type	0187	1 byte	Type of device reboot (0 - complex; 1 - modem only)	-	0
ErrSatNum	0992	1 byte	Authorization to set the number of satellites at the loss of GPS signal	pcs	0
ringNum	0912	1 byte	Number of rings before automatic response (to check the SIM-card)	pcs	3
Notification					
RingEnable	0913	1 byte	Authorization of outgoing voice calls	-	0
OutCallTrigger	0914	2 byte	ID of I/O element - trigger of an outgoing voice call	-	-
Name of parameter	**ID at configuration**	**Grade of parameter**	**Parameter purpose**	**Measurement unit**	**Default value**

SMSTrigger	0816	2 byte	ID of I/O element - trigger to send an SMS to authorized phone number when the events occur	-	-
SMSText	0817	string	Text added to the SMS (no more than 30 characters in the Latin alphabet)	-	-
Roaming					
Operator selection	0917	1 byte	Operator selection mode	-	0
UsipTable	0020...0059	string	List of codes of authorized operators	-	-
UsAPNTable	0060...0099	string	List of APN of authorized operators	-	-
UsLoginTable	0100...0139	string	List of GPRS logins of authorized operators	-	-
UsPassTable	0140...0179	string	List of GPRS passwords of authorized operators	-	-

Name of parameter	ID at configuration	Grade of parameter	Parameter purpose	Measurement unit	Default value
Parameters for I/O elements setting					
RFID Ena	0915	1 byte	Service authorization RFID reader via RCS SOVA protocol by RS-485 bus at 9 network address and control of digital outputs (10 - monitoring, without control; 13 - Out 1; 14 - Out 2)	-	0
Ekey_num	0920…0939	8 byte	ID of allowed RFID-cards	-	-
MinDuration	0349	1 byte	Filter of discrete inputs (Duration less than the predetermined levels will be filtered)	10 msec	5

IgnInput	5006	string	Software switching of the ignition between the discrete inputs (1 - DAThigh 1, 2- DAThigh 2)	-	1
Name of parameter	**ID at configuration**	**Grade of parameter**	**Parameter purpose**	**Measurement unit**	**Default value**
AIN1	0957	2 byte	Kalman rate for the analog input No. 1 filtering (1 - off; filtration range is 2 - 65535)	c.u.	19
AIN2	0958	2 byte	Kalman rate for the analog input No. 2 filtering (1 - off; filtration range is 2 - 65535)	c.u.	19
ValidFuelLevel	0819	1 byte	Permission to use the last valid level of fuel level	-	0
Polling_period_fuel	0197	1 byte	Polling period for 4 fuel level sensors	100 ms	100
Factor F	0950	4 byte	F coefficient for Kalman filter	c.u.	1000000
Factor Q	0951	4 byte	Q coefficient for Kalman filter	c.u.	1000000
Factor H	0952	4 byte	H coefficient for Kalman filter	c.u.	1000000
Factor Rs	0953	4 byte	R coefficient for Kalman filter at motion absence	c.u.	20000000
Factor Rm	0954	4 byte	R coefficient for Kalman filter at motion	c.u.	400000000

Appendix 2 - List of I/O elements

No.	Name of parameter	ID at transmission	ID at configuration	Purpose
1	PSV	66	0410/0411/0412/0413/0414/0415	Power supply voltage
2	VBAT	67	0420/0421/0422/0423/0424/0425	Battery power
3	PCB_Temp	70	0440/0441/0442/0443/0444/0445	Device temperature
4	GPSSpeed	24	0490/0491/0492/0493/0494/0495	Speed by GPS
5	Movement	240	0510/0511/0512/0513/0514/0515	State of motion
6	realOdometr	199	0500/0501/0502/0503/0504/0505	Relative odometer
7	Odometr	200	0710/0711/0712/0713/0714/0715	Absolute odometer
8	GPSPower	69	0450/0451/0452/0453/0454/0455	Availability of GPS-signal
9	GSMCSQ	21	0470/0471/0472/0473/0474/0475	Level of GSM signal
10	OperCode	111	0680/0681/0682/0683/0684/0685	Operator code
11	ModemStat	117	0750/0751/0752/0753/0754/0755	Modem status
12	GSM Stat	118	0760/0761/0762/0763/0764/0765	Registration status in the GSM network
13	GPRS net stat	119	0770/0771/0772/0773/0774/0775	Registration status in the GPRS network
14	GPRS content stat	120	0780/0781/0782/0783/0784/0785	Activation status of GPRS content
15	SIM stat	121	0790/0791/0792/0793/0794/0795	Transfer of SIM-card status
16	dLow	1	0340/0341/0342/0343/0344/0345	Discrete input with active "0"
17	dHigh1	5	0540/0541/0542/0543/0544/0545	Discrete input with active "1" No. 1
18	dHigh2	6	0550/0551/0552/0553/0554/0555	Discrete input with active "1" No. 2
19	AIN 1	9	0300/0301/0302/0303/0304/0305	Analog input No. 1
20	AIN 2	10	0310/0311/0312/0313/0314/0315	Analog input No. 2
21	Jamming	141	0940/0941/0942/0943/0944/0945	Status of GSM signal jamming
22	axesX	114	0720/0721/0722/0723/0724/0725	Value of acceleration by X axis
23	axesY	115	0730/0731/0732/0733/0734/0735	Value of acceleration by Y axis
24	axesZ	116	0740/0741/0742/0743/0744/0745	Value of acceleration by Z axis
25	fuelLevel1	100	0580/0581/0582/0583/0584/0585	Polling of filtered fuel level sensor (1 network address)

No.	**Name of parameter**	**ID at transmission**	**ID at configuration**	**Purpose**
26	fuelLevel2	101	0590/0591/0592/0593/0594/0595	Polling of filtered fuel level sensor (2 network address)
27	fuelLevel5	129	0850/0851/0852/0853/0854/0855	Polling of filtered fuel level sensor (5 network address)
28	fuelLevel6	130	0860/0861/0862/0863/0864/0865	Polling of filtered fuel level sensor (6 network address)
29	fuelLevelUnfilt1	112	0690/0691/0692/0693/0694/0695	Polling of unfiltered fuel level sensor (1 network address)
30	fuelLevelUnfilt2	113	0700/0701/0702/0703/0704/0705	Polling of unfiltered fuel level sensor (2 network address)
31	fuelLevelUnfilt5	131	0870/0871/0872/0873/0874/0875	Polling of unfiltered fuel level sensor (5 network address)
32	fuelLevelUnfilt6	132	0880/0881/0882/0883/0884/0885	Polling of unfiltered fuel level sensor (6 network address)
33	fuelTemp1	102	0600/0601/0602/0603/0604/0605	Fuel temperature per fuel level sensor (1 network address)
34	fuelTemp2	103	0610/0611/0612/0613/0614/0615	Fuel temperature per fuel level sensor (2 network address)
35	fuelTemp5	127	0520/0521/0522/0523/0524/0525	Fuel temperature per fuel level sensor (5 network address)
36	fuelTemp6	128	0530/0531/0532/0533/0534/0535	Fuel temperature per fuel level sensor (6 network address)
37	AccelerationUp	44	0960/0961/0962/0963/0964/0965	Value of acceleration of motion
38	AccelerationDown	45	0970/0971/0972/0973/0974/0975	Value of acceleration of braking
39	FrqVal	25	0830/0831/0832/0833/0834/0835	Frequency value of dl_Low discrete input
40	fuelCounter	136	0180/0181/0182/0183/0184/0185	dl_Low pulse counter
41	HDOP	122	0800/0801/0802/0803/0804/0805	Reduced accuracy in the horizontal plane
42	RFID Ekey	157	3800/3801/3802/3803/3804/3805	ID of approached RFID-card

No.	**Name of parameter**	**ID at transmission**	**ID at configuration**	**Purpose**
43	iMCC	mcc	4010/4011/4012/4013/4014/4015	Positioning by base stations*
44	iMNC	mnc	4020/4021/4022/4023/4024/4025	Positioning by base stations*
45	iLAC	lac	4030/4031/4032/4033/4034/4035	Positioning by base stations*
46	iCellID	cell_id	4040/4041/4042/4043/4044/4045	Positioning by base stations*
47	Rx_level	rx_level	4050/4051/4052/4053/4054/4055	Positioning by base stations*
48	Socket_stat	177	5020/5021/5022/5023/5024/5025	Status of server connection socket

**Note:*
Function to determine the location by the base stations is available only when devices operates according by IPS protocol.

Document version

Date	Document version	Note
1/19/2018	Ver 0.1	Basic document