Galileosky lite terminals User's Manual

firmware 0229

Quality

Reliability

Simplicity

Galileosky

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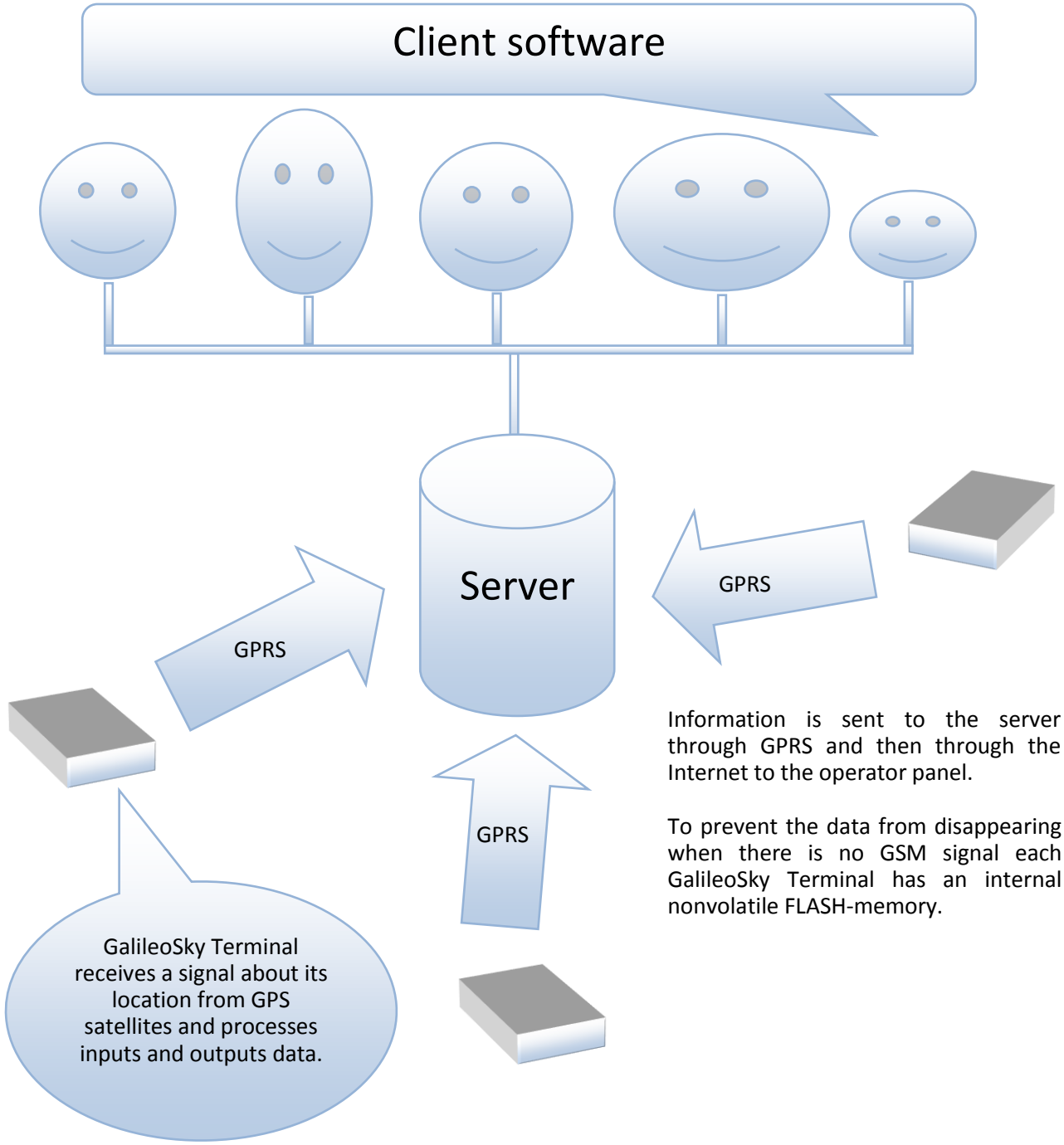
Introduction

GalileoSky Ltd. produces GALILEOSKY terminals for GLONASS/GPS real time vehicles monitoring. The Terminals determine the mobile object location recording the time and route as points with geographical coordinates and send the data to the server to be further processed and sent to the traffic controller panel. In addition, a number of other vehicle parameters are recorded: the state of analog and discrete inputs of the Terminal.
The Terminals can be used in any vehicle.



Information is sent to the server through GPRS and then through the Internet to the operator panel.

To prevent the data from disappearing when there is no GSM signal each GalileoSky Terminal has an internal nonvolatile FLASH-memory.

The terminal provides the following opportunities:

- ✓ Vehicles monitoring in real time;
- ✓ A detailed turn by turn track (without any extra points in a straight track);
- ✓ GSM enabled remote Terminal`s software update;
- ✓ Continuous troubleshooting of the Terminal through the USB port;
- ✓ Remote engine start;
- ✓ Adjusting the Terminal through SMS, GPRS, USB;
- ✓ And others (see sections Terminal units performance and Connecting external peripheral).

The information sent by the terminal includes:

- ✓ The exact Greenwich time and date;
- ✓ Vehicle coordinates: latitude, longitude, height;
- ✓ Vehicles speed and direction;
- ✓ Vehicle acceleration;
- ✓ Inside temperature;
- ✓ Inputs (buttons) and analog sensors state;
- ✓ Discrete output state;
- ✓ And etc.

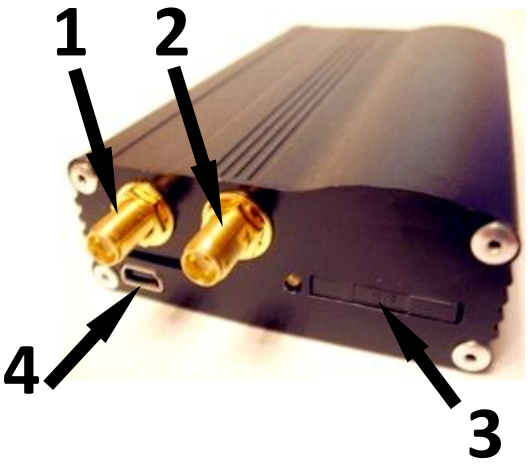
In addition, the company provides warranty service and technical support on its site and forum.

Before starting the work study the instruction carefully.

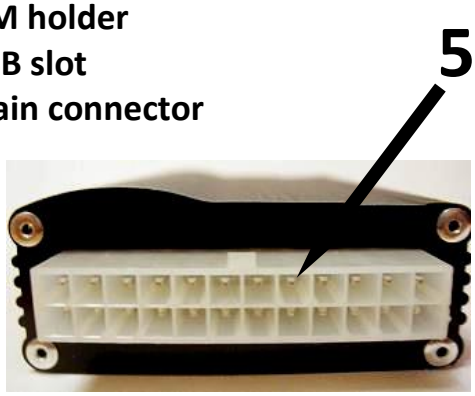
1 Package

The standard package includes the GALILEOSKY terminal (hereinafter referred to as the Terminal) and a pin connector with 10 contacts. Everything extra should be bought separately.

The device appearance:



1. GSM aerial socket
2. GPS aerial socket
3. SIM holder
4. USB slot
5. Main connector



The Terminal has 4 LED indicators which show its current status: red (external power supply), yellow (microcontroller), green (GPS receiver), and blue (GSM modem). **See** section **LED indicators.**

You will also need:

1. USB cable	1
2. GPS aerial	1
3. GSM aerial	1

2 Technical specifications

Parameter	*GALILEOSKY v2.3 lite*	*GALILEOSKY v2.4 lite*	*GALILEOSKY v2.5 lite*
External power supply	***9-39 V***	***10-50 V***	
	Protection from spikes into the vehicle`s network		
Analog-discrete and pulse frequency inputs	*4 pcs.* *voltage range- 0-33V;* *Maximum measured frequency - 4kHz;* *Input resistance of each input is 14 kOhm to the ground;*		
Transistor outputs	*3pcs.* *maximum voltage supply 30V;* *maximum current supply 80mA*		
Average power consumption	*0,696 W*		
ADC resolution in bits	*10*		
FLASH memory capacity	up to 58000 points		
Interfaces	*Terminal troubleshooting, adjusting, reflashing*		
CAN	yes		
Speakerphone	no		
The size of a data packet sent by the device	1. *GalileoSky protocol: variable size, tag format* 2. *EGTS (GOST R 54619-2011, the PF Ministry of Transportation order № 285).*		
Accelerometer	*built-in*		
Coordinates determination accuracy, 95% of time, not worse	*5 m*		
GSM modem	*GSM 900/1800, GPRS class 10*		
Moisture protection	*no*		

3 Physical specifications

Operating temperature range	*-40...+85 °C*
Storage temperature	*-40...+85 °C*
Relative humidity	*0...90% (0...35 °C); 0...70% (35...55 °C)*
Performance (height above the sea level)	*0-2000 m*
Storage	*0-10000 m*
Dimensions	103,0 mm x 65,0 mm x 28,0 mm v2.5 Lite - 103,0 mm x 72,0 mm x 27,0 mm
Weight	*within 300g*
Body material	*Metal*

Warranty	*2 years since the purchase date;*
Average service life	*10 years*

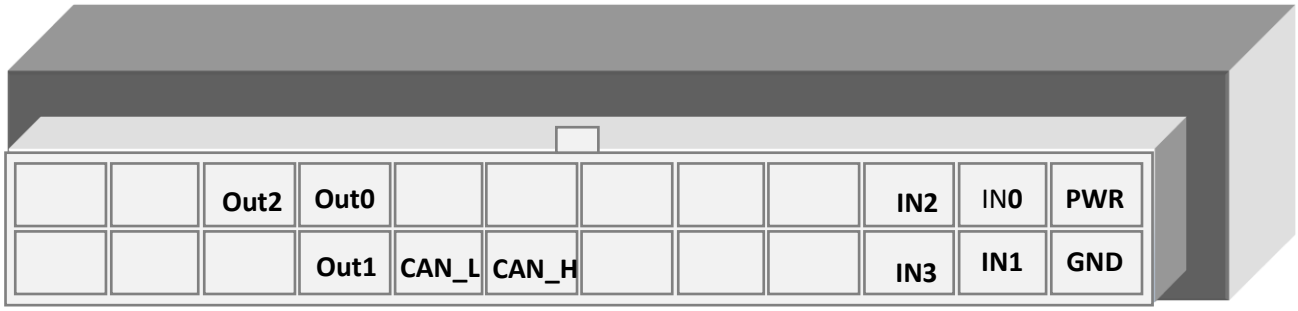
4 Safe operating rules

Before using the Terminal study the instructions of GSM/GPRS devices safe operating.
Make sure the polarity is correct when connecting the Terminal to the power supply.
The device should be connected straight to the vehicle battery, not to the vehicle power supply.
Caution! To avoid failure:

- **Make sure the contacts are connected correctly!**
- **Unused contacts must be well insulated!**

The Terminal`s ground is connected to the device body. In order not to damage the Terminal or the vehicle's electronics, it is necessary to separate the device body and the vehicle.

5 Contacts description



Contact	Description
PWR	Positive supply voltage
GND	Negative supply voltage
IN0	Zero analog-discrete input
IN1	First analog-discrete input
IN2	Second analog-discrete input (**only for GALILEOSKY v2.3 lite**)
IN3	Third analog-discrete input (**only for GALILEOSKY v2.3 lite**)
Out0	Zero transistor output (output 0/1)
Out1	First transistor output (output 0/1) (**only for GALILEOSKY v2.3 lite**)
Out2	Second transistor output (output 0/1) (**only for GALILEOSKY v2.3 lite**)
CAN_H	CAN_H contact of the CAN interface (**only for GALILEOSKY v2.3 lite**)
CAN_L	CAN_L contact of the CAN interface (**only for GALILEOSKY v2.3 lite**)

6 Connecting

6.1 Connecting GPS aerial

Carefully screw the aerial to the Terminal, the upper side is above. To have a better view of the sky it is recommended that the aerial should be mounted on the vehicle roof, windscreen or under the dashboard.

If GPS aerial is mounted correctly, your coordinates will be found in 1.5 minutes. To be sure see that the green LED indicator is on. (section ***LED indicators)***.

6.2 Connecting GSM aerial

Carefully screw the aerial to the Terminal.
The GSM aerial should be mounted in such a way so as to prevent the GSM signal from fading because of the vehicle body, for example, under the dashboard or outside the vehicle.

To make sure the GPRS modem is sending data see that the blue LED indicator is on. (section ***LED indicators)***.

6.3 Inserting SIM-card

Use the SIM-card with activated GPRS and SMS services.
Insert the card carefully ***without applying excessive force***.

1) To eject the SIM-card holder press the indicated place with something sharp (needle, toothpick);

2) Insert the SIM-card so that it is completely hidden in the holder cover.

6.4 Connecting power supply to the device

Positive supply voltage should be connected to PWR contact, negative supply voltage should be connected to GND. (section ***Contacts description).*** If the connection is correct, the red LED will be on.

6.5 LED indicators

- **Red LED**

Is on when the power unit is connected to the Terminal.

- **Yellow LED**

Is on when the microcontroller is running (blinks with the frequency of 1 Hz).
It is also used to indicate the bootloader mode. (section **LED indicators during the Terminal reflashing)**

- **Green LED**

Shows the GPS unit status.

Blinking frequency, times	Description
3	GPS unit is not found or is at the initialization stage
2	GPS unit is found but correct coordinates are absent
1	GPS unit works properly, coordinates are found and updated once a second

- **Blue LED**

Shows the GSM unit status.

Blinking frequency, times	Description
4	Stels mode (GSM unit is off and is set to be on according to schedule)
3	GSM unit is not found or is at the initialization stage
2	GSM unit is found but there is no server connection
1	GSM unit works properly, server is connected

7 Terminal units performance

7.1 Discrete-analog inputs (DAI)

To attach external sensors the terminal has 2 discrete-analog inputs which are pulse-frequency at the same time. Each input's function is set in Terminal settings (section Inputs/outputs). In Contacts description inputs are designated as IN0, IN1, IN2, IN3.
Each input saves its values to the nonvolatile memory, i.e. in case the channel is set to be a pulse one, the pulse number value will be restored after resetting the device.

Feature	**Value**
Maximum measured voltage	33 V
Analog inputs resolution	33 mV
Maximum transmitted signal frequency	4 kHz (synchronous measuring on one input) 3,5 kHz (synchronous measuring on two inputs) 1,5 kHz (measuring on four inputs)

DAI have the following settings:

Parameter	***Explanation***
Filter type (input function)	0 – arithmetical average (also discrete input state is generated); 1 - pulse count; 2 - frequency input; 3 - pulse count from two synchronous connected sensors.
Filter length to calculate the mean value	The greater this parameter, the more slowly the device responds to the input signal change. With filter length equal to 1 - averaging does not happen. Set this parameter to 1 for frequency inputs. It is necessary to set this parameter to 1 for pulse inputs. If the terminal counts extra pulses, the filter length should be increased by one and accuracy estimated.
Ranges for response / nonresponse areas (logical 1 and 0)	To process discrete signals, discrete signal response/nonresponse range should be set where signals equal to one and zero. Discrete input statuses should be seen in the Status of Inputs field, but not in the Input voltage fields. (Table 2. GalileoSky protocol tags). While counting pulses or frequency it is necessary to put the value equal to half the pulse value into all the fields of the given group. (Example: the pulses' amplitude is 5000 mV, so all the fields must take the value 2500 mV). While counting pulses from 2 synchronously connected sensors, response zone limits must be the same and equal to half of pulse value at response of one of the sensors. Non-response zone limits are equal to half of pulse value at two sensors simultaneous response.

7.1.1 Pulse count

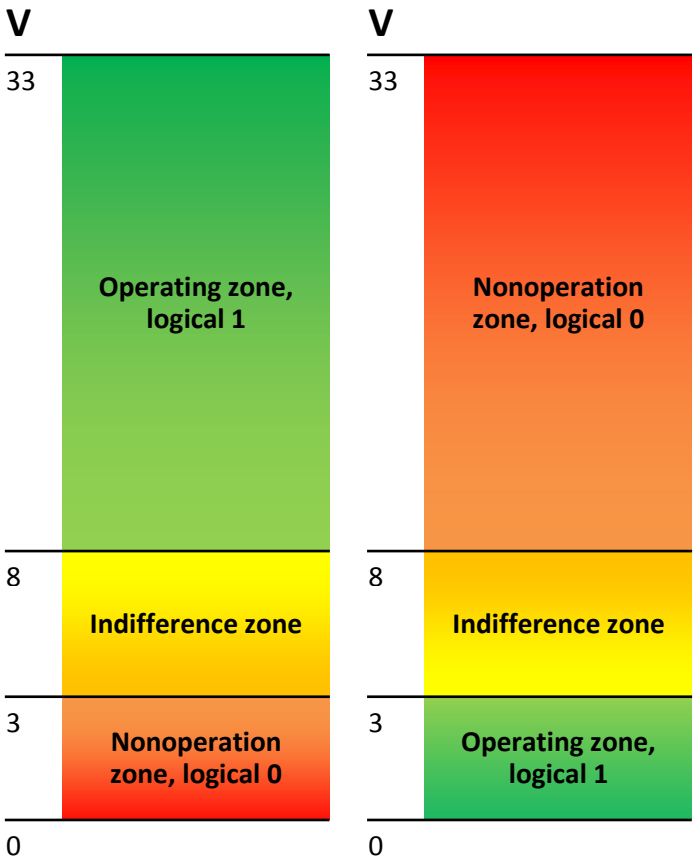
In case of a renewable counter, the maximum pulse number can be 65535, after that the number is reset to zero.
If there is pulse on input, correspondent bit will be set in the Status of Inputs field, and point will be recorded. If there is no another pulse for 30 seconds, the bit returns to 0.

7.1.2 Mean value and discrete event generation

Let us consider the example with the following zero input setting (see the left-hand figure**):**

Filter type is 0;
Filter length is 5;
Logical one zone range is 8-33V;
Logical zero zone range is 0-3V.

The mean value is calculated continuously and is put into the corresponding field IN0.
At the same time, it is continuously checked whether the calculated value belongs to the given range.
If it is in the range 8-33V, the corresponding bit will find itself in the Status of Inputs field and point will be recorded.
By value coming into the indifference zone (3V-8V), the former bit value will be saved to the Status of Inputs field.
If the value is in the logical zero zone (0V-3V), the corresponding bit in the Status of Inputs field will be reset to zero.
Thus, we can see that the given bit changes its state only in the logical one/logical zero zone.



Example2.
In contrast to example 1 (see the right-hand figure**)**, the logical one zone and the logical zero zone have changed places.
In the same way it is possible to set zones of response and non-response for the Terminal`s power supply voltage (POWINCFG command, section Analog-discrete inputs setting). The state of discrete signal for input can be identified according to the 8th bit of the Status of the device field.

7.1.3 Frequency count

To measure frequency in some sensors it is necessary to connect the sensor frequency output to the sensor positive power supply via a 1kOhm resistor. Otherwise, frequency count is impossible.

7.1.4 Frequency count from two synchronously connected sensors

The Terminal allows connection of 2 pulse sensors on one input, in this case, pulse fronts number is counted, i.e. for each sensor response counter value increases by 2. Connection circuit details are given in section Connection of Ш2 passengers flow registration sensors .

7.2 Determination of strike and incline

All devices can determine the incline and strike.
Accelerometer axis directions:

To determine strike:

1. Install the Terminal so as one of the accelerometer axis looks vertically, it will exclude false detections on road bumps;
2. Turn on strike and incline determination by SHOCK command (section Track parameters setting). For example, if Z axis is vertical: SHOCK 3,90,5,1200.

A strike is acceleration increase of 4g in horizontal plane; the correspondent bit is put in the device state field (Table 3. Explanation of device state field) and strike coordinates are recorded.

To determine incline:

1. Install the Terminal in vehicle;
2. By SHOCK command set maximum allowable incline angle and allowable time of this angle exceeding. For example, a maximum angle is 20º, allowable exceed time is 5 seconds; SHOCK 3,20,5,1200.

By the Terminal homing position change in a vehicle, SHOCK command should be given to adopt the Terminal to a new position.

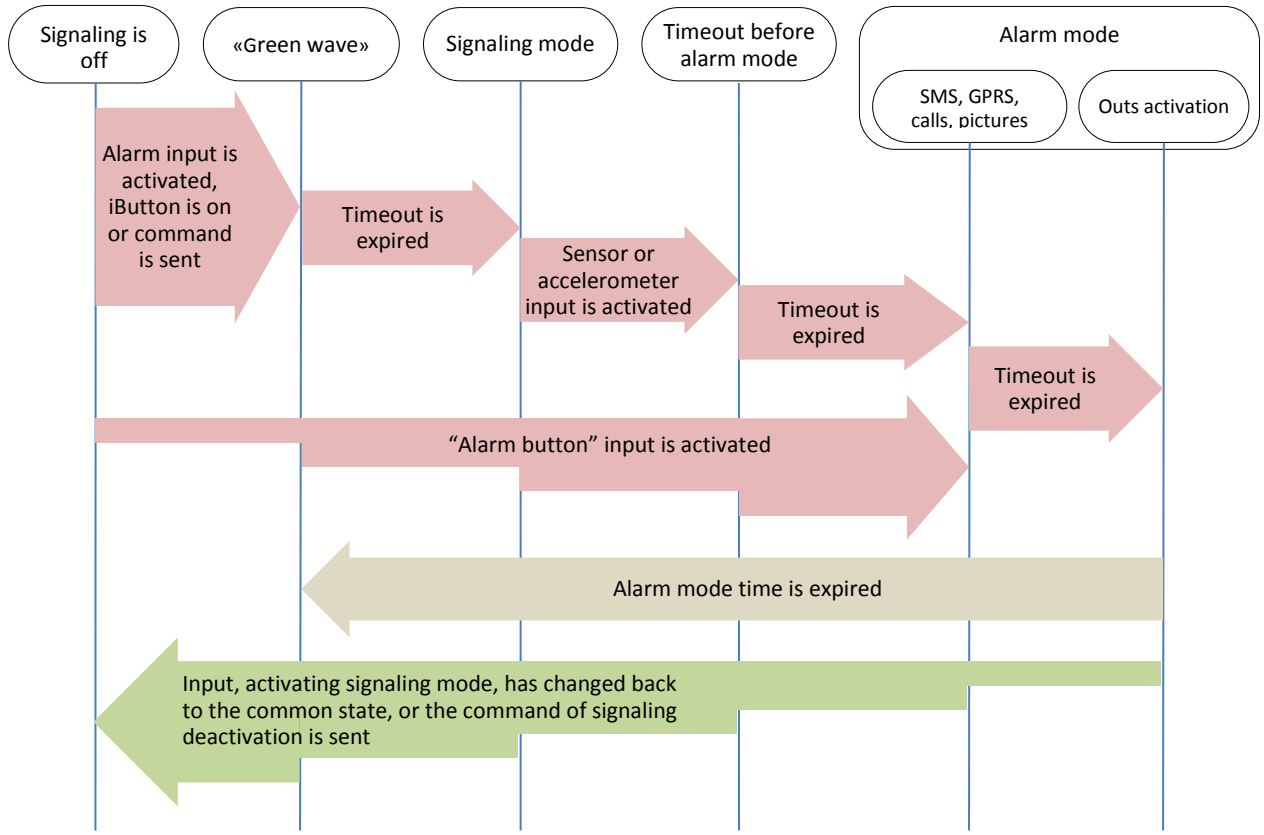
7.3 Signaling function

Signaling function is available for the GALILEOSKY v2.3 lite terminals. It allows assigning the response to:

1. analog input status change;
2. strikes and inclines (accelerometer data);
3. location change;
4. speeding;

The Terminal can react by inverting input status, sending an output pulse, sending SMS, making a preset number(s) telephone call, taking a picture or recording the point.
The settings that users can change are as follows (section Signaling setting):

1. the time when input signals are not processed ("green wave"), with signaling enabled;
2. the maximum time of alert mode, after which the Terminal automatically changes into an alarm system mode;
3. the time between activation and change to the alert mode individual for each input;
4. an SMS text message when changing to the alert mode individual for each input;
5. the time between enabling the alert mode and status change individual for each input.

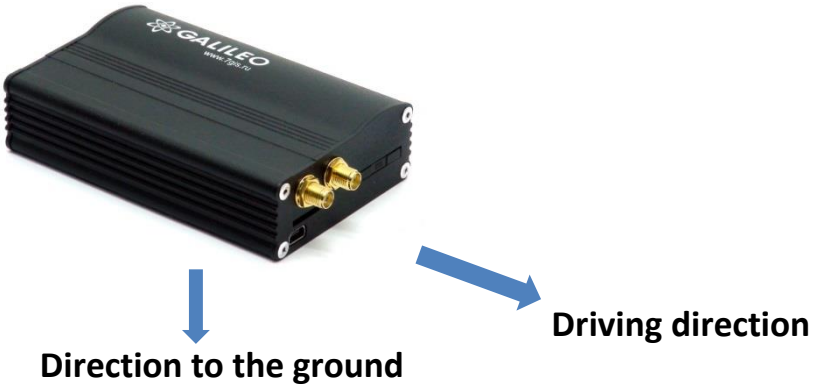


Alarm mode states change diagram

Alarm system activation and deactivation can be made by input, SMS or server message. Commands prevail over inputs states. Input activation depends on the settings given by the InCfg command (section Analog-discrete inputs setting), the level, outputs are inverted with respect to, is set by the Out command (section Analog-discrete inputs setting).

7.4 Economical driving "EcoDrive" and determination of the driving style

The Terminals, equipped with the digital accelerometer, can detect rapid acceleration, braking, harsh turns and strikes on bumps. For correct operation of this function, the terminal must detect its orientation in space with respect to the vehicle (the vehicle´s running direction and the direction in respect to the ground). The driving style data are stored only if dynamic archive is enabled, FLASHARCHIVE 1 command (section Service command).
The default orientation of the terminal:



If the terminal cannot be installed as illustrated by the picture, user-defined installation may be performed with the subsequent calibration of orientation.
To determine the position of the terminal in respect to the vehicle, perform the following steps:

1. Install the Terminal to ensure its rigid link with the vehicle's body;
2. Ensure the horizontal position of the vehicle;
3. Execute the shock 0 command, the Terminal will determine the direction of to the ground;
4. Start driving the vehicle at a speed exceeding 20 km/h; choose straight-line sections of the road while driving and keep performing acceleration and braking; in a few minutes the Terminal will perform determination of the running direction.

Data on the driving style can be sent out using the mainpackbit 174,1 command.

7.5 Monitoring data transmission

Terminal allows specifying the list of preferred GSM-networks. The main priority is given to networks from the beginning of the list. Every network is specified with country's code and operator's code. Terminal supports up to 30 networks (OPS0 and OPS1 commands, section Data transmission settings). If it's impossible to connect to one of the preferred GSM-networks, the Terminal connects to any network but doesn't establish connection to the server, thus voice communication and SMS will be available according to a tariff of the installed SIM-card.
The Terminal allows data transmission to the main and backup monitoring server. If there is only transfer to the main server set, continuous connection will be maintained. If there is transfer to both servers set, the Terminal is connected to the main server and then after the set period of time it breaks the communication and connects to the backup server and etc. The Terminal accounts transmitted data separately for each server, thus both will receive full archive with the track.
Transmitted data may be coded, XTEA3 algorithm (http://tomstdenis.tripod.com/xtea.pdf) is used for coding. Commands and responses to them are not coded.

7.6 *Internal Archive Structure*

The Terminal stores data from all the inputs and interfaces, even when they have no connected sensors, in the internal flash memory archive. If storing all the data is unnecessary, the dynamic archive can be used (FLASHARCHIVE command, section Service commands). In this case, only the data, selected in configuration of the head and main packets, will be saved (HEADPACK and MAINPACK commands, section Server exchange protocol settings). Any change of configuration of the head and main packets when the dynamic archive is on can cause flash memory formatting and data loss. The use of dynamic archive can considerably increase the maximum number of stored points up to 58000.
It is possible to choose the order of points sending to the server. By default, data are sent in the depth of the data store, i.e. current data are saved before older data. Transfer in chronological order can be set by FLASHARCHIVE command. After changing the direction of memorizing data the flash memory is formatted and all previously stored data are lost.
Note that only current data are used for the first packet.

7.7 GPRS traffic costs optimization

GPRS-traffic costs decrease by online monitoring may be reached by following these advices:
1. Turn off the transmission of unused data, for example temperature, acceleration, analog and digital inputs values, which have no connected sensors. It can be made in the Configurator on Settings\Protocol tab or by MainPack and HeadPack commands (section Server exchange protocol settings).
2. Increase points record period. It can be made in the Configurator on Settings\Track tab or by WrPeriod command (section Track parameters settings).
3. Increase turning angle, at which the device records a point, and distance, at exceed of which the point is recorded. It can be made in the Configurator on Settings\Track tab or by Turning command (section Track parameters settings).
4. Find out the time of disconnection due to the Terminal inactiveness from the server software developers. This parameter should be taken into account by point's record period setting, otherwise, the traffic will increase due to costs for restoring connection to the server. Example: point's record period at a stop is 1200 seconds (20 minutes), the server disconnection due to the terminal inactiveness is 180 seconds (3 minutes). The Terminal determines that a vehicle has stopped and switches on a timer for the next point record in 20 minutes, in 3 minutes the server disconnects as it hasn't received data from the Terminal. The Terminal tries to reconnect the server at once. It happens 6 times and only in 20 minutes the Terminal sends the next point. As a result, traffic costs considerably exceed savings from points record interval increase.
5. Set coordination filtering at a stop so as the Terminal can correctly choose point's record period. The Terminal can determine a stop according to several elements:

- accelerometer data (AccSens command, section Track parameters setting);
- external supply voltage (MHours command, section Track parameters setting);
- ignition sensor indications (Ignition command, section Track parameters setting).

If continuous online monitoring is not necessary, it is possible to set packet data transmission (section Stels mode and packet transmission). In this case, the device will periodically communicate, send data from the blackbox and disconnect from the server. Savings due to decrease of costs for one data packet transmission as by data sending from archive packet size may be up to 1000 byte, and by online monitoring usually one point is sent (a few tens of bytes). At the same time, the Terminal operation from the battery increases as during server disconnection periods the device switches off GSM-unit.

7.8 Operation in international roaming

The Terminal allows setting special parameters of data transmission in the international roaming (Roaming command, section Data transmission settings). After registration in GSM-network the Terminal receives code of the country and code of the operator from the base station and compares them with the set ones, if they do not match, the Terminal is in roaming. It is possible to specify only code of country (international roaming) or code of country and code of operator (national roaming). Being in roaming the Terminal constantly supports registration in GSM-network but initializes GPRS-session only according to the schedule, thus it is always possible to make a call to the terminal or send SMS with a command and decrease GPRS-traffic costs. For GPRS-session the maximum volume of transmitted data in bytes is determined. Each cellular operator has minimum tariffing interval in roaming, it is recommended to set maximum data volume equal to half of this interval (the second half is for official traffic TCP/IP, the volume of which depends on connection quality).

7.9 Stels mode and packet transmission

In this mode the Terminal switches off GSM-unit and communicates only according to a strict schedule, which allows decreasing the Internet traffic and power consumption.
Stels mode settings command: stels pday,phours,minGSMon where

- *pday* – Terminal communication is enabled once on *p days* since the beginning of the month, in other words on days, multiple to *pday*;
- *phours* –Terminal communication is enabled on at *p hours* since midnight GMT, in other words at hours, multiple to *phours*.
- *minGSMon* –GSM unit is enabled for *minGSMon minutes since the beginning of the hour*.

Packet transmission can also be set in the Configurator on Settings/Data transmission tab.
To disable these modes use the stels 0,0,0 command.
Settings examples:

1) – communication once a day;
   – communication at 14.00 GMT;
   – staying in network for 15 minutes.
   Setting command: stels 1,14,15
   To enable the Terminal contact once a day *phours* must be greater than 11, i.e. it can be enabled at 11 and at 22 o'clock. By contact every 12 hours, the contact will be enabled at 12.00 and the next must be at 24.00, but this is another day, i.e. it is not realized.
2) – communication once a day;
   – communication every 2 hours GMT;
   – staying in network for 15 minutes.
   Setting command: stels 1,2,15
3) – communication once on three days;
   – communication at 23.00 GMT;
   – staying in network for 15 minutes.
   Setting command: stels 3,23,15

Note.

- contact at 0 o'clock GMT cannot be enabled whatever the settings are;
- remote commands will work only when the Terminal radio silence mode is disabled, i.e. GSM unit is on;
- do not set the contact time less than five minutes, otherwise, the Terminal will not have enough time to establish a link with the server and to report about its location.

7.10 Geofences

The Terminal allows setting areas where coordinates are not updated, the GSM unit is switched off. Each area is described by coordinates of the center and radius. Geofences' setting commands are given in section Track parameters setting.

7.11 Power saving

To reduce power consumption of the Terminal in the operating mode, perform the following steps:

1. Reduce the degree of track details. The lower this degree, the less the power consumption.

To reduce power consumption of the Terminal at a stop, perform the following steps:

1. Set up the shutdown of the GPS\GLONASS-unit at a stop, this can be performed using SLEEPMODE command (section **Service commands**) or on Power saving tab in the Configurator.
2. Enable the deep sleep mode at a stop. The deep sleep mode is turned on at the end of a pre-specified time period at stop. In this mode the Terminal disables the specified modules, reduces the ADC sampling rate. The behaviour in the deep sleep mode can be configured using SLEEPMODE command (section **Service commands**) or on Power saving tab in the Configurator. It is possible to setup a period of connection to a server in the deep sleep mode.

7.12 Remote configuration

Remote configuration can be performed through several data transfer channels:

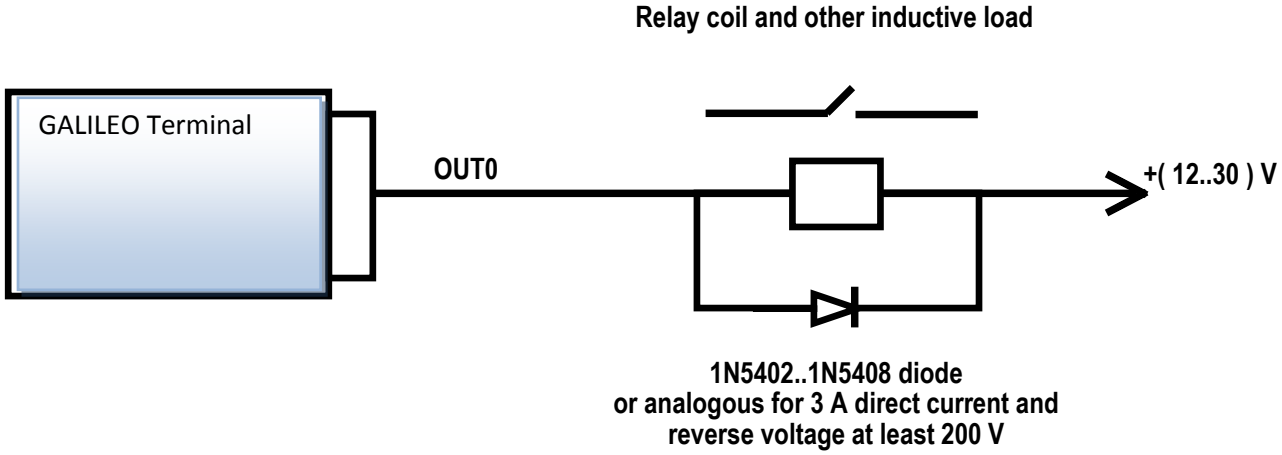
1. SMS. The Terminal has a list of 4 authorized phone numbers, the messages from which are treated as configuration commands. The available commands are described in the section Commands list. A phone number can be added to the list of authorized numbers either in the Configurator, or by sending a message with AddPhone command (section Settings for SMS control).
2. GPRS. Commands can be sent from the monitoring data processing server. The format of the commands is described in the section Server exchange protocols.
3. GPRS. For devices with the SIM900 or SIM900R GSM-unit commands can be sent via the Configurator and the remote configuration server of GalileoSky Ltd. In this case, the Terminal supports two parallel connections: the first – with the monitoring data processing server, and the second – with the remote configuration server. Remote configuration can be enabled using RemoteConfig 1 command (section Service commands). It is possible to send commands to the Terminal, to receive current information from the sensors connected and to receive troubleshooting messages, when working with the remote configuration server. Using the Configurator, it is possible to create a command pack to configure the Terminal and to save it on the server. These commands will be sent to the Terminal when it establishes the connection to the server.

8 Connecting external peripheral

8.1 Transistor outputs (0/1)

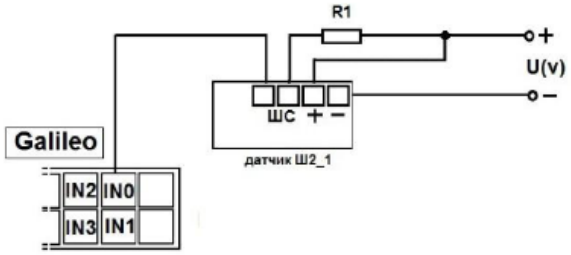
To operate external devices there is discrete «open collector» outputs (section Contacts description).The maximum output voltage is -+30V, each output current is within 80mA.
The output values are stored in the nonvolatile memory, so the device sets the stored values even after being reset.
To operate outputs use Out command or the Configurator (Settings\Inputs\Outputs tab).

Outputs relay connection circuit

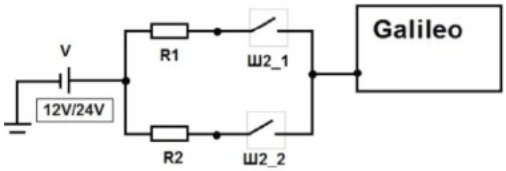


8.2 Connecting Ш2 passenger flow registration sensors

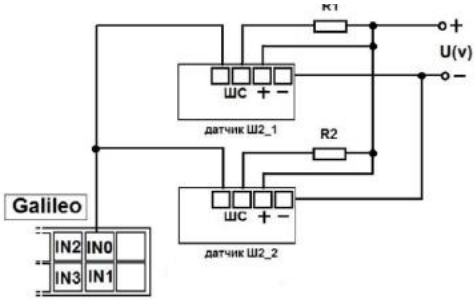
The Terminal supports connection up to 4 Ш2 sensors through 2 discrete-analog inputs (DAI) IN0, IN1 (Contacts description).
Connection order of one Ш2 sensor through resistor to one of DAI inputs of the Terminal.



To connect 2 Ш2 sensors to one of DAI use divisor on two resistors. Calculation principle is realized on voltage level change by sensors triggering.



V – Power supply (battery/ vehicle power supply);
R1, R2 – resistors;



Ш2_1, Ш2_2 – Ш2 passenger flow registration sensors.

Connection order of 2 Ш2 sensors through resistors to one of DAI inputs of the Terminal.

To set an input to count pulses from two sensors one may through the Configurator or by **incfg0 3,2,X,X,Y,Y command** (where Y – one sensor is triggered; X – two sensors are triggered).
Parameter **X** and **Y** depending on supply voltage and **R1,R2** resistors resistance take different values, for example:
U(v)=12, R1=10k, R2=10k, then X=3500, Y=7921
U(v)=12, R1=14k, R2=14k, then X=3000, Y=7000
U(v)=24, R1=10k, R2=10k, then X=7000, Y=15842
U(v)=24, R1=14k, R2=14k, then X=6000, Y=14000
It is calculated by formula:

$$X = \left(\frac{7 * U}{14 + R1 * 0.001}\right) * 1000; \qquad Y = \left(\frac{14 * U}{28 + R1 * 0.001} + \frac{7}{14 + R1 * 0.001}\right) * 1000;$$

Attention! To avoid false operation by sensors connection and further operation of sensors use stable voltage power supply.
Terminal operation result will be pulse fronts count from each sensor, i.e. when one person passes one door, total pulse number increases by 2. Correspondingly, to count passengers number passed through the sensors divide pulse count result by 2.

8.3 CAN-interface

The GALILEOSKY v2.3 lite Terminals allow extracting information from the vehicle`s CAN-bus.
The following protocols are supported:
– J1939 (FMS). According to this protocol, the Terminal is not a device transmitting to CAN bus, the device does not change vehicle operation, it also doesn't send confirmations to vehicle units packets and there is no electrical noise in the CAN-bus. In some cases, by connection to the troubleshooting socket for correct reading of information from the bus it is necessary to send confirmations to vehicle units packets, for this give ActiveCAN 1 command to the Terminal (section CAN settings).
– J1979 (OBD II). This protocol works according to the question-answer mode, consequently, the Terminal transmits the data to the CAN-bus.

Available performance modes:
J1939_SCANER – the bus scanner sending bus reports to the configurator.
FMS – a standard FMS protocol filter. (see www.bus-fms-standard.com).
J1939_USER_29bit – a configurable user filter. Identifier length is 29 bits.
J1939_USER_11bit – a configurable user filter. Identifier length is 11 bits.
J19379_SCANER – the bus scanner defining bus speed and identifier capacity.
J1979_29bit – a standard J1979 protocol filter for 29 bits identifiers.
J1979_11bit – a standard J1979 protocol filter for 11 bits identifiers.

8.3.1 J1939_SCANER mode

This mode is intended to study CAN-bus reports, according to J1939 protocol.
Bit rates from 10000 bit/s up to 500000 bit/s (typical values: 62500, 12500, 250000, 500000) are supported.
11 and 29 bit identifiers are supported.
The scanning mode works as follows:

1. **The CAN. Start scan.** message is displayed;
2. The CAN-bus reports are displayed with a delay indicated by the CAN Regime command. (section CAN settings).

29bit identifiers are displayed in the following format:
ID= 00000009 (8) 06 07 08 09 00 CC DD EE
Where:
ID - is a 29bit message identifier;
(8) - is the number of received bus bytes.
06 07 08 09 00 CC DD FF - is an 8byte message. (The lower byte is on the left, the higher byte is on the right),
11bit identifiers are displayed as
ID=009 (8) 06 07 08 09 00 CC DD EE
Where:
ID - is an 11bit message identifier;
(8) - is the number of received bus bytes;
01 02 03 04 05 AABBFF is an 8byte message. (The lower byte on the left, the higher byte on the right).

3. After all the identifiers have been displayed, you can see the **CAN. End scan message**.

To enable this mode:
1) connect the Terminal to the vehicle CAN-interface;
2) in the Configurator on Settings/CAN tab select bus rate and delay time (time of message waiting time);
3) press Start Scanning J1939. Received data are displayed in the right panel.

8.3.2 FMS mode

This mode is included in all Terminals by default; it allows retrieving and decoding messages relevant to FMS protocol:

- total fuel consumption: the amount of fuel the vehicle has used since it was made;
- tank fuel level: measured in percent. 0%-empty, 100%- full;
- coolant temperature;
- engine speed;
- total mileage.

Attention! Many car manufacturers support FMS protocol partially or do not support it at all.
To enable this mode:

1) connect the Terminal to the vehicle's CAN-interface;
2) give the CanRegime 2,25000,2000 command (section CAN settings) or select FMS filter type in the Configurator on Settings/CAN tab;
3) make sure the device receives bus data and sends them to Device tab in the Configurator;
4) set the right data transmission to the server using the MainPack command (section Server exchange protocol settings) or in the Configurator on Settings/Protocol tab.

8.3.3 J1939_USER_29bit mode

This mode enables us to receive 29bit identifiers (ID) messages from the vehicle CAN-bus, according to J1939 protocol.
To enable this mode:

1) connect the Terminal to the vehicle's CAN-interface;
2) select Custom filter (29bit identifiers)type in the Configurator on Settings/CAN tab, set the bus rate and delay time or give CanRegime command with necessary parameters (section CAN settings);
3) set filters for CAN-bus messages.
4) set sending of received data to the server with the help of MainPack command (section Server exchange protocol settings) or in the Configurator on Settings/Protocol tab.

Notes:

1) In protocol of the first and the main packet of the Terminal (Table 2. GalileoSky protocol tags) there are 1-byte, 2-bytes and 4-bytes tags for this mode operation, i.e. if the necessary ID needs only one byte from all data, better choose 1-byte tag.
2) Any of these tags can correspond to the right CAN message ID

Attention! The data should be recorded in the decimal system in the Terminal. The hexadecimal notation is used for convenience only.
By means of shifting it is possible to choose exactly that part of bytes, which should be filled in the tag from the useful information received with this ID.

Let us consider an example:
The CAN message identifier is ID=Ox18F00300.
We need only the first byte of all the sent content with this ID.
As we need only one byte, we shall choose the tag CAN_R0 as an example.
The command to set the tag is as follows: CAN8BITRO ID,Shift
1) The tag number ID=Ox18FEEEOO will look as 419260256 in the decimal system.
2) The byte we need is shifted by one byte that is the second parameter is equal to 1.
So we have the following filter settings: CANBITRO 419360256,1.
Now when the message in question is passing through the bus, the first effective load byte will automatically be placed to the tag R0 and sent to the server.
These settings are easier to make in the Configurator:
1) Scan the bus;
2) Indicate identifier in the first column;
3) Select the correspondent tag;
4) Visually indicate the shift using a mouse. The number transmitted to the server will be displayed in the Value column.
J1939_USER-11bit mode is set similarly.

8.3.4 J1979_SCANER mode

This mode is used to define data transfer rate and Identifier length according to J1979 protocol. If the parameters of transfer are known, it is recommended to use the ***J1979_29bit*** and ***J1979_11bit*** modes, having specified the necessary rate of the bus.
The rate of 250000 bits per second and 500000 bits per second and 11 and 29 bit identifiers are supported.
To enable this mode:

1) connect the Terminal to the vehicle's CAN-interface;
2) press "Test OBD II". Received data are displayed in the right panel.
3) if scanning finished successfully, data transfer rate and Identifier length will be set automatically.

Attention! Scanning can cause failures in on-board equipment operation. GalileoSky Ltd bears no responsibility for any failures after CAN-bus scanning.

8.3.5 J1979_29bit mode

This mode allows extracting and decoding the messages with 29 bit identifiers, transferred according to J1979 protocol automatically:

- tank fuel level: measured in percent. 0%-empty, 100%- full;
- coolant temperature;
- engine speed ;
- errors codes.

Attention! Many car manufacturers support J1979 partially or do not support it at all.
To enable this mode:

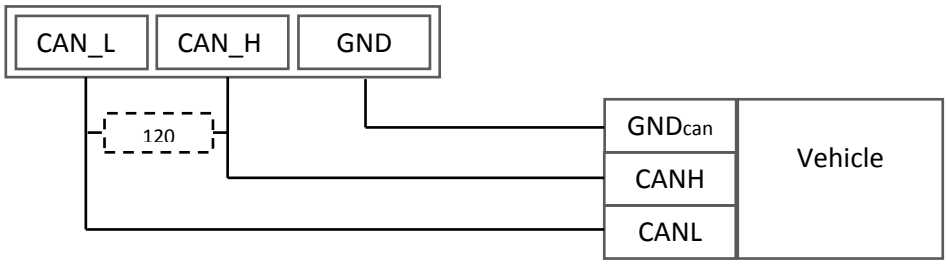
1) connect the Terminal to the vehicle's CAN-interface;
2) give the CanRegime command (section CAN settings) or select OBD II 29bit filter type in the Configurator on Settings/CAN tab;
3) make sure the device receives bus data and sends them to Device tab in the Configurator;
4) set the right data transmission to the server using the MainPack command (section Server exchange protocol settings) or in the Configurator on Settings/Protocol tab.

J1979_11bit mode is set in a similar way.

Attention! If your vehicle doesn't support J1939 protocol, **J1979_29bit** and **J1979_11bit** modes operation can cause failures of board equipment operation. GalileoSky Ltd bears no responsibility for failures after activation of these modes.

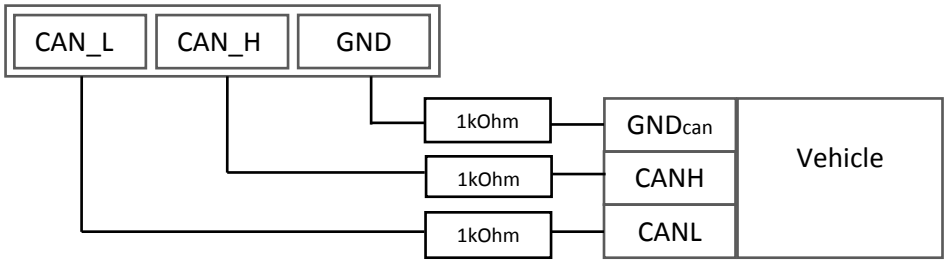
8.3.6 Variants of terminal connection to CAN-bus

1. Direct connection.



Attention! If the terminating resistor (is shown with a dotted line in the diagram) is not installed on the vehicle side, it should be installed. Its presence can be checked with the help of a multimeter: it is necessary to measure the resistance between CAN_H and CAN_L when the vehicle electronics is off. If the resistance is about 60 Ohm, there is no need for a terminating resistor. If the resistance is 120 Ohm, it is necessary to connect a standard 120 Ohm resistor between the CAN_H and CAN_L wires.

2. Connection with current-limiting resistors



To plug the Terminal into the troubleshooting socket it is necessary to use the first connection variant.
Only the second variant is recommended for use to connect the Terminal directly to the vehicle's CAN bus.

9 Configurator

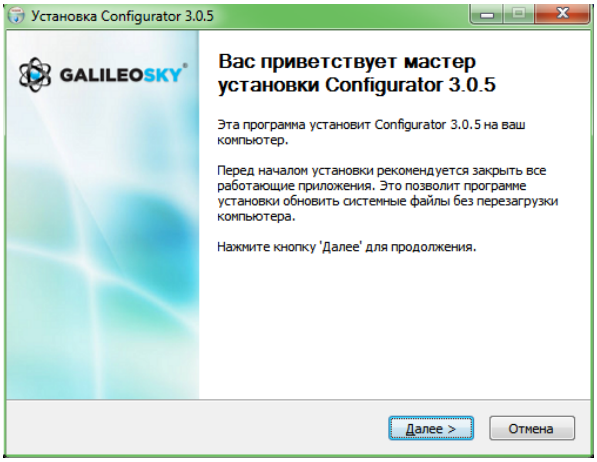
Configurator is a PC program, which allows:

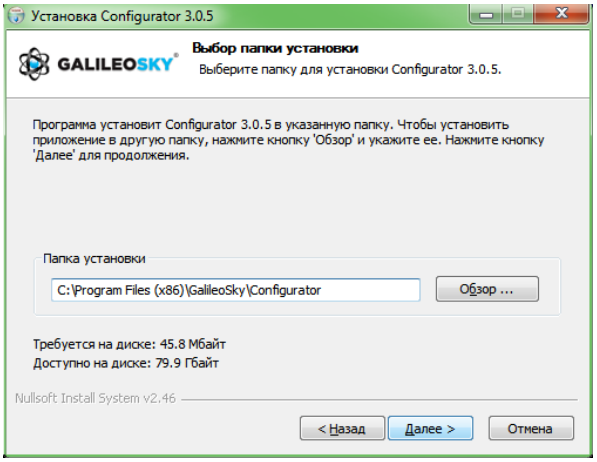
- configuring the Terminal via graphic interface and with the help of commands;
- troubleshooting the Terminal saving results in a log-file;
- seeing the Terminal units state in real time;
- downloading monitoring data to a file from the internal memory;
- sending the downloaded data to the server;

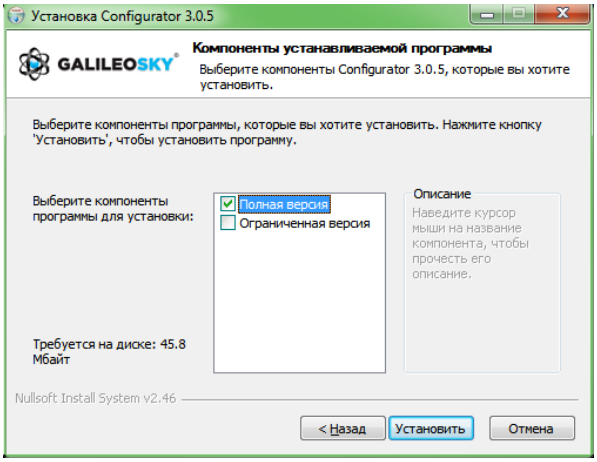
32 and 64 bit OS are supported: Windows 2000, Windows XP, Windows Vista, Windows 7.

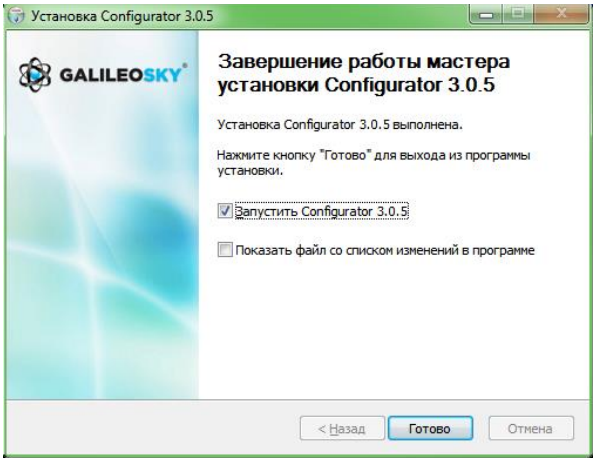
9.1 Program installation and running

Download the Configurator program from the site and start it.
Attention! Program installation may require changes of crucial OS elements. Do not let your antivirus program block the installer operation.
In case of a security system warning, confirm starting the program.





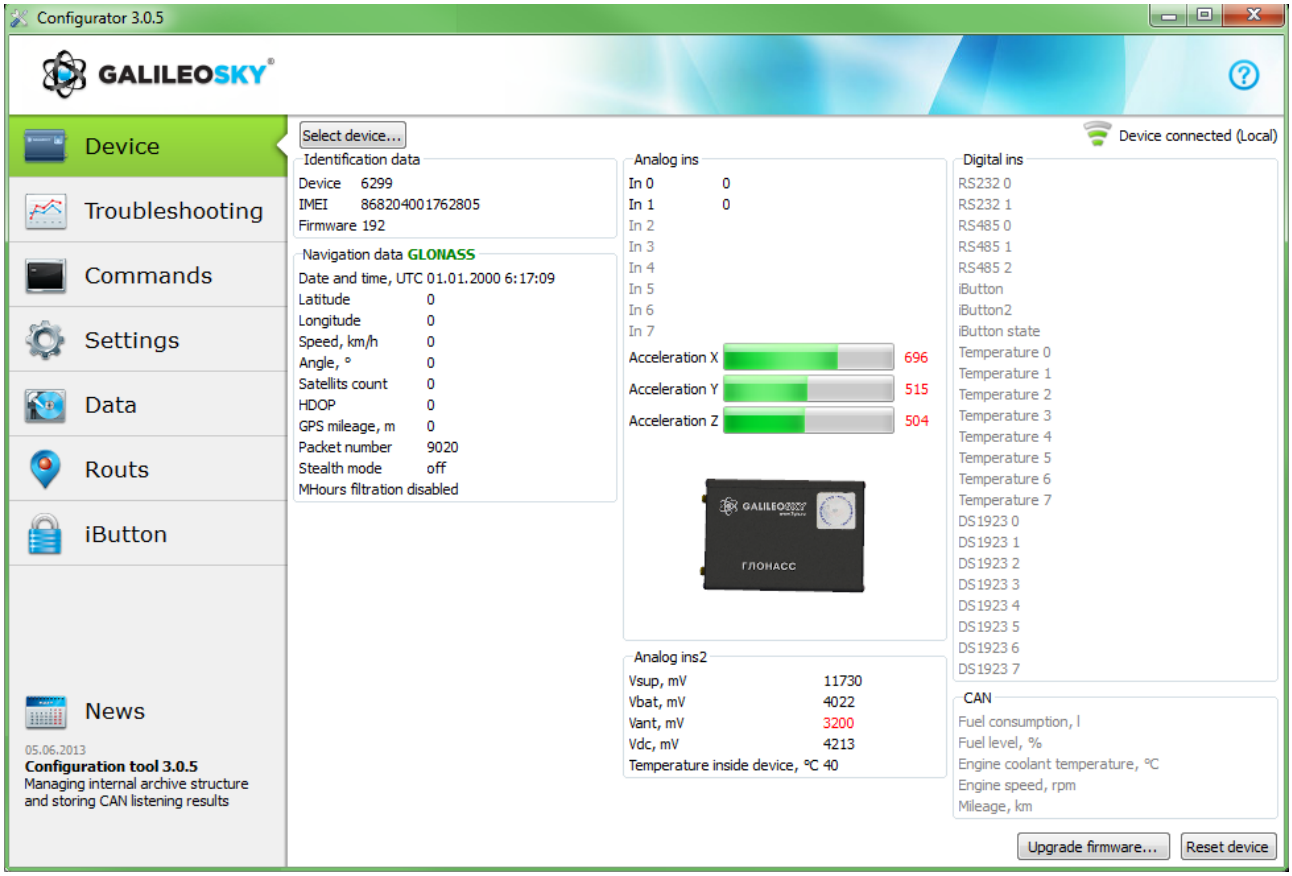




During the Configurator installation old drivers will be deleted and new ones will be installed.
Start the Configurator program (from Start menu\Programs\GalileoSky\Configurator). Turn on the power of the Terminal and connect it to the computer via a USB cable.
After the Terminal connection the program automatically downloads all the device settings parameters. If the program identifies the Terminal, all the buttons on the vertical left-hand panel will be active.

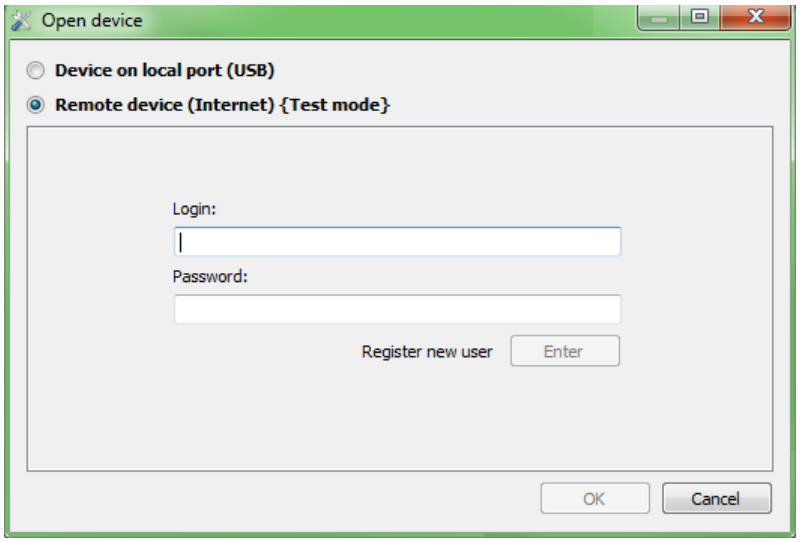
9.2 Device tab

The tab displays the information about the Terminal state and allows its resetting. This tab contains the Terminal model, oriented in space according to accelerometer indications. The model is rotated by mouse. Parameter values which are beyond the allowable limits, wrong coordinates and exceeding of maximum incline angle are shown in red.

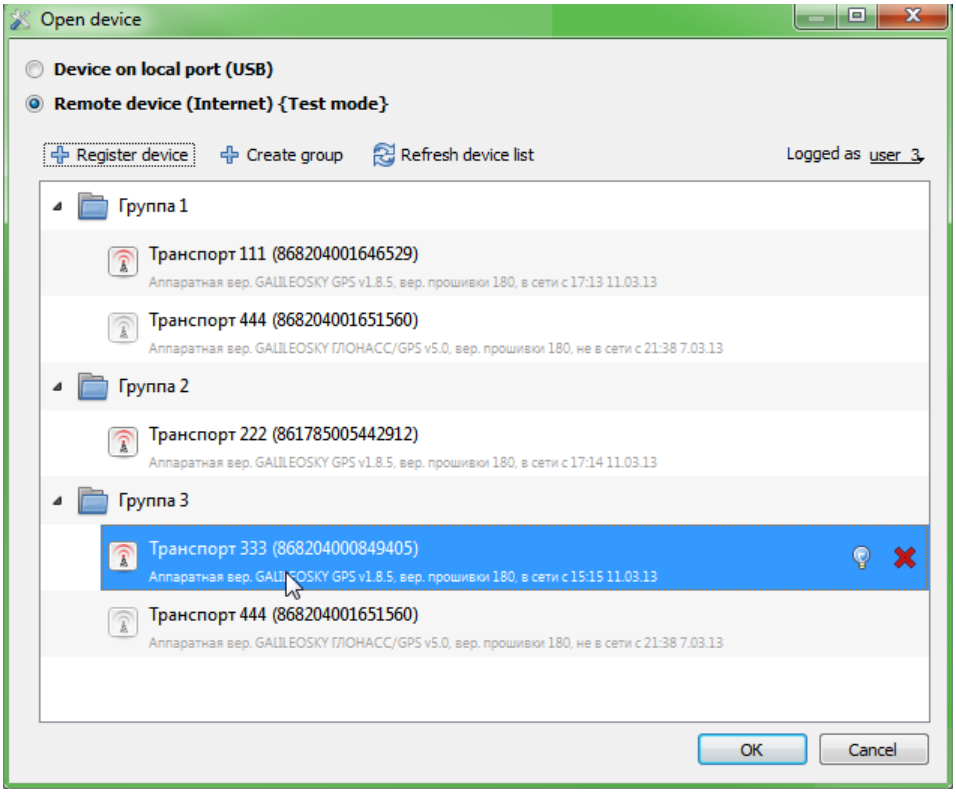


If there is a PIN code in the Terminal, the program will request it to access the settings. By wrong code entering the terminal disconnects from computer, resets, connects to the Configurator again and waits for the right code enter.

For remote configuration and troubleshooting of the Terminal, click Select device... button. In the window appeared, enter your login and password to get the access to the remote configuration server. You can get the login and the password in department of technical support of GalileoSkay Ltd. or by clicking the Register new user button.



After successful authorization on the server, the form of terminals list management will become available. When connecting for the first time, the list of the controlled terminals will be empty. To add a Terminal to the list, click Register Device button. During registration the Configurator will request a password for a particular Terminal, a default password corresponds to IMEI of the Terminal; this can be later changed by the user through the Configurator. Terminals may be arranged in groups.



After selecting of a specific Terminal, it can be controlled through the Configurator, the same way as it occurs with the USB connection.

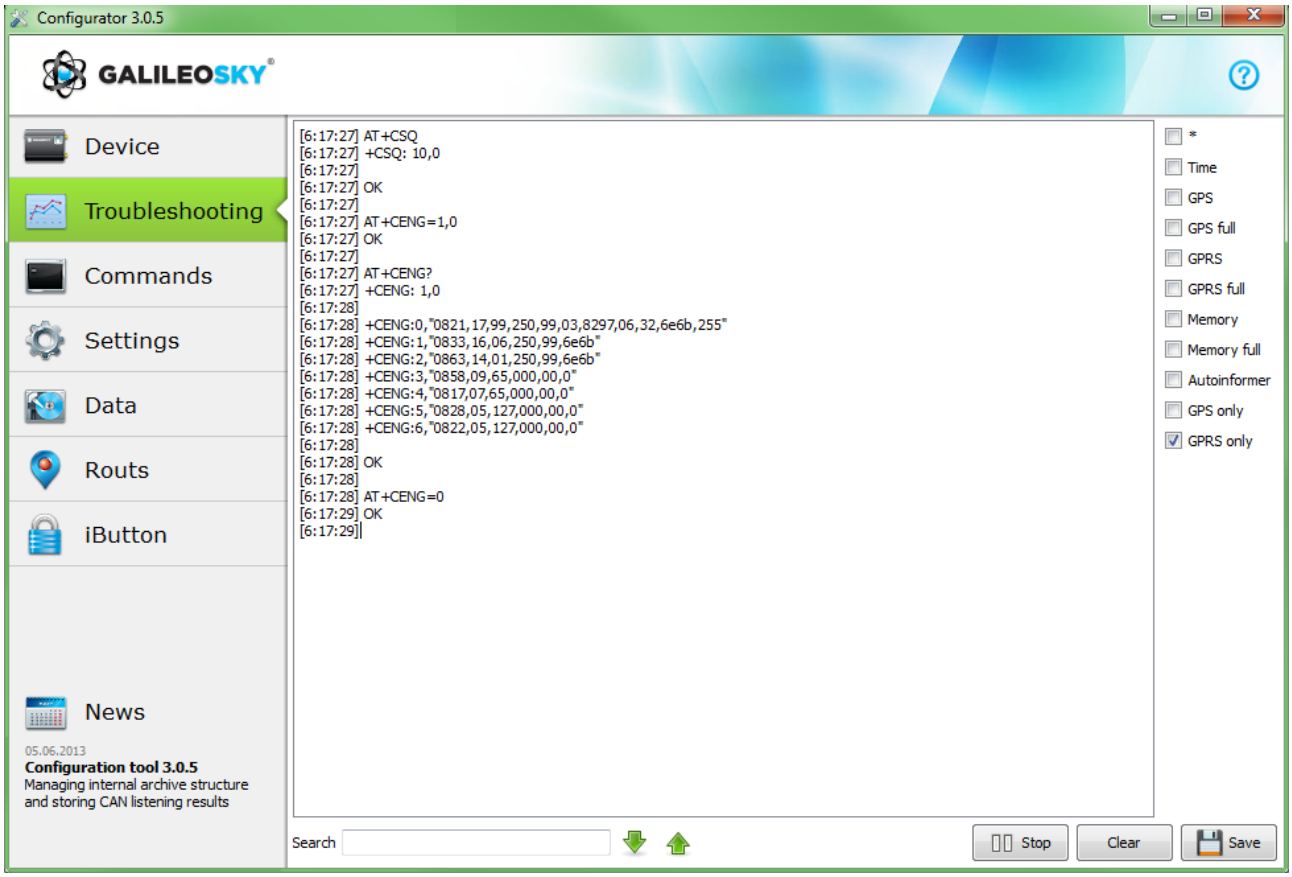
9.3 Troubleshooting tab

This tab allows seeing the current Terminal state through the troubleshooting reports.
The troubleshooting mode has the following buttons:

1) **Start /Stop**
   With a 10 sec interval the time scale displays information about the server connection, packet recording, updating coordinates and etc.
2) **Clear troubleshooting window**
3) **Save** troubleshooting results as a log-file which can be opened by any text editor
4) **Search** in troubleshooting history file

GSM unit debug info

Attention!
If the service has already been registered by the Terminal, another GPRS connection is only possible through switching off the GSM modem (troubleshooting report: sim300 gotopowdown). It means that no money will be lost due to the minimum chargeable session.



Troubleshooting messages	Description	Possible causes
GSM. Success turn on.	GSM unit is powered. Turning on is successful.	
GSM. Not success turn on!	GSM unit is powered. Turning on is denied by the unit.	
GSM. Success init.	GSM unit initialization is successfully performed.	
GSM. Not success init!	GSM unit initialization was failed.	
GPRS. Activated.	GPRS service initialization is successfully performed.	

GPRS. Not activate.	GPRS service initialization was failed.	GPRS is not activated on this SIM card. Not enough money on the account. GSM-network is overloaded.
GPRS. Success connect to server.	Device server connection is successful	
!GPRS. Not success connect to server.	Device server connection is failed	The server access is denied or wrong server settings for the device.
GPRS. Reconnect Number=№	Number of server reconnections. № - reconnection number	
GPRS. Firstpack OK.	First packet has been sent to the server	
!GPRS. Firstpack False.[0]	The device has sent the first packet, but there is no confirmation at TCP/IP protocol level.	GSM network is overloaded. The packet has been blocked by device brandmauer or FireWall.
!GPRS. Firstpack False.[1]	The device has sent the first packet, but there is no confirmation at the application level.	GSM network is overloaded. The server is not handling the first packet

SMS debug info

Troubleshooting message	Description
SMS. RX SMS.	A new SMS message is received
SMS. TelNum: +79112299922	received from a given phone number
Command: ID	ID command is received
SMS. TX OK.	Message is successfully sent
SMS delfromslot 1	handled SMS deleting (from the first SIM-card slot)
Not reply SIM. Slot 1	no SIM-card reply (from the first SIM-card slot)
GSM. No SIM-card	no SIM -card reply (the card is probably not inserted)

Internal Flash-memory (tracks memory) debug info

Troubleshooting message	Description
MEM. Inp-s	Point record reason is inputs state change;
MEM. Turn,dist	Point record reason is the change of distance between previous and new place or angle of driving direction;
MEM. Time	Record reason is time;
MEM. Write point - 200	Point with sequence number 200 is recorded.

GPS-unit debug info

Troubleshooting information	Description	Possible causes
SAT. Coord refresh.	Current record coordinates have been updated by GPS unit. The vehicle is considered to be moving, packet has not been filtered off.	
SAT. Coord not refresh.	Current record coordinates have not been updated. Filtering at stops is activated.	
SAT. Temper is low than -40	Device temperature is lower than -40ºC. Unit operation at lower temperatures is impossible.	
SAT. Temper is high than 65	Device temperature is higher than +65ºC. Unit operation at higher temperatures is impossible.	
SAT. Time out. Restart MCU.	No GPS data for 60 seconds. Device reset.	GPS unit is out of order. GPS unit failure.
GLONASS. Message received. Len = 401	Terminal received information from GLONASS unit. 401 byte is received.	
GPS. Message received. Len = 172	Terminal received information from GPS unit. 172 byte is received.	
GPS. Change baud rate = 1	Attempt to set GPS unit rate. Attempt № 1.	
SAT. Fix = 1	Current position is fixed (0 – not fixed);	

SAT. SatInUse = 7	7 satellites are used for navigation;	
SAT. Valid = 1	Coordinates are right (they can be used for location determination). This *Valid* is not related to *valid* in packet and status.	
Galileo uses GPS	Terminal uses GPS system.	
SAT. Incorrect data from GLNS/GPS module	Wrong data are received from the used unit (probably due to processor overload)	
SAT. Time out. Restart MCU	Device gets no data from receivers (GLNS/GPS)	
SAT. High Speed = 200	Navigation speed data filter turned on (these data will be skipped by the unit).	
SAT. HDOP is high = 6	Navigation HDOP data filter turned on (these data will be skipped by the unit).	
SAT. Jump = 5000	Navigation coordinate data filter turned on (large distance jump occurred).	
SAT. First start OK. Sat count >= MIN	By the Terminal turning on the unit must get more MIN satellites (only in this case, the data is reliable).	

Other troubleshooting messages are not described, but they have intuitive names. If there are any questions, you will find the answer at our forum.

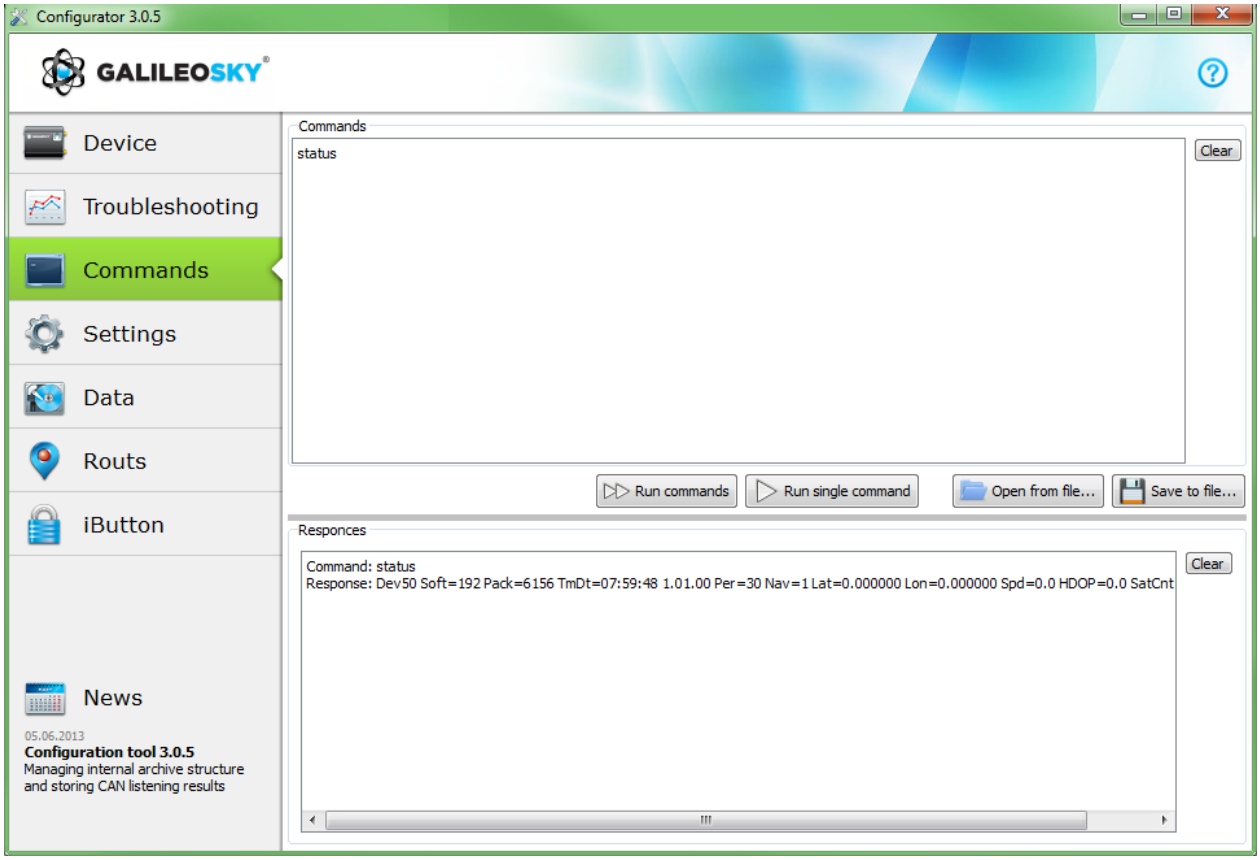
9.4 Command mode tab

This tab is intended to message a single command or a set of commands to the Terminal.

The command mode has the following buttons:

1) **Run commands;**
2) **Run single command;**
3) **Open from file;**
4) **Save to file.**

The commands will be identified whether you use capital or lower-case letters or both in turn.
Attention!
There are no spaces in command name!
Spaces between parameters are not allowed!
Commands and parameters are separated by space.
Commands are separated by Enter.



Single command example

An example of a command with a parameter:
Enter APN internet.beeline.ru,beeline,beeline as shown in the figure above and press **Run single command** button. The command and the response will be displayed in the Responses window.
Command: APN internet.beeline.ru,beeline,beeline
Response**:** GPRS: APN=INTERNET.BEELINE.RU, user=BEELINE, pass=BEELINE

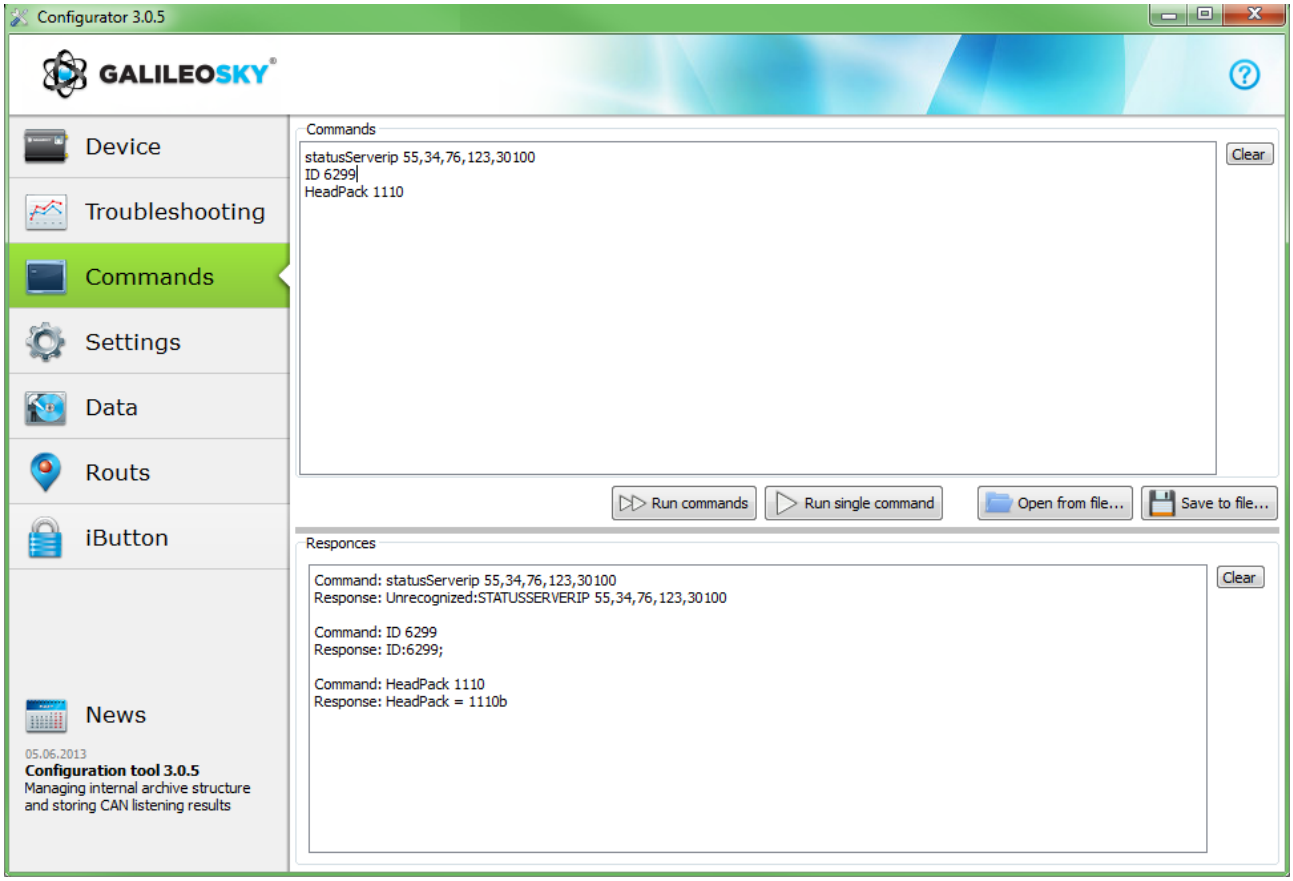
To access the parameters in the Terminal memory you should use a command without parameter!

An example of a command without parameter:

APN command	Request: **APN** Response: **GPRS:APN=INTERNET.BEELINE.RU,user=BEELINE,pass=BEELINE**

Set of commands example

Enter the necessary commands in Command window, each beginning a new line, as shown in the figure below and press the **Run commands** button.
Example: Serverip 55,34,76,123,30100
ID 6299
HeadPack 1110
The given commands and results will be displayed in the Command Responses window.
Command: Serverip 55,34,76,123,30100
Response: ServerIp=55.34.76.123:30100
Command: ID 6299
Response: ID: 6299
Command: HeadPack 1110
Response: HeadPack = 00000000000000000000000000000000000000000000000000000000000001110b

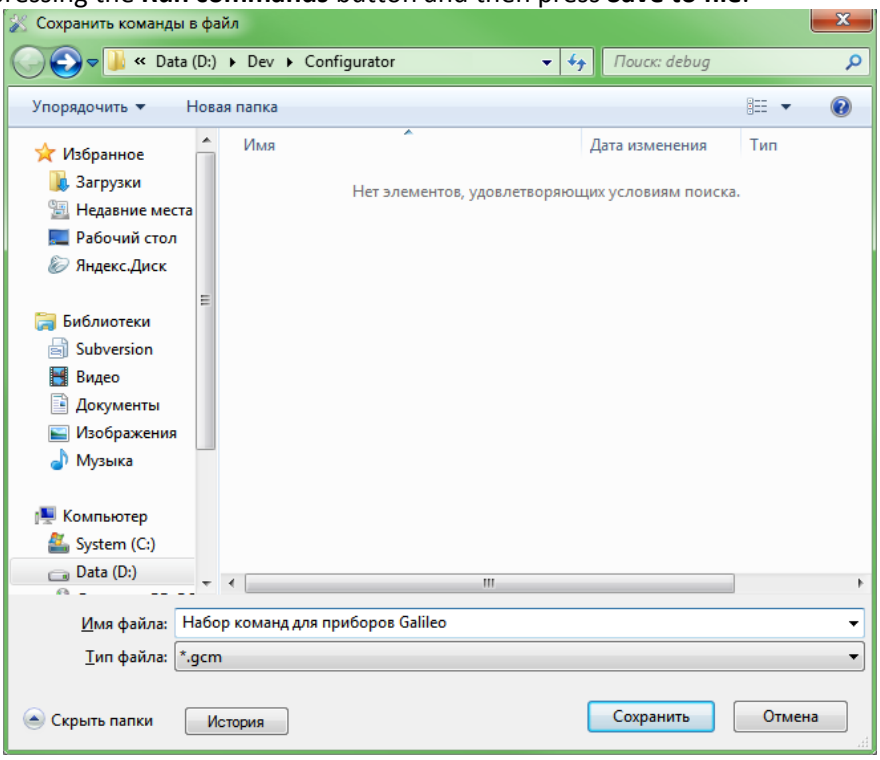


Example of saving and downloading parameter set

For quick configuration of several Terminals with the same set of commands, it is recommended to run the commands from a pre-saved file. To do this, enter a list of commands in the Command window. Make sure that they are typed correctly by pressing the **Run commands** button and then press **Save to file**.

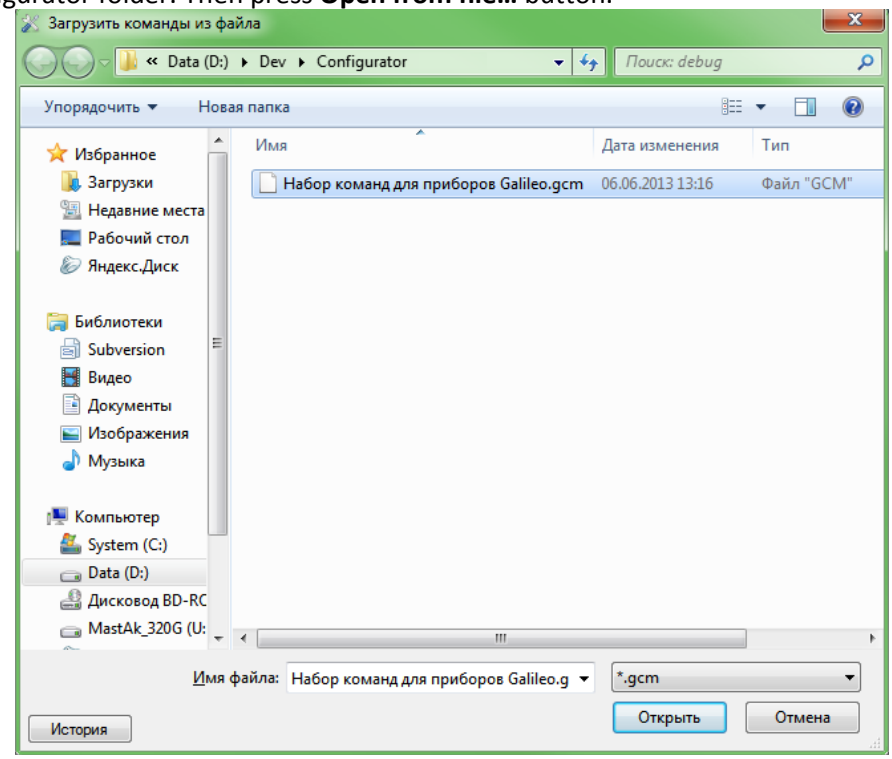
In the opened window you will be offered to save the file in log configurator folder.

Type the file name and press Save button as shown in the right-hand figure



The file will be saved in log configurator folder. Then press **Open from file…** button.

Select the necessary file and press Open button, as shown in the right-hand figure.



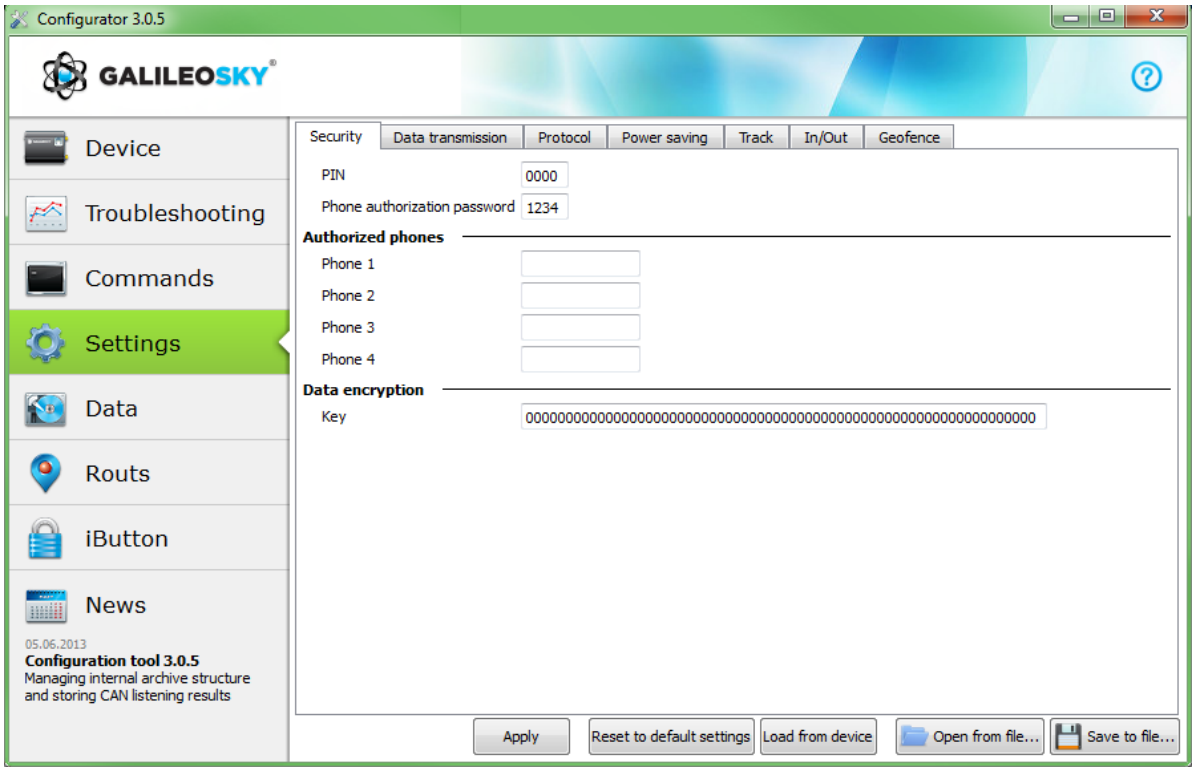
To run several commands at the same time press **Run commands** button.
To run only one command it is necessary to go to it in Commands window and press **Run single command** button.

9.5 Graphic interface settings

All the main settings of the Terminal are placed in tabs in the program upper part.

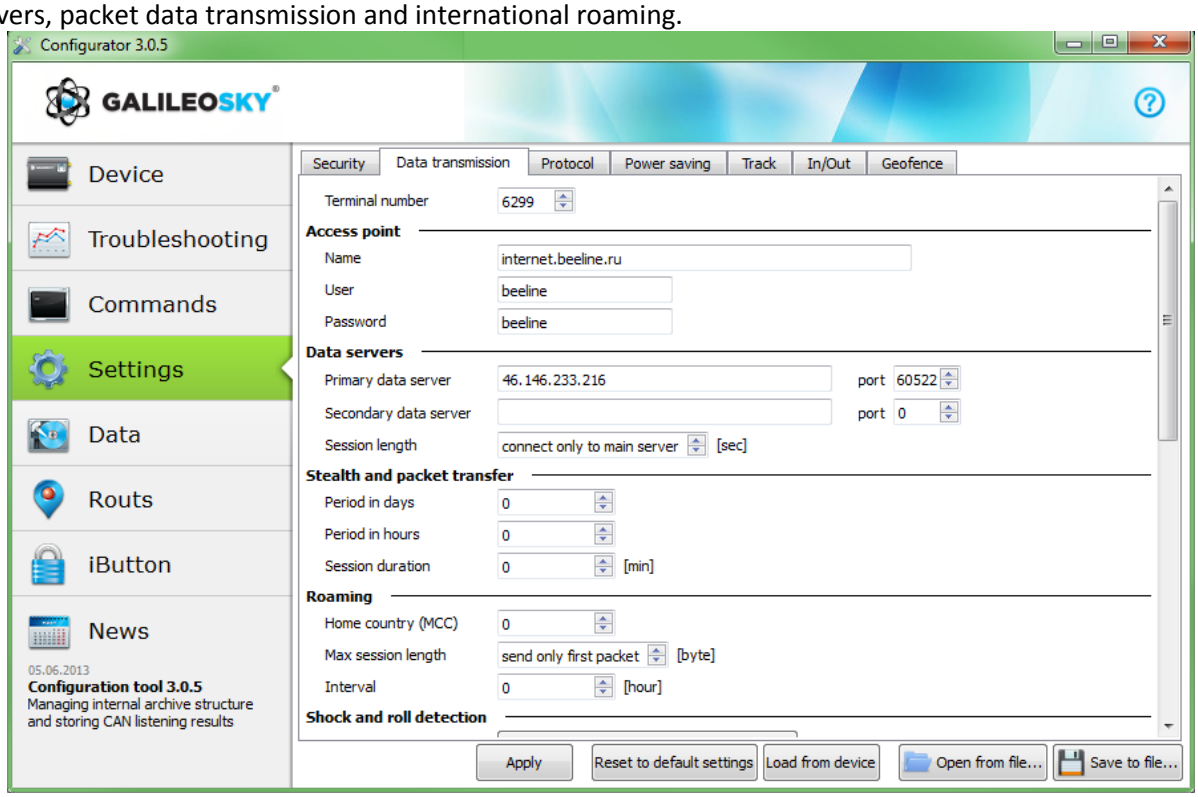
9.5.1 Security

This tab allows setting SIM-cards PIN code, list of authorized phone numbers and encryption key for data transfer to the server.



9.5.2 Data transmission

This tab allows setting SIM-card PIN code, APN for the Internet connection, monitoring data processing servers, packet data transmission and international roaming.

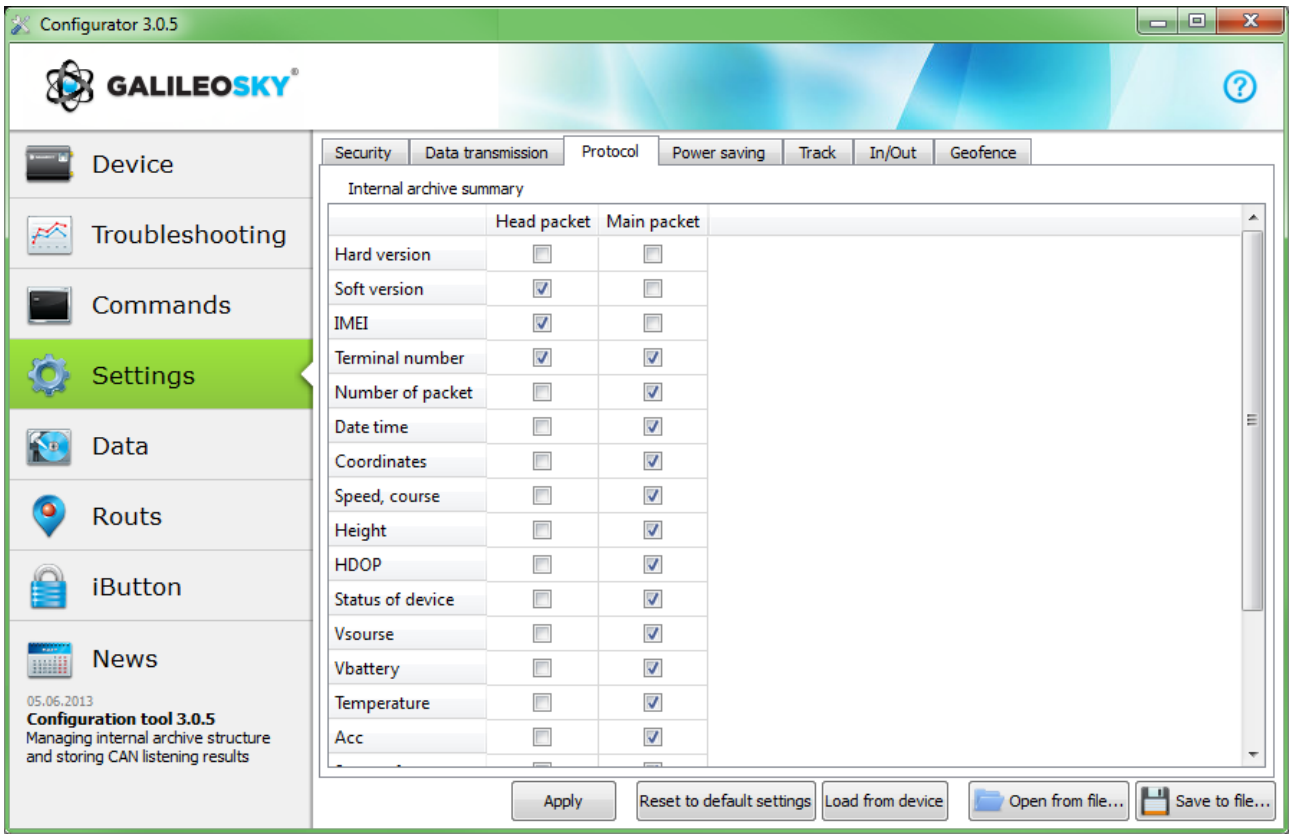


9.5.3 Protocol

The device has its own data transmission protocol developed by GalileoSky Ltd.
During device operating and data sending to the server, the following stages are possible:

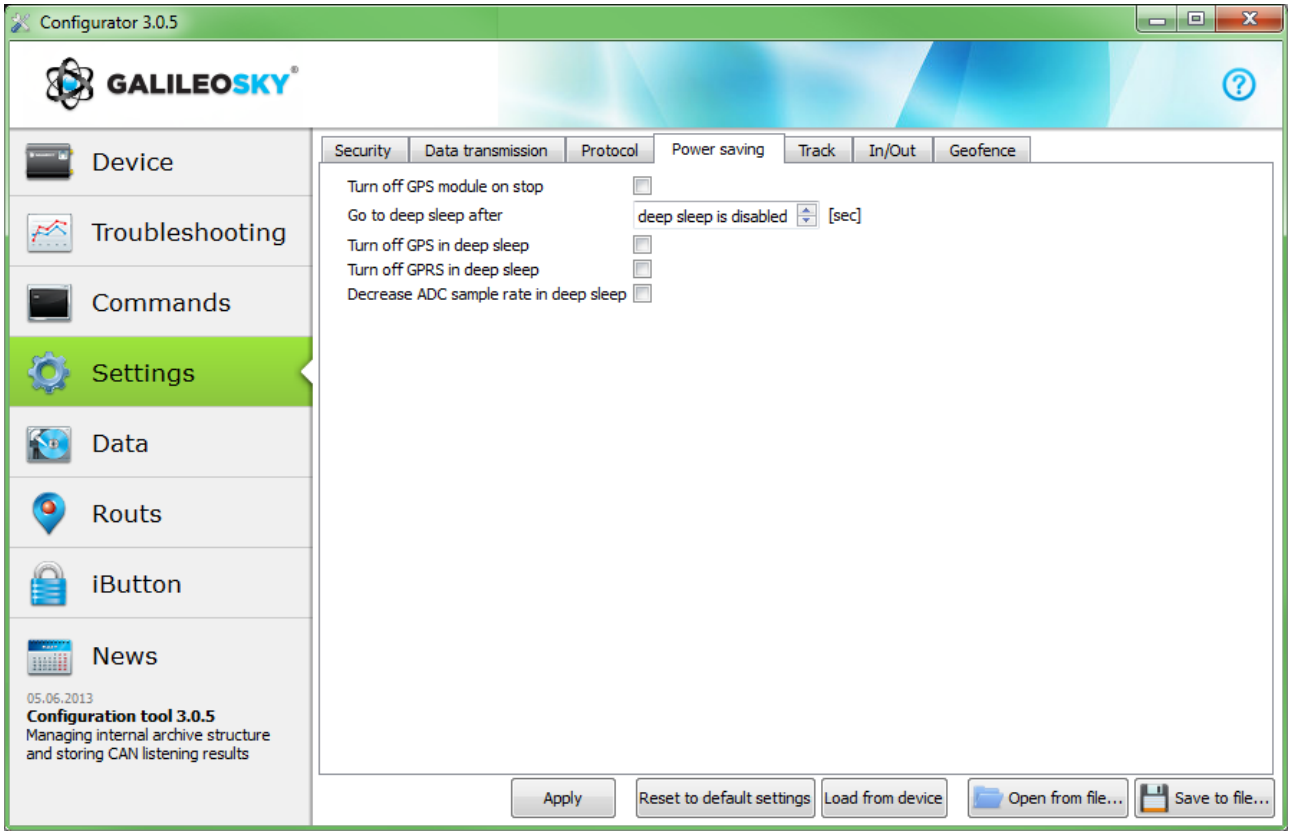
1) Initialization of TCP/IP connection (does not need any additional settings);
2) Sending of initialization data described in the Head packet column (the data to be sent to the server are marked in the first column);
3) If the Terminal has passed the first two stages, it starts sending accumulated packets according to the format described in the Main packet column.

To send data the modem establishes a server link and keeps it active even after sending the data packet. It is done to save server connection traffic used to establish the connection.



9.5.4 Power saving

This tab allows setting shutdown options of the Terminal units at stop, to reduce power consumption.



9.5.5 Track

This tab allows setting archive storage place and recording periods of coordinates at stops and in motion, details of track and filtering false coordinates.
The device filters coordinates by speed, acceleration, travelled distance, horizontal accuracy, number of satellites.
In addition, the Terminal allows filtering of coordinates crowding during stops by supply voltage at vehicles battery (Mhours command).
Parameters:

- supply voltage at stopped engine;
- supply voltage at started engine;

The first parameter is selected in the following way:

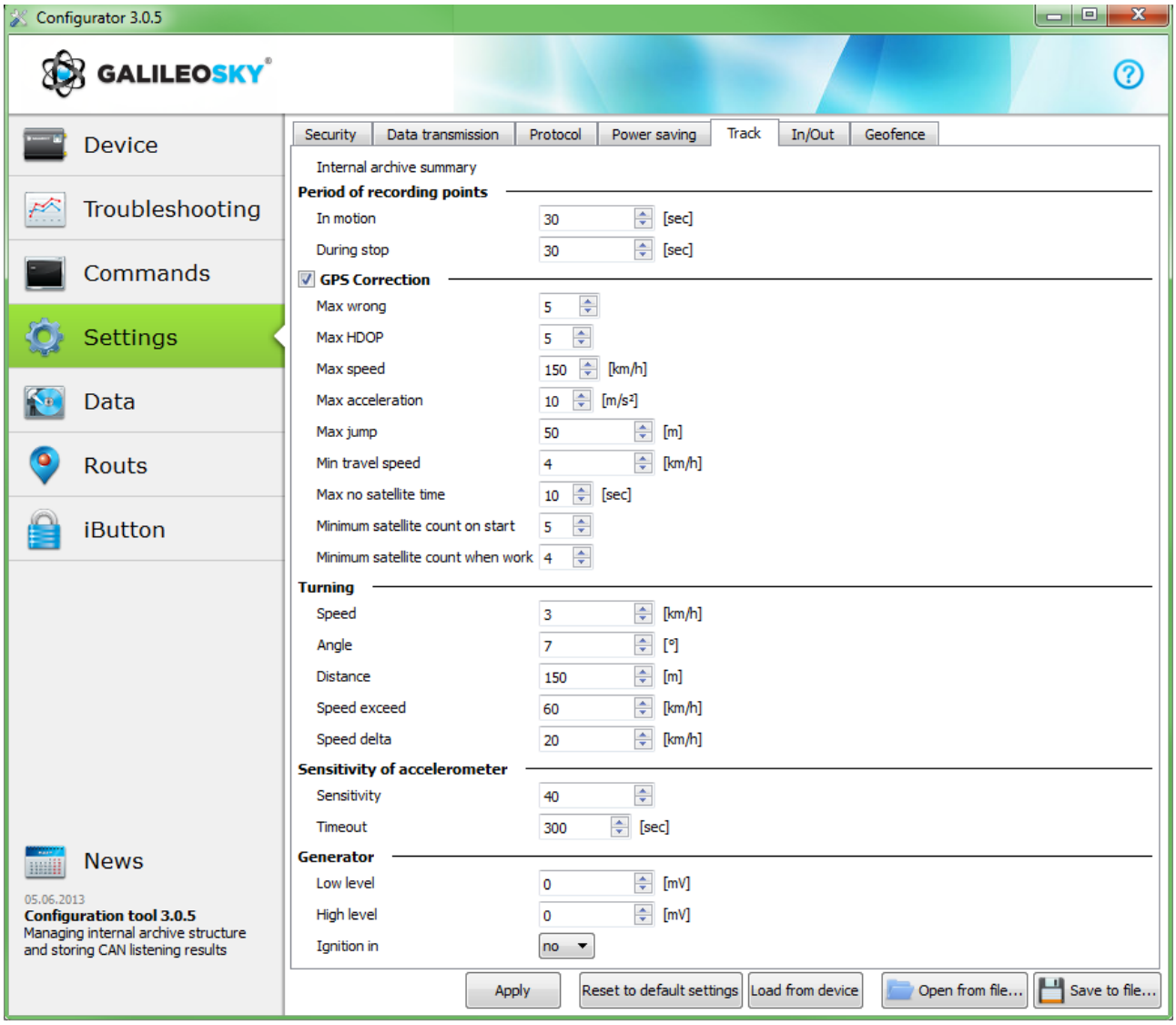
1) stop the engine for 5 minutes;
2) save the Vpit voltage parameter from Device tab.

The second parameter is selected in the following way:

1) start the engine;
2) save the Vpit parameter;
3) parameters of the mhours command are filled in and sent to the Terminal.

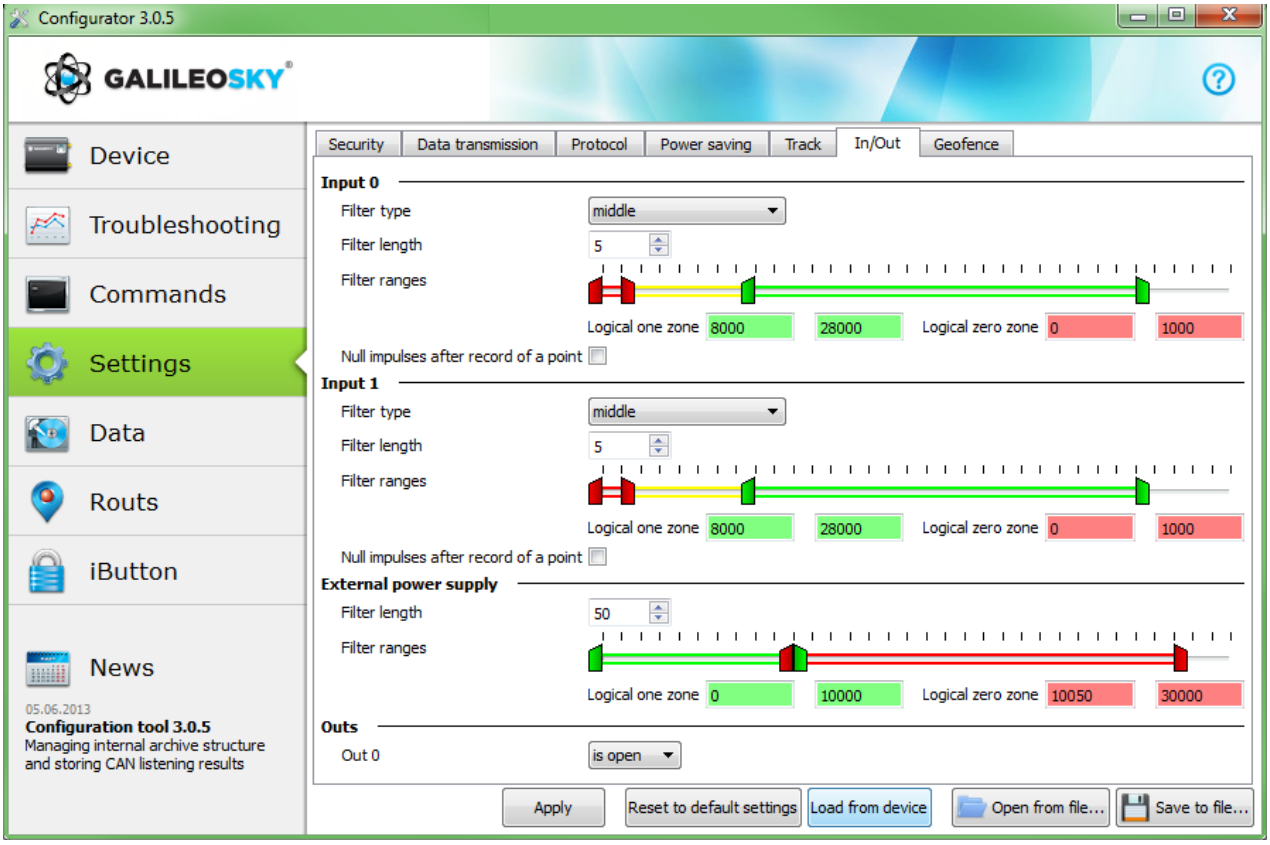
When engine is started, the 9th bit will be set in the device status (Table 3. Device status field explanation).
Each Terminal is equipped with an accelerometer, which allows filtering coordinates crowding during stops based on vehicles vibration.
Parameters:

- Sensitivity– a standard unit, where the sensitivity of 600 units corresponds to acceleration of 1g (gravitational acceleration)
- Time parameter. The Terminal switches on this filter when there is no vibration within a certain time period. The filter operates until the necessary amplitude acceleration is reached.


Configurator 3.0.5
GALILEOSKY
Device
Troubleshooting
Commands
Settings
Data
Routs
iButton
News
05.06.2013
Configuration tool 3.0.5
Managing internal archive structure and storing CAN listening results
Security
Data transmission
Protocol
Power saving
Track
In/Out
Geofence
Internal archive summary
Period of recording points
In motion 30 [sec]
During stop 30 [sec]
GPS Correction
Max wrong 5
Max HDOP 5
Max speed 150 [km/h]
Max acceleration 10 [m/s²]
Max jump 50 [m]
Min travel speed 4 [km/h]
Max no satellite time 10 [sec]
Minimum satellite count on start 5
Minimum satellite count when work 4
Turning
Speed 3 [km/h]
Angle 7 [°]
Distance 150 [m]
Speed exceed 60 [km/h]
Speed delta 20 [km/h]
Sensitivity of accelerometer
Sensitivity 40
Timeout 300 [sec]
Generator
Low level 0 [mV]
High level 0 [mV]
Ignition in no
Apply
Reset to default settings
Load from device
Open from file...
Save to file...

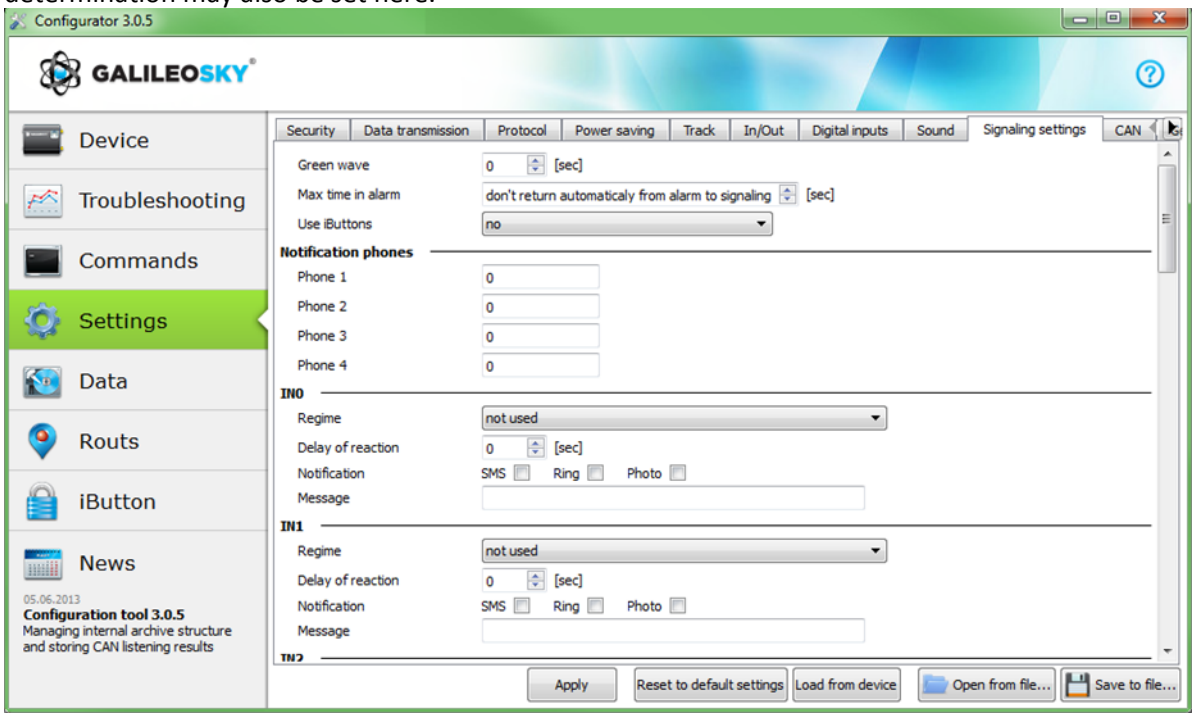
9.5.6 Inputs/Outputs

For input's operating principles see section Discrete-analog inputs (DAI).
For discrete inputs' description see section Transistor output (0/1).



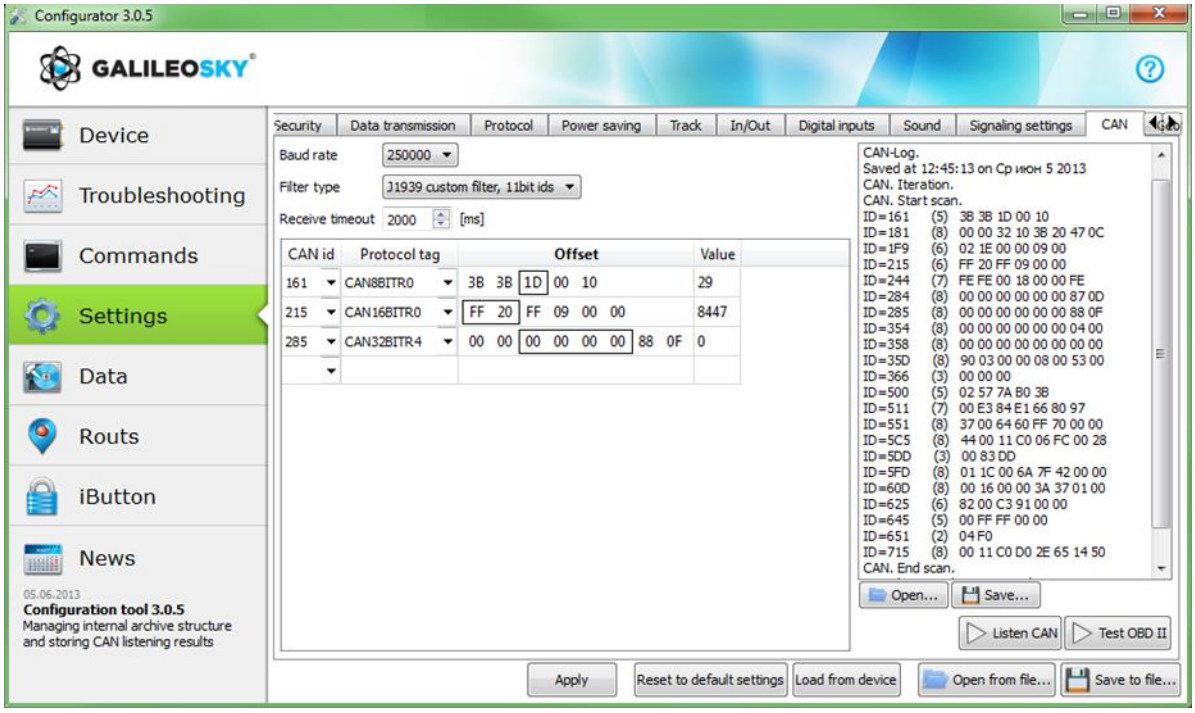
9.5.7 Signaling

This option allows setting the response of the Terminal to inputs state change, speed and coordinate change. You can set telephone numbers for SMS or call in case of signaling activation. Strike and incline determination may also be set here.



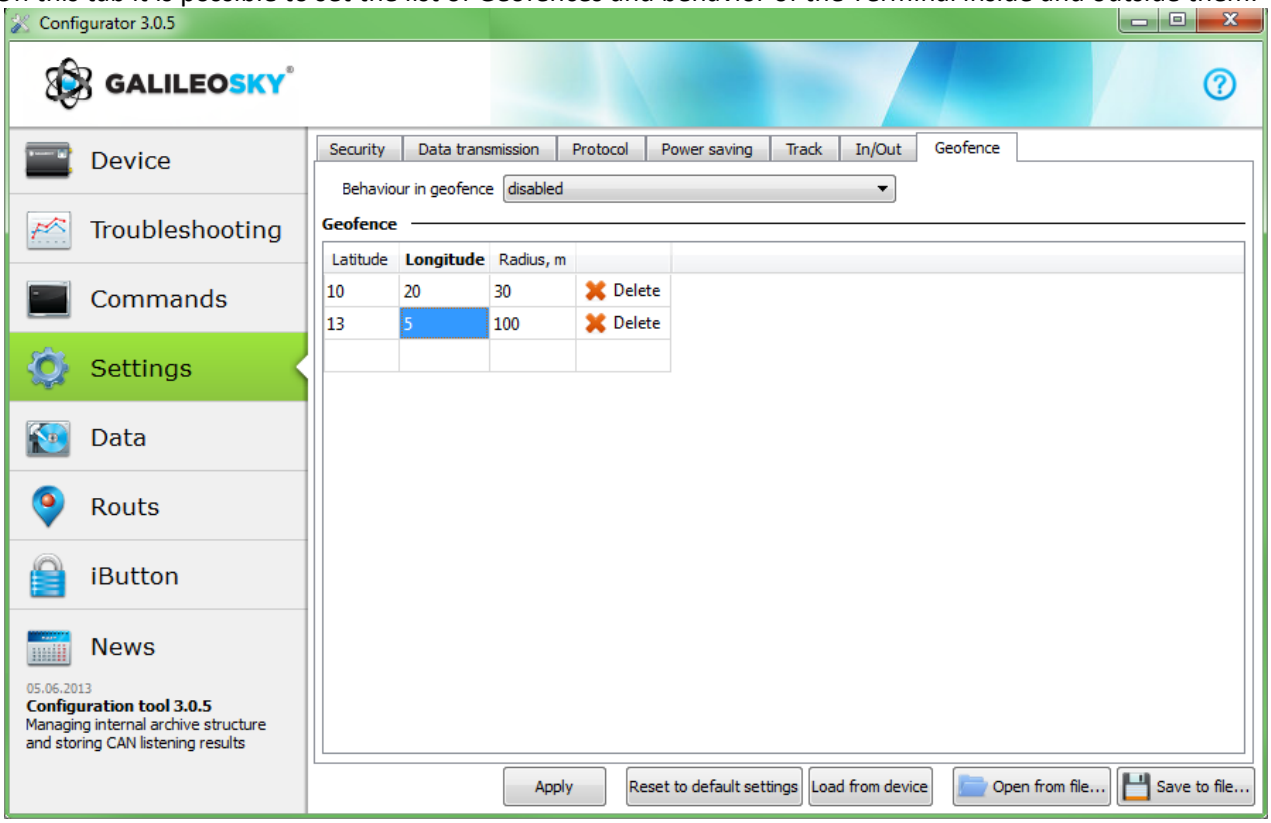
9.5.8 CAN

This option allows setting a CAN-filter and scanning the CAN-bus for message identifiers being used. After clicking Listen CAN the CAN scanner will be activated and received messages will be displayed in the right-hand panel. When scanning is completed, it is possible to set tags in the protocol, in which the bus data will be sent. To do this: choose CAN identifier and tag and point transmitted part of the message with a mouse. To delete the filter the corresponding message identifier should be selected and deleted.



9.5.9 Geofences

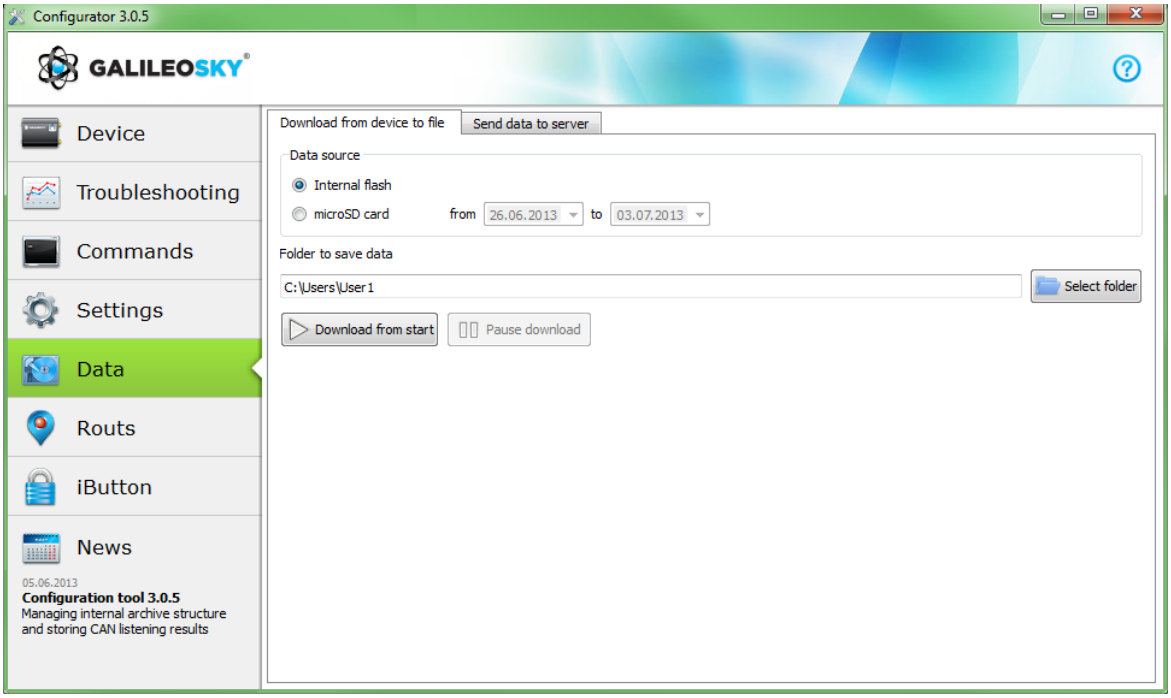
On this tab it is possible to set the list of Geofences and behavior of the Terminal inside and outside them.



9.6 Data loading and sending to server

9.6.1 Data loading from the Terminal to file

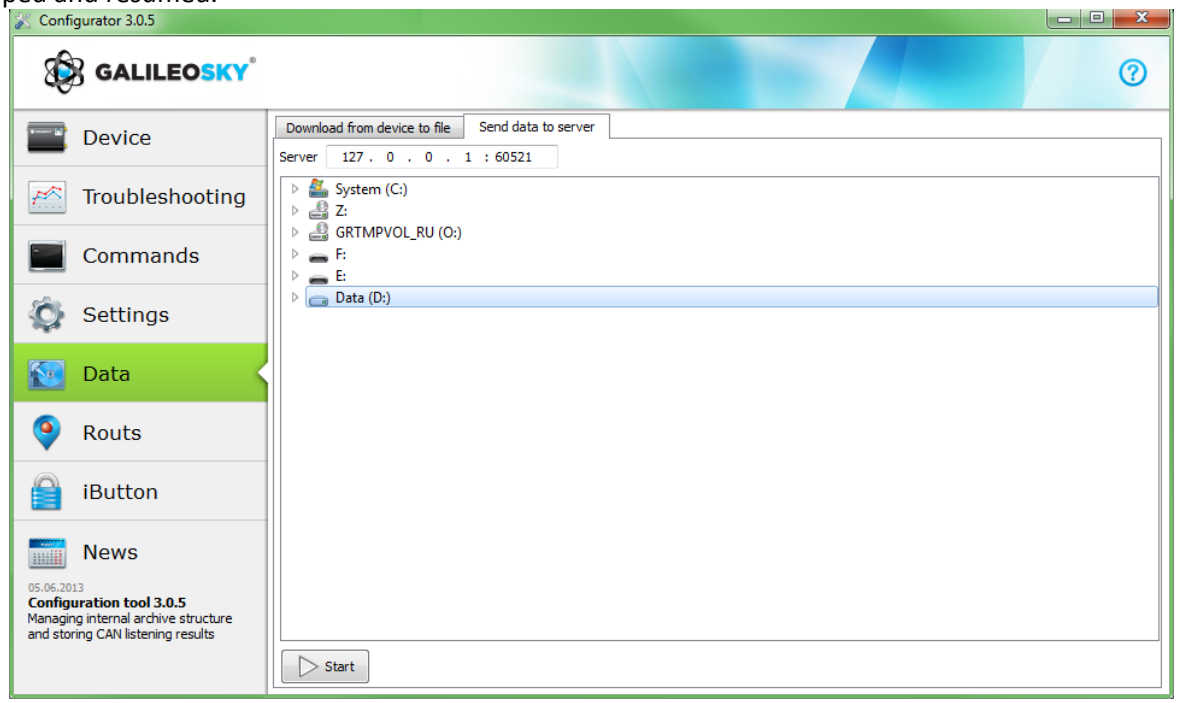
This option allows transferring data from the internal memory of device to a computer file (InternalFlash.csv) via a USB cable.



Data transfer from the internal memory can be stopped and resumed.

9.6.2 Data sending to server

This option allows sending data previously transferred from the Terminal to any server emulating the GalileoSky protocol. To send it you should specify the IP-address and the server port and choose the file or catalogue to be sent. If a catalogue is chosen, the program will send all its data files. The process can be stopped and resumed.



10 Commands list

To request current settings you need issue a command without any parameter.

10.1 Settings for SMS control

Settings are performed only from the GSM-phone.

Command format	**AddPhone xxxx[,n]**
Parameters	**xxxx** - is a four- digit password, 1234 by default **n** – slot number (0-3) where a telephone number will be saved.
Explanation	When you configure the Terminal from a cell phone, first of all, you should authorize it by using this command. Up to 4 telephone numbers can be authorized.
Example	Request: AddPhone 1234 Reply: Phones (0) = 890101243456 (1) = (2) = (3) =

Command format	**ChangePass aaaa, bbbb**
Parameters	**aaaa** - is initial numeric four-digit password; **bbbb** - is newly set numeric four-digit password.
Explanation	Changing and viewing the current password.
Example	Request: ChangePass 1234,5678 Reply: CurrentPass 5678

Command format	**Phones**
Explanation	Getting the list of authorized phones
Example	Request: Phones Reply: Phones (0)=+790101243456 (1)= (2)= (3)=

10.2 Data transmission settings

Command format	**APN a,u,p**
Parameters	**a** – access point name **u** – user **p** – password
Explanation	Access point setting
Example	Request: APN internet.beeline.ru,beeline,beeline Reply:APN=internet.beeline.ru, user=beeline, pass=beeline

Command format	**Serverip host,port**
Parameters	**host –** server domain name or its IP-address**;** **port –** server port. Old command syntax is also supported for indication of IP-address: **Serverip ip1,ip2,ip3,ip4,port** **ip1, ip2, ip3, ip4** - server IP-address**.**
Explanation	Main server parameters where monitoring data will be transmitted to.
Example	Request: Serverip m.7gis.ru,60521 Reply: SERVERIP=m.7gis.ru:60521 Request: Serverip 46.146.233.216,60521 Reply: SERVERIP=46.146.233.216:60521

Command format	**Serverip2 ip1,ip2,ip3,ip4,port**
Parameters	**host** – server domain name or its IP-address; **port** – server port. Old command syntax is also supported for indication of the IP-address: **Serverip2 ip1,ip2,ip3,ip4.port**

	ip1, ip2, ip3, ip4 - server IP -address.
Explanation	Additional server parameters.
Example	Request: Serverip2 m.7gis.ru,60521 Reply: Serverip2=m.7gis.ru:60521

Command format	**ServersCfg t**
Parameters	**t** – time of connection with one server, [sec]. When the value is equal to 0, data will only be transmitted to the main server.
Explanation	Sets the time of server connection session.
Example	Request: ServerCfg 120 Reply: SERVERCFG:SeansTime=120;

Command format	**ID n**
Parameters	**n** - terminal number
Explanation	Changes terminal number.
Example	Request: ID 123 Reply: ID=123

Command format	**OPS0 n1,n2,n3,n4,n5,n6,n7,n8,n9,n10,n11,n12,n13,n14,n15**
Parameters	**n1-n15** – preferred GSM-networks.
Explanation	A list of preferred GSM-networks. The network is defined by a mobile country code and a mobile operator code (the list of codes is given in http://www.itu.int/dms_pub/itu-t/opb/sp/T-SP-E.212A-2010-PDF-E.pdf), for example, the Russian Federation code is 250.
Example	Request: OPS0 25001,25099 Reply: OPS0:25001,25099,,,,,,,,,,,,;

Command format	**OPS1 n16,n17,n18,n19,n20,n21,n22,n23,n24,n25,n26,n27,n28,n29,n30**
Parameters	**n16-n30** – preferred GSM-networks.
Explanation	A list of preferred GSM-networks . The network is defined by a mobile country code and a mobile operator code (the list of codes is given in http://www.itu.int/dms_pub/itu-t/opb/sp/T-SP-E.212A-2010-PDF-E.pdf), for example, the Russian Federation code is 250.
Example	Request: OPS1 25001,25099 Reply: OPS1:25001,25099,,,,,,,,,,,,;

Command format	**Roaming MCC_MNC,Size,Interval**
Parameters	**MCC_MNC** – a mobile code of the country where data can be transmitted without any limitations (codes list is given in http://www.itu.int/dms_pub/itu-t/opb/sp/T-SP-E.212A-2010-PDF-E.pdf), for example, the Russian Federation code is 250 or it may be a combination of a country and an operator mobile codes. Zero means that there are no special roaming settings used; **Size** – maximum number of bytes which can be transmitted during one connection session in roaming, when the value is equal to 0, only the first packet is transmitted; **Interval** – communications interval in hours.
Explanation	Data transmission settings in international roaming.
Example	Request: Roaming 250,10000,24 Reply: ROAMING:Home=250,MaxBytes=10000,Interval=24;

Command format	**Protocol n**
Parameters	**n –** protocol version of data transmission: 0 – GalileoSky protocol; 3 – EGTS.
Explanation	Selection of monitoring data transmission protocol to the server.
Example	Request: Protocol 0 Reply: PROTOCOL:0;

Command format	**Car VIN,N**
Parameters	**VIN** – VIN of the vehicle, is transmitted in EGTS protocol. **N** – vehicle`s number plate, is transmitted in EGTS protocol.
Explanation	Settings of the vehicle description.
Example	Request: car 123456789,A000AA00 Reply: CAR:123456789,A000AA00;

10.3Server exchange protocol settings

Command format	**HeadPack bbbbbbbbbbbbbb**
Parameters	**bbbbbbbbbbbbbb** is tags set if b is replaced by 1,the tag is on. If b is replaced by 0, the tag is off. Tag numeration order is given in Table 2. GalileoSky protocol tags.
Explanation	Head packet configuring**.**
Example	*Request: HeadPack 1110* *Reply: HeadPack=* *00000000000000000000000000000000000000000000001110b ,* *This means that tags from the second to the fourth inclusive are on and the first and the rest tags inclusive are off.*

Command format	**HeadPackBit index, value**
Parameters	**index** – a tag number, which is on or off for transmission to the server **value** – 1 if the tag should be transmitted to the server 0 if the tag should not be transmitted to the server Tag numeration order is given in Table 2. GalileoSky protocol tags.
Explanation	Head packet configuring.
Example	*Initially the second tag is off:* *HeadPack=1100b* *Switch on this tag.* *Request: HeadPackBit 2,1* *Reply: HeadPack=1100b*

Command format	**MainPack bbbbbbbbbbbbbb**
Parameters	**bbbbbbbbbbbbbb** – tags set If b is replaced by 1, the tag is on. If b is replaced by 0 the tag is off. Tag numeration order is given in Table 2. GalileoSky protocol tags.
Explanation	Main packet configuring.
Example	*Request: MainPack 11111111111111111111110000* *Reply: MainPack= 00000000000000000000011111111111111111111110000b* *This means that tags 1, 2, 3, 4 are off and tags 5-26 inclusive are on. All the next tags are off.*

Command format	**MainPackBit index,value**
Parameters	**index** – tag number, which is on or off for transmission to the server **value** – 1 if tag should be transmitted to the server 0 if tag should not be transmitted to the server Tag numeration order is given in Table 2. GalileoSky protocol tags.
Explanation	Main packet configuring.
Example	*Initially the second tag is off:* *HeadPack=1100b* *Switch on this tag.* *Request: HeadPackBit 2,1* *Reply: HeadPack=1100b*

Command format	**DataKey Key**
Parameters	**key** – data encryption key in hexadecimal form, if it is equal to 0, data are not encoded.
Explanation	Specifies the key, which encrypts the transmitted data..

10.4Track parameters setting

Command format	**Turning V,A,D,S,dS**
Parameters	**V** – minimum speed that enables drawing of the track on the corners, [km/h]; **A** – minimum turn angle for Terminal to record a track point, [º]; **D** – the distance above which the next packet will be saved to the Terminal memory, [m]; **S** – the speed above which for dS-multiple amount track point will be recorded, [km/h]; **dS** – speeding interval, [km/h].
Explanation	Configures track detail representation.
Example	Request: Turning 3,10,300,60,20 *Reply: TURNING:Speed=3,Angle=10,Distance=300,SpeedEx=60,SpeedDelta=20;*

Command format	**WrPeriod x,y**
Parameters	**x** – Period of packet recording in memory in motion, [sec.]; **y** – Period of packet recording in memory when the vehicle stops, [sec.].
Explanation	Period of packets recording when the vehicle is moving or when it stops.
Example	Request: WrPeriod 60,180 Reply: WRPERIOD move=60 parking=180

Command format	**GPS.Correct OnOff,MaxWrong,MaxHDOP,Spd,Acc,Jump,TravelSpeed**
Parameters	**OnOff** – GPS coordinates filtering is on (1) or off(0); **MaxWrong** – the number of wrong coordinates to be filtered (the recommended number is 5). This parameter accounts errors of acceleration exceed and jump, for other parameters the coordinates are always filtered; **HDOP** – Maximum HDOP above which the coordinates are not updated; **Spd** – Maximum speed. When it is exceeded, coordinates are considered to be false and are not updated, [km/h]; **Acc** –GPS or GLONASS data based acceleration; **Jump** – Maximum coordinate jump in the nearest 2 seconds, [m]; **TravelSpeed** – Minimum speed for coordinates to be updated, [km/h]. This function is not suitable for low speed vehicles (tractors, asphalt placing machines)
Explanation	Allows filtering false coordinates: jumps when the vehicle stops, in or out of tunnels, near high-rise buildings
Example	Request: GPS.CORRECT 1,5,2,150,3,50,3 Reply: GPS.correct: OnOff=1, MaxWrong=5, MaxHDOP=2, MaxSpd=150, MaxAcc=3, MaxJump=50, MaxTravelSpeed=3;

Command format	**GPS.Correct2 MaxNoSatTime,MinSatStart,MinSatWork**
Parameters	**MaxNoSatTime** – maximum time without satellite connection when no disconnection is registered, [sec.]; **MinSatStart** – minimum number of satellites to be connected to when the Terminal is on; **MinSatWork**– minimum number of satellites during the operation mode of the Terminal. If the number is smaller, disconnection will be registered.
Explanation	These settings affect coordinates updating if filtering is on by **GPS.Correct** command.
Example	Request: GPS.CORRECT2 10,5,4 Reply: GPS.correct2:MaxNoSatTime=10,MinSatStart=4,MinSatWork=3;

Command format	**AccSens Sens,TO**
Parameters	**Sens** – accelerometer sensitivity. **TO** – operating time after the vehicle stops, during which coordinates are updated, [sec].
Explanation	This function allows avoiding unnecessary outliers after the vehicle stops. Default value is 40,300. Sens value equal to 600 is 1g (g –gravitational acceleration)
Example	*Request: AccSens 40,300* *Reply: Accelerometer sensitive: sens = 40, time out=300*

Command format	**Ignition N**
Parameters	**N** – an input used as an ignition sensor: 0 – ignition sensor is not used; 1 – input 0 is used as ignition sensor; 2 – input 1 is used as ignition sensor;
Explanation	If there is no response for a given input, vehicle is considered to be not started, and coordinates are not updated. It allows avoiding outliers after the vehicle stops. Triggering on input is determined by the limits set by InCfg command.
Example	*Request: Ignition1* *Reply: IGNITION:1;*

Command format	**Shock Mode,Angle,Timeout,ShockSens**
Parameters	**Mode** – strike determination mode: 0 – strike determination is switched off; 1 – strike determination is switched on, X axis is in vertical position; 2 – strike determination is switched on, Y axis is in vertical position; 3 – strike determination is switched on, Z axis is in vertical position; **Angle** – maximum incline angle [0º-180º], value equal to 180 switches off incline determination; **Timeout** – maximum allowable time when incline angle is exceeded, [sec.]. **ShockSens** – maximum acceleration by exceed of which a strike is detected. 600 points – gravitational acceleration.
Explanation	Switching on strike and incline determination mode.
Example	*Request: Shock 3,30,5* *Reply: Shock: Mode=3,MaxAngle=30,RT=5;*

Command format	**Mhours LoLevel,HiLevel**
Parameters	**LoLevel** – input voltage +supply voltage by stopped engine, [mV]; **HiLevel** – input voltage +supply voltage by started engine, [mV];
Explanation	Allows filtering false coordinates after the vehicle stops.
Example	*Request: mHours 12000,14500* *Reply: Mclock: lolevel=12000,hilevel=14500;*

10.5Information commands

Command format	**Status**
Explanation	Allows finding device status at the moment of sending a command. Dev– this device number; Soft – current firmware version; Pack – Last recorded packet serial number; TmDt – Current time and date; Per – Current packet saving period (different when the vehicle is moving and stops); Nav – Coordinates determination accuracy. 0 – coordinates are found. Lat – Latitude; Lon – Longitude; Speed – Linear speed (vehicle speed); HDOP – Horizontal accuracy (The closer to 1, the better); SatCnt – Number of available satellites; A – Movement directional angle
Example	Request: Status Reply:Dev50 Soft=91 Pack=17230 TmDt=10:58:6 20.6.9 Per=60 Nav=0 Lat=60.4007 Lon=31.0070 Speed=0.0194 HDOP=0.88 SatCnt=10 A=27.55

Command format	**imei**
Explanation	Allows obtaining a unique GSM unit identifier,15byte
Example	Request: IMEI Reply: IMEI 123456789012345

Command format	**imsi**
Explanation	Allows obtaining a unique IMSI code
Example	Request: IMSI Reply: IMSI 123456789012345;

Command format	**inall**
Explanation	Allows analog input values in0, in1,in2,in3 as well as accelerometer values with respect to three axes (10bit for each axis starting with the zero bit) being obtained.
Example	Request: inall Reply: INALL:in0=0,in1=0, in2=0,in3=0,Acc=332943891;

Command format	**Insys**
Explanation	Allows obtaining external source voltage, internal battery voltage, GPS aerial voltage, the main power bus voltage of the Terminal and also the temperature inside the device.
Example	Request: insys Reply: INSYS: Pow=12438,Vbat=4196,Vant=2921,Vdc=4115,Temper=37

Command format	**statall**
Explanation	Allows device, inputs, outputs decimal status (Table 3. Device status field explanation) and mileage according to GPS/GLONASS data being obtained.
Example	Request: statall Reply: StatAll: Dev=1,Ins=2,Outs=7,Mileage=152;

Command format	**AccType**
Explanation	Allows obtaining accelerometer type. Returns "analog" for analogue type and "digital" for digital type.
Example	Request: AccType Reply: AccType: digital

10.6Service commands

Command format	**PIN N**
Parameters	**N** – four-digit PIN-code of a SIM card.
Explanation	SIM-card PIN-code and password setting for access settings via the Configurator. The default PIN-code is 0. If you enter a wrong code through the Configurator, the Terminal will be blocked for 25 seconds and then reset.
Example	Request: PIN 1234 Reply: PIN:1234;

Command format	**EraseCfg**
Explanation	Setting default configuration.
Example	Request: EraseCfg Reply: ERASECFG

Command format	**EraseTrack**
Explanation	Deleting all tracks from memory.
Example	Request: EraseTrack Reply: ERASETRACK

Command format	**Reset**
Explanation	Allows resetting the device remotely.
Example	Request: Reset Reply: Reset of device. Please wait 15 seconds…

Command format	**Upgrade N**
Parameters	**N** – firmware number, up to which the Terminal shall be upgraded. If it is 0, the Terminal will be upgraded up to the last stable firmware.
Explanation	Firmware upgrading up to the specified one.
Example	Request: Upgrade 47 Reply: UPGRADE 47

Command format	**SleepMode OnOff**
Parameters	**OnOff** – 0 – to switch off power saving mode; 1 – to switch on power saving mode.
Explanation	Power saving mode supposes switching off GPS or GLONASS-unit during vehicle`s stop. The unit will be switched on again as soon as the vehicle starts moving.
Example	Request: SLEEPMODE 1 Reply: SLEEPMODE:1;

Command **FLASHARCHIVE Dynamic,SendOrder**

Parameters	**Dynamic** – whether the dynamic archive structure is used or not: 0 – the dynamic archive structure is off, all possible data are saved in archive; 1 – the dynamic archive structure is on, only the data selected to be transmitted to the server are saved to archive **SendOrder** – order of data transmission from the archive to the server: 0 – the data are sent deep into the archive; the most actual data are sent first 1 – data are sent in chronological order
Explanation	Setting of the archive structure and data transmission order to the server
Example	Request: FLASHARCHIVE 1,1 Reply: FLASHARCHIVE: Dynamic=1,StraightSendOrder=1;

Command format	**SleepMode OffOnStop,DSTime,GNSS,GPRS,ADC, WakeUp,ST**
Parameters	**OffOnStop** – 0 – do not turn off GPS-unit at stop;

	1 – turn off GPS-unit at stop. **DSTime** – time, spent at stop, after which the Terminal switches to the deep sleep mode; **GNSS** –to turn off GPS-unit in the deep sleep mode; **GPRS** –to turn off GSM-unit in the deep sleep mode; **ADC** – to reduce ADC sampling rate in the deep sleep mode, the maximum frequency that can be measured at inputs is reduced by 2 and the minimum pulse period that can be registered increases twofold; **WakeUp** – a period in seconds between connections to a server in deep sleep mode; **ST** – a length of connection to a server in seconds in the deep sleep mode.
Explanation	Power saving modes control.
Example	Request: SLEEPMODE 1,60,1,1,1,3600,600 Reply: SLEEPMODE:OffGNSSOnStop=1,DSTimeout=60, GNSS=1,GPRS=1,ADC=1, GSMWakeUp=3600, SessionLen=60;

Command **RemoteConfig OnOff**

Parameters	**OnOff** – turning on the remote configuration function: 0 – remote configuration is off; 1 – remote configuration is on.
Explanation	Turning on and off the remote configuration (section Remote configuration).
Example	Request: RemoteConfig 1 Reply: REMOTECONFIG:1;

Command format **LastCmd N**

Parameters	**N** – record number in the memory starting from 0. Records are stored in cyclic array, so record 0 is not always the earliest record.
Explanation	Request of settings change log. The Terminal stores up to 10 last commands with date and source of the command.
Example	Request: LastCmd 1 Reply: USB 10:10:10 2013.01.01 REMOTECONFIG 1

Command format **ColdStart**

Explanation	Cold start of GPS or GLONASS/GPS-unit.
Example	Request: ColdStart Reply: GLONASS cold start

10.7Analog-discrete inputs setting

Command format	**InCfg_num_in ft,fl,up_low,up_hi,down_low,down_hi,imp_null**
Parameters	**num_in** – an input number, beginning from 0; **ft** – filter type 0 – mean value computation; 1 – pulse count; 2 – frequency count 3 – pulse count from two synchronously connected sensors. **fl** – filter length [1÷50]. It is used for average and discrete signal function; **up_low** – lower limit of discrete signal triggering, [mV]; **up_hi** – upper limit of discrete signal triggering , [mV]; **down_low** – lower limit of discrete signal failure, [mV]; **down_hi** – upper limit of discrete signal failure, [mV]; **imp_null** – pulses counter behavior: 1 – counter is set to zero, 0 – counter continues increasing.
Explanation	Allows one of 4 analog/discrete inputs being configured.
Example	Request: InCfg0 0,10,8000,15000,0,3000,0 Reply: INCFG0:FiltType=0,FiltLen=10,UpLow=8000,UpHi=15000,DownLow=0,DownHi=3000, ImpNull=0;

Command format	**PowInCfg fl,up_low,up_hi,down_low,down_hi**
Parameters	**fl** – length of the averaging filter [1÷50]; **up_low** – lower limit of a discrete signal triggering, [mV]; **up_hi** – upper limit of a discrete signal triggering, [mV]; **down_low** – lower limit of a discrete signal failure, [mV]; **down_hi** – upper limit of a discrete signal failure, [mV];
Explanation	Allows configuring the operating limits for the external power input.
Example	Request: PowInCfg 10,8000,15000,0,3000 Reply: POWINCFG:FiltLen=10,UpLow=8000,UpHi=15000,DownLow=0,DownHi=3000;

Command format	**AccVal**
Explanation	Obtaining filtered accelerometer mean-square value by three axes. Accelerometer sensitivity: min = 555mV/g; average = 600mV/g; max = 645mV/g; where g is gravitational acceleration ($g \approx 9.8 m/s^2$).
Example	Request: AccVal Reply: ACCVAL = 625 --- AccVal = 0.625V. As it can be seen, the accelerometer is affected by the gravity force only.

10.8 *Transistor output setting*

Command format	**Out v,s**
Parameters	**v** – output serial number (count from the zero output); **s** – desired state (0 – on-state transistor output; 1 –off-state transistor output).
Explanation	Transistor outputs control. Transistor outputs are off by default.
Example	Request: Out 0,1 Reply: OUT(2..0) = 010 All outputs are opened except the first one.

10.9CAN settings

Command format	**CanRegime Mode,BaudRate,TimeOut, DoNotCleanAfterTimeOut**
Parameters	**Mode** – operating mode: • 0 – CAN interface is off and is not used; • 1 – CAN-bus scanner; • 2 – standard FMS filter; • 3 – user filter29 bit; • 4 – user filter 11 bit **BaudRate** – data bus rate. It must be the same as the vehicle data bus rate. It can have the following values: from 10000 up to 500000. Typical values: 62500, 125000, 250000, 500000. **TimeOut** – measured in msec. For CAN_SCANER mode it is response latency. If it is too small, not all bus messages will be received. The recommended time for CAN_SCANER is 2000 msec. For all the rest modes it is time to receive at least one message, otherwise, the value will be set to zero. **DoNotCleanAfterTimeOut** – data should not be set to zero by disconnecting CAN-bus.
Explanation	General CAN-bus control.
Example	Example: switching on scanner for a 250000 b/sec bus with the message (answer) latency, equal to 2 sec. Request: CanRegime 1,250000,2000 Reply: CANREG: Mode=1,BaudRate=250000,TimeOut=2000; DoNotCleanAfterTimeOut=0;

Command format	**ActiveCAN OnOff**
Parameters	**OnOff** – operating mode: 0 – passive mode: packets receiving confirmations are not sent to the CAN-bus. It is a safe mode of operation. It does not interfere with the on-board equipment; 1 – active mode: packets receiving confirmations are sent to the CAN-bus.
Explanation	Control of packets confirmation sending to the CAN-bus. Confirmation sending may be necessary by connection to the troubleshooting socket if the data cannot be read in passive mode.
Example	Request: ActiveCAN 1 Reply: ACTIVECAN:1;

Command format	**CAN8BitR0 ID,Shift**
Parameters	**ID** – captured bus identifier: **Shift** – useful data shift in the received packet
Explanation	Single CAN-tag content control.
Example	Request: Can8BitR 0419360256,1 Reply: CAN8BITR0:ID=419360256,Shift=1;

Commands: **CAN8BitR1, …, CAN8BitR30, CAN16BitR0, …, CAN16BitR14, CAN32BitR0, …, CAN32BitR14** are similar to CAN8BitR0 command.

10.10 Packet transmission, power saving mode, Stels mode settings

Command format: **Stels pday, phours, minutesGSMOn**. See section Stels mode and packet transmission.

10.11 Signaling mode settings

Command format	**SIGN GWTime,DropAlarmTimeout**
Parameters	**GWTime** – duration of the "green wave" which is the time after the signalling starts, during which no sampling of sensors takes place, [sec]; **DropAlarmTimeout** – time in the alarm mode, after which an automatic switching to the alarm mode is performed. By zero, the Terminal will stay in the signalling mode until the command is sent or until it is switched off using the input, [sec].
Explanation	General configurations of signalling.
Example	Request: SIGN 40,60 Reply: SIGN:GWTime=40,DropAlarmTimeout=60 ,UseIB=0;

Command format	**S**
Explanation	Arming.
Example	Request: S Reply: Signaling is enabling

Command format	**DS**
Explanation	Disarming.
Example	Request: DS Reply: Signaling is disabling

Command format	**ST**
Explanation	Signaling state. Possible states: Signaling is disabled – signaling is off, Signaling is enabled – signaling is on, Alarm – alarm mode.
Example	Request: ST Reply: Signaling is disabled

Command format	**AddSigPhone phone[,n]**
Parameters	**phone** – a phone number **n** – an optional parameter, added phone number index.
Explanation	Notification phone setting
Example	Request: AddSigPhone 123456789 Reply: SignPhones 123456789;;;;

Command format	**SGPS type,speed,r,t,sms,ring**
Parameters	**type** – operating mode: • 0 – is not used for signaling; • 1 – switching to alert mode when the specified speed is exceeded; • 2 – switching to alert mode if the vehicle is beyond the radius longer than a predetermined time interval; • 3 – switching to alert mode when the specified speed is exceeded or if the vehicle is beyond the radius longer than a predetermined time interval. **speed** – maximum speed, [km/h]. **r** – maximum radius, [m]. **t** – maximum time interval staying beyond the radius, [s]. **sms** – enables SMS notification: 1 – yes, 0 – no **ring** – enables phone call notification: 1 – yes, 0 – no
Explanation	Setting of the use of GPS data in signaling mode
Example	Request: sgps 1,10,1,10,1,1 Reply: SGPS:SignType=1,Speed=10,R=1,T=10,SMS=0,Ring=0;

Command format	**SIN0 type,delay,sms,ring,photo,msg**
Parameters	**type** – an input mode: • 0 – is not used for signaling; • 1 – input activation results in signaling mode on; • 2 – input activation results in alert mode on if signaling mode is on; • 3 – input activation results in alert mode on even if signaling mode is off. **delay** – post-activation delay before switching to alert mode, [sec]. **sms** – enable SMS notification: 1 – yes, 0 – no **ring** – enable phone call notification: 1 – yes, 0 – no **photo** – take photo: 1 – yes, 0 – no **msg** – alert mode message. The message may contain the parameters, which are replaced by the current data: %IMEI – IMEI of the terminal, %LAT – latitude, %LON – longitude.
Explanation	Setting the behavior of an input in signaling mode.
Example	Request: SIN0 3,0,1,1,Alarm %IMEI Reply: SIN0:SignType=3,Adelay=0, SMS=1,Ring=1,Photo=0,Msg=Alarm %IMEI;

sin1, sin2, sin3 commands are similar to sin0.

Command format	**SACC type,sms,ring,photo,msg**
Parameters	**type** – operating mode: • 0 – is not used for signaling; • 1 – an incline more than the given angle results in Alarm in Signaling mode; • 2 –acceleration exceeding (strike) results in Alarm in Signaling mode; • 3 – both an incline and a strike result in Alarm in Signaling mode. **sms** – enables SMS notification: 1 – yes, 0 – no **ring** – enables phone call notification: 1 – yes, 0 – no **photo** – take photo: 1 – yes, 0 – no **msg** – alert mode message. The message may contain the parameters, which are replaced by the current data: %IMEI – IMEI of the terminal, %LAT – latitude, %LON – longitude.
Explanation	Setting of the use of accelerometer data in signaling mode. Operation thresholds are set by SHOCK command (section Determination of strike and incline)
Example	Request: SACC 2,1,1,0,Strike Reply: SACC:SignType=2,SMS=1,Ring=1,Photo=0,Msg=Strike;

Command format	**SOUT0 EMode,ElmpT,ElmpC,DMode,DlmpT,DlmpC,AMode,AlmpT,AlmpC,ADelay**
Parameters	**EMode –** output operating mode by arming: 0 – no reaction, 1 – output is inverted, 2 – output generates pulses, **ElmpT** – pulse time during Arming, m/sec. **ElmpC** – number of pulses during Arming. **DMode** – output operating mode by Disarming 0 – no reaction; 1 – output is inverted; 2 – output generates pulses. **DlmpT** – pulse time during Disarming, m/sec. **DlmpC** – number of pulses during Disarming **AMode** – output operating mode by Alarm: 0 – no reaction; 1 – output is inverted; 2 – output generates pulses. **AlmpT** – pulse time during Alarm, m/sec. **AlmpC** – number of pulses during Alarm. **ADelay** – activation delay after Alarm mode is on. The device rounds off pulse duration to 0.1 sec
Explanation	Setting the behavior of an output in signaling mode.
Example	Request: SOUT0 2,1,1,2,2,2,1,0,1,20 Reply:SOUT0:EMode=2,ElmpT=1,ElmpC=1,DMode=2,DlmnpT=2,DlmpC=2, AMode=1,AlmpT=0,AlmpC=0,ADelay=20;

sout1, sout2, sout3 commands are similar to sout0.

11 Bootloader

The processor program (firmware) is a set of algorithms developed by RSA "GALILEOSKY", LLC specialists. Owing to this program, the central processor receives data from different system units, processes them logically and mathematically and takes decisions for control commands of controller units to be worked out depending on the situation.
Bootloader is the Terminal`s sub-program allowing the main program part (hereinafter referred to as Firmware) to be updated. The firmware can be downloaded from the official site www.7gis.com . The main program can be downloaded via the USB or GPRS channel.

11.1 USB channel download

1) Connect the Terminal to the external power supply;
2) Connect the USB cable; the device must be defined on the computer;
3) Launch the Configurator and open the Command mode tab;
4) Type in upgrade 0 command after which the Terminal will be reset in 15-20 sec;
5) After resetting the Terminal will enter the bootloader mode, and the device should be defined as the system storage device (flash memory);
6) Download the right firmware version and extract firmware.bin file from the archive;
7) Copy the downloaded version (firmware.bin) to the flash memory;
8) After reflashing the device will be reset and enter the operating mode in 15 seconds.

11.2 GPRS channel download

1) Connect the Terminal to the external power supply;
2) APN settings must conform to the SIM-card, inserted in the Terminal, otherwise, the device flashing will not happen, and the Terminal will return to the operating mode;
   Using any available channel (SMS, GPRS, USB) give the following command: UPGRADE firmware №, where firmware № is the necessary firmware version. UPGRADE 0 initiates downloading the latest firmware;
3) You may see if the flashing is in progress by LEDs blinking;
4) In 15-25 minutes (depending on connection conditions and GPRS terms of service by operator) upgrade will be completed, and the Terminal will automatically turn into operation mode.

11.3 Using analog inputs to enter bootloader mode

After the device power supply is off, energize all analog-discrete inputs (section Contacts description) by applying the voltage of 7.0V ± 0.2V until the Terminal enters the bootloader mode. This function is used only during an improper device flashing. An improper firmware is the firmware designed for devices with the other functions.

11.4 LED operation during reflashing

Depending on the GSM-unit and microcontroller units activation stages, the Terminal will go through the following stages:

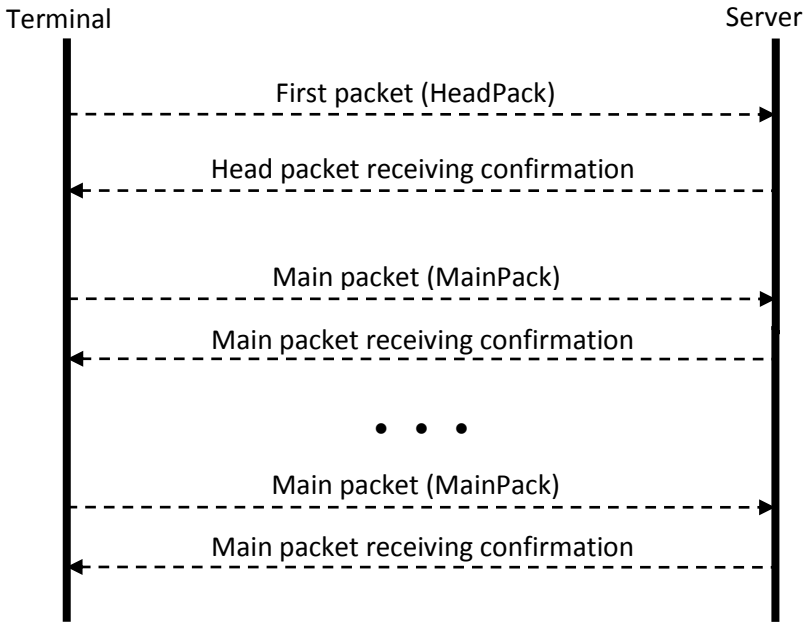
Yellow LED blinking, times	GSM-unit activation stage
6	Procedure of GSM unit activation was successful.
5	GPRS service registration was successfully.
4	Establishing firmware update connection to the server.
3	The Terminal switched to downloading mode.
2	Server connection is not lost, and the Terminal is in downloading mode.
1	First request sending was successful.

Blue LED blinking: each successfully received and recorded packet is accompanied by a blue LED light change.

12 Server exchange protocols

This protocol supports bidirectional data exchange between the terminal and the server. Data are transmitted via GPRS channel with the use of TCP/IP protocol. The server must have static address and port for connecting terminals as clients.

Data transmission from the terminal to the server:



After establishing terminal-server connection the device sends head pack and then main packs with data. Each pack needs confirmation from the server; if confirmation is not received, the terminal sends the pack once again.

Head pack structure:

Field	**Size**
Header 0x01	1 byte
Packet length	15 bites
Indicator of unsent data to the archive	1 bit
Tag 1	1 byte
Data, corresponding to tag 1	depends on the tag type
…	
Tag N	1 byte
Data, corresponding to tag N	depends on the tag type
Checksum	2 bytes

A high-order bit is an indicator of unsent data in the archive, 15 low-order bits is the number of bytes in the packet. Maximum packet length is 1000 bytes.
Transmitted tags are set by HeadPack command. Packet length is calculated from the head tag to checksum beginning. Tags are in ascending order. Data and the checksum are transferred in little-endian format. The checksum is calculated for the whole packet including header, length field and indicator of unsent data. The checksum is calculated by CRC-16 Modbus algorithm, you can find example of its realization in http://www.modbus.org/docs/Modbus_over_serial_line_V1_02.pdf .
Main pack structure is the same as the structure of head pack. Transmitted tags are set by MainPack command. Main pack may transmit several records from the archive. First record's tags go first, then the second record's tag and etc.
Data may be coded; XTEA3 algorithm is used for coding (http://tomstdenis.tripod.com/xtea.pdf) with block length 128 bit, key length 256 bit and 32 rounds.

In this case, the header, length and unsent data indicator stay unchanged, and archives records with the tags are coded. If the data length is not multiple to code block length, missing place is filled with zeros and then coded. The Checksum is calculated for coded data packet.

Field	Size
Header 0x02	1 byte
Received packet checksum	2 bytes

Table 1. Confirmation packet structure

Packet will be transmitted again if its checksum does not correspond to the checksum in confirmation packet.

№	Tag number	Designation	Parameter	
			Length, byte	Format
1	0x01	Hardware version	1	Unsigned integer.
2	0x02	Firmware version	1	Unsigned integer.
3	0x03	IMEI	15	ASCII line.
4	0x04	Device's identifier	2	Unsigned integer.
5	0x10	Number of an archive record	2	Unsigned integer.
6	0x20	Date and time	4	Unsigned integer, seconds since 1970-01-01 00:00:00 GMT
7	0x30	Coordinates in degrees, number of satellites, indication of coordinates determination correctness	9	4 lower bits: number of satellites. The next 4 bits: coordinates determination correctness, 0 – coordinates are correct. The next 4 bytes: signed integer, latitude, the value should be divided by 1000000; negative values correspond to southern latitude. Last 4 bytes: signed integer, longitude, the value should be divided by 1000000; negative values correspond to western longitude. For example, result: 07 C0 0E 32 03 B8 D7 2D 05. Coordinates correctness: 0 (coordinates are correct). Satellites number: 7 Latitude: 53.612224 Longitude: 86.890424
8	0x33	Speed in km/h and direction in degrees	4	2 lower bytes: unsigned integer, speed, the value should be divided by 10. 2 higher bytes: unsigned integer, direction, the value should be divided by 10. For example, result: 5C 00 48 08. Speed: 9.2 km/h. Direction: 212 degrees.
9	0x34	Height, m	2	Signed integer.
10	0x35	HDOP	1	Unsigned integer. The value should be divided by 10.
11	0x40	Status of device	2	Unsigned integer, each bit corresponds to a separate unit state.
12	0x41	Supply voltage, mV	2	Unsigned integer.

№	Tag number	Designation	Parameter	
			Length, byte	Format
13	0x42	Battery voltage, mV	2	Unsigned integer.
14	0x43	Terminal temperature, ºC	1	Signed integer.
15	0x44	Acceleration	4	10 lower bits: acceleration by X axis. Next 10 bits: acceleration by Y axis. Next 10 bits: acceleration by Z axis. 0g = 512, values, which are less than 512 – acceleration, directed against the axis. Scale 1g=186. For example, 326 = -1g, 605 = 0,5g. Example, result: AF 21 98 15. Acceleration X: 431, Y: 520, Z: 345.
16	0x45	Status of outputs	2	Each bit, beginning with the lower one, indicates the state of a correspondent output.
17	0x46	Status of inputs	2	Each bit, beginning with the lower one, indicates triggering on a correspondent input.
18	0x50	Input voltage 0, mV	2	Unsigned integer.
19	0x51	Input voltage 1, mV	2	Unsigned integer.
33	0xc0	CAN-bus or CAN-LOG data (CAN_A0). Fuel, consumed by the vehicle since its creation date, l	4	Unsigned integer, the value should be divided by 2.
34	0xc1	CAN-bus or CAN-LOG data (CAN_A1). Fuel, consumed by the vehicle since its creation date, l	4	Lower byte: fuel level, the value should be multiplied by 0.4. The second byte: coolant temperature, the value should be deducted 40. The third and fourth bytes: engine speed, values should be multiplied by 0.125. Example, received: FA 72 50 25. Fuel level: 100%. Temperature 74ºC. Engine speed: 1194 rmp.
35	0xc2	CAN-bus and CAN-LOG data (CAN_B0). Vehicle`s mileage, m.	4	Unsigned integer, the value should be multiplied by 5.
36	0xc3	CAN_B1	4	
37	0xc4	CAN8BITR0	1	
38	0xc5	CAN8BITR1	1	
39	0xc6	CAN8BITR2	1	
40	0xc7	CAN8BITR3	1	
41	0xc8	CAN8BITR4	1	
42	0xc9	CAN8BITR5	1	
43	0xca	CAN8BITR6	1	
44	0xcb	CAN8BITR7	1	
45	0xcc	CAN8BITR8	1	
46	0xcd	CAN8BITR9	1	
47	0xce	CAN8BITR10	1	
48	0xcf	CAN8BITR11	1	
49	0xd0	CAN8BITR12	1	
50	0xd1	CAN8BITR13	1	

№	Tag number	Designation	Parameter	
			Length, byte	Format
51	0xd2	CAN8BITR14	1	
53	0xd4	Total mileage according to GPS/GLONASS-units data, m.	4	Unsigned integer.
55	0xd6	Depending on settings: 1. CAN16BITR0 2. the 1st vehicle`s axle load, kg 3. failure code OBD II	2	In case the load is on axle, the value is an unsigned integer; values should be divided by 2.
56	0xd7	Depending on settings: 1. CAN16BITR1 2. the 2nd vehicle`s axle load, kg 3. failure code OBD II	2	In case the load is on axle, the value is an unsigned integer; values should be divided by 2.
57	0xd8	Depending on settings: 1. CAN16BITR2 2. the 3rd vehicle`s axle load, kg 3. failure code OBD II	2	In case the load is on axle, the value is an unsigned integer; values should be divided by 2.
58	0xd9	Depending on settings: 1. CAN16BITR3 2. CAN-LOG, N prefix, the 4st axle load, kg 3. OBD II failure code	2	In case the load is on axle, the value is an unsigned integer; values should be divided by 2.
59	0xda	Depending on settings: 1. CAN16BITR4 2. CAN-LOG, O prefix, the 5th axle load, kg 3. OBD II failure code	2	In case the load is on axle, the value is an unsigned integer; values should be divided by 2.
60	0xdb	Depending on settings: 1. CAN32BITR0 2. CAN-LOG, A or B prefix, total time of engine operation, h	4	In case the time of engine operation is transmitted, the value is an unsigned integer; values should be divided by 100.
61	0xdc	Depending on settings: 1. CAN32BITR1 2. CAN-LOG, R prefix, fuel level, l	4	In case the fuel level is on CAN-LOG, the value is an unsigned integer; values should be divided by 10.
62	0xdd	Depending on settings: 1.CAN32BITR2 2. CAN-LOG, user prefix	4	
63	0xde	Depending on settings: 1.CAN32BITR3 2. CAN-LOG, user prefix	4	
64	0xdf	Depending on settings: 1.CAN32BITR4 2. CAN-LOG, user prefix	4	
129	0xA0	CAN8BITR15	1	Accessible only by a dynamic archive structure
Tags CAN8BITR16 - CAN8BITR29 (0xA1-0xAE) similar to CAN8BITR15 with numbers 130-143				
144	0xAF	CAN8BITR30	1	Accessible only by the dynamic archive structure
145	0xB0	CAN16BITR5	2	Accessible only by the dynamic archive structure
Tags CAN16BITR6 – CAN16BITR13 (0xB1-0xB8) similar to CAN16BITR5 with numbers 146-153				
154	0xB9	CAN16BITR14	2	Accessible only by the dynamic archive structure
161	0xF0	CAN32BITR5	4	Accessible only by the dynamic archive structure
Tags CAN32BITR6 – CAN32BITR13 (0xF1-0xF8) similar to CAN32BITR5 with numbers 162-169				
170	0xF9	CAN32BITR14	4	Accessible only by the dynamic archive structure

№	Tag number	Designation	Parameter	
			Length, byte	Format
174	0x47	EcoDrive and driving style determination	4	Accessible only by the dynamic archive structure. Unsigned integer. Lower byte: acceleration. The second byte: braking. The third byte: cornering acceleration. The fourth byte: strike on bumps. All accelerations are expressed in standard units, 100 = 1g = 9,8 m/s2

Table 2. GalileoSky protocol tag

Bit number	Field explanation
0	0 – vibration level corresponds to parking; 1 – to driving (set by AccSens command).
1	0 – incline angle does not exceed the allowable one, 1 – incline level exceeds the allowable one.
2	---
3	0 – there is a SIM-card, 1 – GSM unit can't determine the SIM-card.
4	---
5	0 – voltage of internal source is normal; 1 – lower than 3.7 V.
6	0 – GPS aerial is connected; 1 – disconnected.
7	0 – voltage of internal Terminal bus supply is normal, 1 – declined from normal.
8	0 – external supply voltage is normal, 1 - declined from normal.
9	0 – vehicle is stopped; 1 – vehicle is started (set by mhours command).
10	0 – vibration level corresponds to normal movement, 1 – vibration level corresponds to a strike.
11	0 – GPS is activated; 1 – GLONASS unit is activated.
12	Signal quality, range: [0-3]. The less value, the worse communication.
13	
14	0 – Signaling mode is off; 1 – on.
15	0 – There is no alarm; 1 – Alarm is activated.

Table 3. Device status field explanation

Example1.
The Terminal should be configured so that the head pack (HeadPack) contains information about the Terminal version (HardVersion), firmware version (SoftVersion), unique 15 digit GSM-unit identifier (IMEI), Terminal`s user ID (ID device).
Correspondent tag mask: 00000000000000000000000000001111.
To apply the settings we should use the following command
HeadPack 00000000000000000000000000001111, or omitting zeros, HeadPack 1111

Example 2.

It is necessary to configure the main packet (sent in normal mode) so that the Terminal user ID (ID device), packet number (NumberOfPacket), date and time of packet record (TimeDate), coordinates are sent.

Correspondent tag mask: 00000000000000000000000001111000

To apply the settings we should use the command: MainPack 1111000.
In this case, zeros have been omitted at once.

The server can send commands to the device. After command receiving and its successful execution, the terminal sends a packet with text reply.

Structure of a packet with a command:

Field	**Size**
Header 0x01	1 byte
Packet length	2 bytes
Tag 0x03	1 byte
IMEI	15 bytes
Tag 0x04	1 byte
Device identifier	2 bytes
Tag 0xE0	1 byte
Command number, random number selected by the server	4 bytes
Tag 0xE1	1 byte
Command line length	1 byte
Command text in ASCII	
Checksum. Calculated for the whole packet beginning with the header.	2 bytes

Respond's structure is analogous to the command's packet, but reply text is sent instead of command text.

13 Additional information

1. **Certifying**

The Terminal is certified to comply with GOST R.

2. **Warranty**

RSA "GALILEOSKY", LLC hereby guarantees the realization of consumers' rights provided by the local laws throughout Russia and the CIS.

RSA "GALILEOSKY", LLC guarantees the operability of the terminal subject to compliance with the instructions set out in the above user`s manual.

2.1. Warranty conditions

The warranty period is 24 months since the day of purchase.

Note: a defective terminal (with cracks and fissures, dents and impact marks etc.) due to consumer's fault resulting from inappropriate maintenance, storage and transportation is not liable to warranty. The above also holds for a device without the body or battery.

In case the guarantee document proving the device sale to the customer does not contain the date of purchase, the name and seller's seal the warranty period starts since the day of production.

The consumer has the right for free maintenance in the manufacturer's service centre if a production or design defect appeared during the warranty period. The consumer has the right for maintenance during the whole period of operation of the device. The consumer has all the other rights provided by the laws of the Russian Federation and the CIS.

If the failure cause cannot be found at the moment of appeal, a technical examination is held which cannot exceed 30 days since the moment of appeal.

The warranty does not apply in case of:

- Inappropriate transportation, storage or maintenance;
- Unauthorised opening the device during the warranty period;
- Repairing controller by someone or some organization not authorised by GalileoSky during the warranty period;
- Signs of electrical and/or other damage due to prohibitive mains parameter changes, misapplication and neglect of the device;
- Physical damage of the device body and board, SIM holder, aerials or wires break;
- Traces of oxidation of outer and inner parts or exposure of the device body to moisture;
- Theft or criminal damage of the external aerial or cable;
- Damages caused by foreign objects, substances, liquids, insects coming into body;
- Damage caused by exposure to high temperature or intense microwave radiation;
- Damage caused by elemental forces, fire, social factors, random external factors and accidents;
- Damage caused by parameters incompatibility or inappropriate attachment of additional devices or sensors to the terminal;
- Operation of the terminal by the vehicle network voltage deviating from the range mentioned in technical specifications.
- Connection socket, contacts and SIM-holders are not covered under warranty.
- Warranty period for aerials – 6 (six) calendar months from the moment of realization note in device passport, but not more than 8 (eight) calendar months from the moment of device shipping to the Buyer from the Manufacturer storage included in delivery note.
- Warranty period for a processor, GSM module, GLONASS/GPS module – 34 (thirty-four) calendar months from the moment of realization note in device passport, but not more than 36 (thirty-six) calendar months from the moment of device shipping to the Buyer from the Manufacturer storage included in delivery note.

Attention! The manufacturer shall in no case be liable for claims concerning the damages or loss of the data exceeding the cost of the product, as well as claims for incidental, special or consequential damages (including in each case, without limitation, damages for inability to use the equipment, loss of the data, loss of business, loss of profit, loss of savings, loss of time), arising out of the use or inability to use the equipment within legal limits.

Attention! The Warranty does not affect the statutory rights of the consumer such as the guarantee of satisfactory quality of work or conformity of the product to the purpose for which analogous products are used under normal conditions and service maintenance and also your rights with regard to the seller of the product resulting from the fact of purchase and contract of sale and purchase.

Attention! Terms of Warranty service which are in conflict with the current law have no legal effect and are subject to the current law.

Attention! If the Purchaser fails to comply with the Terms of Warranty, the validity of the Warranty is void.