



NEOMATICA

**Vehicle tracker ADM333
GLONASS/GPS-GSM/GPRS**

Operation manual

Edition 2.0

EAC

Neomatica, +7(342) 211-15-00 ext.42, <https://neomatica.com>

Content

| | |
|---|-----------|
| 1 Purpose and function | 5 |
| 2 Technical specifications | 6 |
| 3 Design | 8 |
| 3.1 Disassembling and assembling of the housing | 9 |
| 4 Installation | 10 |
| 5 Tracker setting | 11 |
| 5.1 Connection to ADM configurator | 11 |
| 5.2 Using configuration commands..... | 12 |
| 5.3 Configuring SIM | 13 |
| 5.4 Setting connection to the server..... | 14 |
| 5.5 Setting data transmission..... | 14 |
| 5.5.1 Dynamic black box..... | 15 |
| 5.6 Setting route (track) drawing | 15 |
| 5.6.1 Selecting presets of route drawing quality..... | 15 |
| 5.6.2 Expert setting of tracking parameters..... | 16 |
| 5.7 Alarm mode of data record..... | 18 |
| 5.8 Setting the fixation (freezing) of coordinates during the parking | 18 |
| 5.8.1 Coordinates fixation according to ignition..... | 18 |
| 5.8.2 Coordinates fixation according to vibration level | 19 |
| 5.9 Operation mode | 19 |
| 5.9.1 “Tracker” operation mode..... | 19 |
| 5.9.2 “Beacon” operation mode..... | 20 |
| 6 Connection of extra devices | 20 |
| 6.1 Analogue inputs | 20 |
| 6.2 Discrete output..... | 21 |
| 6.3 RS-485..... | 23 |
| 6.3.1 Connection of digital fuel level sensor..... | 23 |
| 6.4 1-Wire | 24 |
| 6.4.1 Connection of temperature sensors | 24 |
| 6.4.2 Connection of iButton..... | 25 |
| 6.5 Connection of devices via Bluetooth Low Energy | 25 |
| 6.5.1 Connection of BLE sensors..... | 26 |

| | |
|---|-----------|
| 6.5.2 Adding BLE sensors in automatic mode | 26 |
| 6.5.3 Adding sensors ADM31, ADM 32 in manual mode, viewing added sensors list | 28 |
| 6.5.4 Adding BLE fuel level sensor in a manual mode, viewing added sensors list | 30 |
| 7 Data transmission to the server from connected sensors | 32 |
| 7.1 Description of ADM31 sensors parameters transmitted to the server | 32 |
| 7.1.1 Conversion of incoming data at the server side | 32 |
| 7.2 Selecting data to be transmitted to the server from ADM31/32 sensors | 34 |
| 7.3 Selecting the transmission format of the illumination level | 34 |
| 8 Commands description | 36 |
| 9 Updating tracker software | 46 |
| 9.1 Updating tracker software via ADM Configurator | 46 |
| 9.2 Updating tracker software via ADM Configurator using a firmware file | 46 |
| 9.3 Updating the tracker software via GPRS | 47 |
| 10 Handling and transportation regulations | 47 |
| 11 Warranty obligations | 47 |
| 12 Marking and packaging | 48 |
| 13 Disposal | 48 |
| 14 Scope of supply | 48 |
| 15 Acceptance certificate | 48 |
| Appendix A. Description of the bits of the field «STATUS» | 49 |
| Appendix B. Description of transmitted parameters in Wialon | 50 |

This Operation manual relates to the vehicle tracker ADM333 (hereinafter referred to as tracker) and describes the procedure of its installation and connection as well as its function and settings.

The Operation manual is designed for professionals who have familiarized themselves with the rules of repair and installation works execution in vehicles and who have special professional knowledge in electronic and electric equipment used on various transport means.

The tracker proper work can be guaranteed if it is installed and set by qualified professionals. To use the tracker properly it is necessary to familiarize with the monitoring system work principles in general and to understand the function of all its components. For this reason, it is strictly recommended to get basic knowledge on GLONASS and GPS global navigation satellite systems functioning, GSM network, issues related to data transmission by means of short message service (SMS), GPRS and Internet.

1 Purpose and function

The tracker is intended for installation on a vehicle as an additional device that records the location of the vehicle, its speed, and travel direction. View of the tracker is shown in Figure 1.

Additionally, the voltage level at the analogue inputs and data received from supported sensors connected via radio channel Bluetooth Low Energy, RS-485 and 1-Wire interfaces. All events and conditions fixed by the tracker are stored in its non-volatile memory.

The accumulated data is transmitted through the GSM 850/900/1800/1900 cellular network operator using packet data transmission technology GPRS to a dedicated server with a static IP address or domain name from which it can be received via the Internet for further analysis and processing in a monitoring center.

The tracker can be configured in any convenient way: locally (via Bluetooth, using the ADM Configurator (hereinafter referred to as Configurator) or remotely (by sending commands via SMS or GPRS).

To ensure data security, when the external power is turned off and the GSM network is lost, the tracker has a non-volatile memory. Data transmission is possible only if there is a GSM 850/900/1800/1900 cellular network supporting a packet data service (GPRS).



Figure 1 – View of the tracker

The vehicle travel route is described in the form of separate points in time. The route point is saved when at least one event occurs, such as:

- travel direction changes by an angle which is greater than the pre-set one;

- the straight-ahead travel is performed at a distance, which is longer than the pre-set one;
- the pre-set acceleration limit is broken;
- the time for putting the point while traveling (parking) is expired;
- device status change (description is given in [Appendix A. Description of the bits of the field «STATUS»](#));
- an event occurs at analogue input.

In this way, route points might be saved with the time interval from one second to several minutes allowing for a quality routing, recording any changes without a surfeit of information saved in the “black box” and increase in GPRS traffic.

After connection to the power supply, the tracker starts receiving data from GLONASS and/or GPS satellites, locating itself, identifying time, speed, travel direction, and in case of GSM network availability establishes connection with the server. After connection to the server, the tracker transmits the data packets with the pre-set frequency or when an event occurs. If for any reason the connection to the server fails, all the information will be saved in the tracker non-volatile memory and transmitted as soon as the connection is restored.

If there is no signal from GLONASS and/or GPS satellites and there is GPRS connection the time is synchronized via NTP protocol with one of the available public servers. The points will be recorded without data about location.

Data transmitted by the tracker:

- GMT date and time;
- coordinates (latitude, longitude, altitude);
- speed, acceleration and travel direction;
- number of satellites when fixing a navigation problem;
- precision loss factor in a horizontal plane;
- voltage values at analogue inputs
- data about events occurred;
- device status;
- data from the sensors connected via radio channel Bluetooth Low Energy;
- data from the sensors connected to RS-485 and 1-Wire.

2 Technical specifications

- GLONASS/GPS receiver:
chipset: MT3333 (MediaTek);

frequency bands: GLONASS – L1 (CT-code), GPS - L1 (C/A code);

sensitivity in cold start/tracking, dBm: -149/-167;

number of tracking/picking-up channels: 33/99;

positioning precision, 95% of time, not worse: 3 m.

- Connection standard: GSM 850/900/1800/1900, GPRS Multi-slot Class 12.
 - GSM transmitter power: 2 W.
 - Number of SIM-cards, form factor: 2, nano-SIM (4FF).
 - Number of analogue inputs: 2.
 - Analogue inputs features:
 - voltage measurement range: 0...58,8 V;
 - discreteness (sensitivity): 57,4 mV;
 - input resistance: 200 kOhm.
 - Number of discrete outputs of “open collector”: 1.
 - Characteristics of discrete output of “open collector” type:
 - maximum voltage – 45V;
 - maximum commutated current – 100mA.
 - Interface RS-485: 1.
 - Interface 1-Wire: 1.
 - Acceleration meter: digital, triaxial.
 - Battery: Li-Pol 250 mA/h 3.7V (0,9 W/h).
 - Number of route records: up to 63000.
 - PC connection interface: Bluetooth.
 - Connection interface with wireless sensors: Bluetooth Low Energy.
 - Operation temperature:
 - with a battery: - 20...+60°C;
 - without a battery: - 40...+85°C.
- Power voltage: +8...+45 V of unregulated direct current.
- Current consumption (at the supply voltage 12 V):
 - maximum: 200 mA;
 - average: 30 mA.- Dimensions: 55x49x20mm;
- weight: not more than 39 g.

3 Design

Functionally, the tracker consists of a microcontroller, non-volatile memory, a combined GLONASS/GPS-, GSM-, Bluetooth module, digital interface RS-485, digital interface 1-Wire, a battery, analog inputs, and a discrete output.

The GLONASS/GPS unit of the combined module is designed to receive signals from the GLONASS/GPS satellites and determine the geographical coordinates of the receiver antenna (latitude, longitude and altitude), as well as the exact time (GMT), speed and direction of travel.

GSM/GPRS unit of the combined module performs the following functions:

- establishment and maintenance of outgoing TCP/IP connection (data reception and transmission in GPRS mode);
- reception and sending SMS messages.

For information transmission, the GSM/GPRS unit of the combined module establishes and maintains connection to the server, periodically transmitting information packets. The periods of data transmission to the server during the parking and during the movement of the vehicle are different and can be changed by user.

Bluetooth unit of the combined module provides connection to the PC, wireless information exchange between the tracker and the ADM Configurator as well as data receipt from wireless sensors.

To display the operating status, the tracker has got 2 LED indicators: green and blue

The green LED indicates the status of the GLONASS/GPS unit of the combined module:

- flashes three times– the GLONASS/GPS unit is on, but there is no data from it;
- flashes twice – data from the GLONASS/GPS unit received, but the coordinates are invalid;
- flashes once – the GLONASS/GPS unit has determined the time and the valid coordinates.

The blue LED indicates the status of the GSM/GPRS unit of the combined module:

- flashes three times - the GSM/GPRS unit is disabled for re-initialization;
- flashes twice - the GSM/GPRS unit is on, but there is no connection to the server;

- flashes once - the tracker has established connection to the server and successfully transmits the information packets;
- constantly shines, briefly turning off - SIM card is not available.

The scheme of tracker connector pins is given in Fig. 2

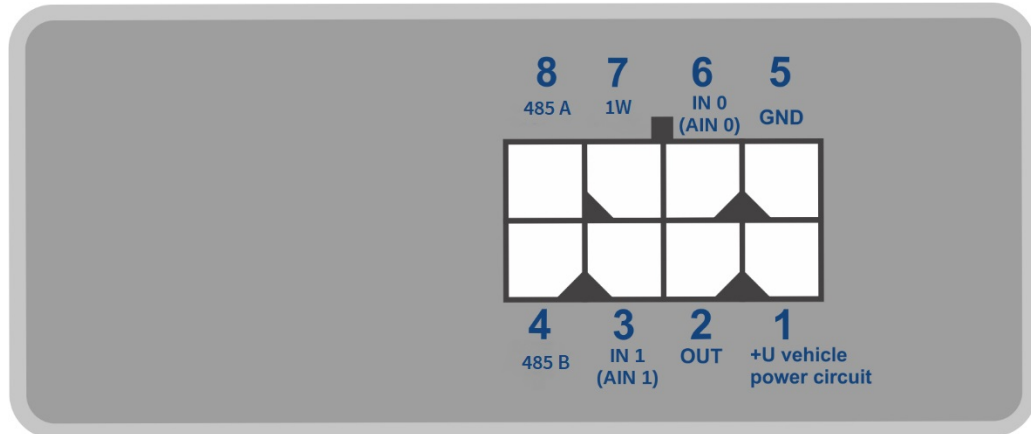


Figure 2 –Scheme of pins location

3.1 Disassembling and assembling of the housing

There are logo and LEDs on the upper part of the housing.

There is a sticker with marking on the lower part of the housing.

- **The disassembling should be done as follows:**

- 1) Place the housing on a solid surface in such a way the logo to be upwards
- 2) Insert a card into the gap at the angle of 45 degrees until the housing starts splitting
Do not split two parts of the housing at this stage.
- 3) Insert a card into the gap from the other side of the housing at the angle of 45 degrees until the housing starts splitting.
- 4) Take off the lower part of the housing
- 5) Bending two latches of any side of the housing, lift the scheme up and gently remove it without damaging the wires and the built-in battery.

- **The assembling should be done in the reverse order:**

- 1) Make sure the wires of the battery are not squeezed and then install the scheme.
- 2) Pressing to the scheme alternately from both the sides, clamp the scheme holders
- 3) Install the upper part of the housing.

4 Installation

It is strongly recommended to carry out a preliminary check of the tracker before installation, using a power supply different from the vehicle on-board power, with an output voltage from 8 V to 40 V DC and current of at least 1 A.

The internal GLONASS/GPS and GSM antennas are used in the tracker, which allow its installation almost in any place of the vehicle. However, it is not recommended to install it in the places where the received signals will be attenuated by the vehicle metallic housing, since this may affect the tracker working quality. For a proper function of the receiver GLONASS/GPS, put the tracker so that its sticker is directed upwards.

Insert into the holder a SIM card SIM0 with a deactivated PIN code request, activated data transmission service via GPRS, SMS and sufficient balance for these services.

Supply the power to the tracker according to the layout in Figure 3 and the scheme of pins location in Figure 2. When connecting the plus of the vehicle network to the tracker, install a 2A fusible as close as possible to the point of connection to the vehicle network, which is especially important when connecting directly to the battery clamp.

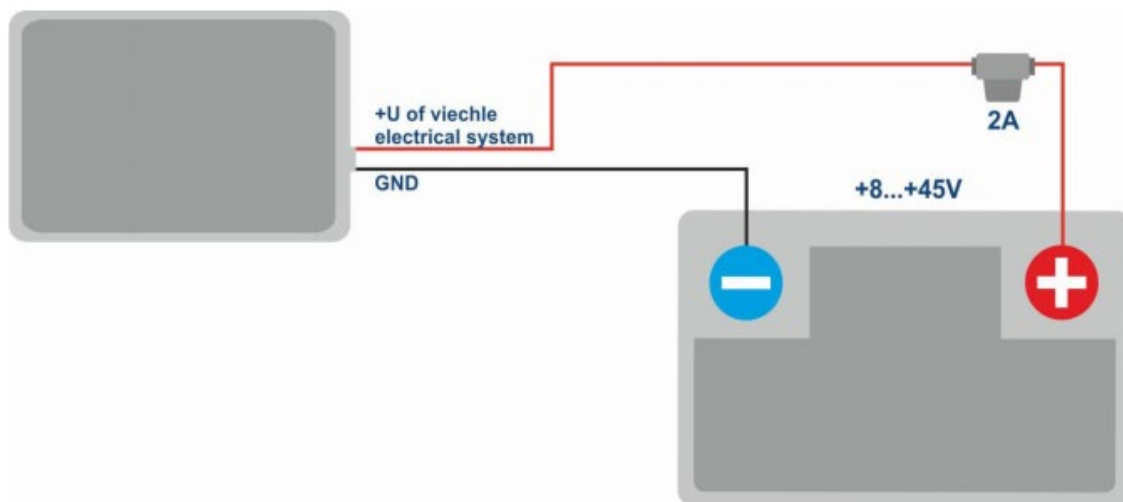


Figure 3 – Standard connection layout of the tracker

If there are valid satellite data and an established connection to the server, the tracker will catch the time, coordinates and transmit information packets to the server, which will be marked by a single flashing of the green and blue LEDs.

5 Tracker setting

5.1 Connection to ADM configurator

To connect the ADM333 tracker to a personal computer using Bluetooth wireless technology, do the following:

- 1) Bring the Bluetooth adapter of the PC to the working state;
- 2) Start the ADM Configurator program of the version 2.5.0 or later (available for loading in website <http://neomatica.com>);
- 3) Switch the ADM Configurator to the Bluetooth radio connection mode. To do this, you need to select the way to connect the device by clicking on the Bluetooth icon in the upper left corner of the ADM Configurator, as shown in Figure 4;



Select method of device connection

Figure 4 - ADMConfigurator: choosing how to connect the device

- 4) Supply power to the tracker;
- 5) If there are several active trackers within the reach of the Bluetooth adapter of the personal computer, select the "Select device" flag and enter the last 4 digits of IMEI as shown in Figure 5. If there is only one tracker within the reach of the Bluetooth adapter of the personal computer it is possible to remove "Select device" flag. In such a case a random tracker from all the detected ones will be connected.



Select the device

Waiting for device connection



Figure 5 – ADM Configurator waiting for device connection

- 6) After a few seconds the connection between the tracker and the ADM Configurator program will be installed and the settings window will be displayed;
- 7) After the device is set or, if connection of another tracker is required, click "disable device" in the upper right corner of the ADM Configurator. The ADM Configurator will go into a standby mode as shown in the Figure 6.

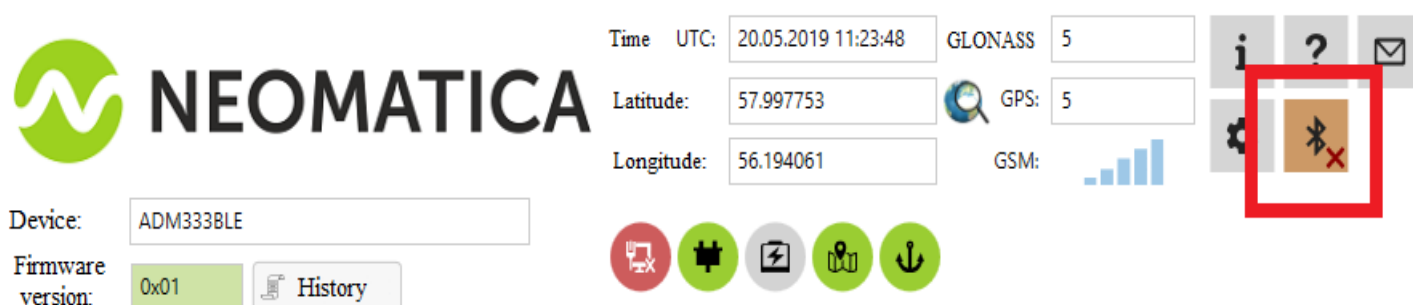


Figure 6 – ADM Configurator: “disable device button”

5.2 Using configuration commands

The tracker is managed by commands sent via SMS, GPRS or Bluetooth. Commands syntax is the same for any way of transmission.

General rules of writing and sending commands:

- only Latin characters and punctuation can be used in commands;
- character case does not matter;
- commands transmission syntax is the same for SMS, GPRS and Bluetooth;
- commands syntax: «CMD X1,X2,X3», where CMD is a command, X1..X3 are commands parameters;
- commands are separated by a SPACE. Parameters are separated by commas, **except** for the **DNO** command which parameters are separated by a colon;

After receiving a command, the tracker performs it and sends a feedback.

If the command parameters extend beyond the acceptable range, the tracker changes them to the nearest acceptable values. If it is not possible to change parameters or parameters are not enough, the tracker will answer with an error message. A command without parameters returns the current settings.

- **Sending commands using ADM Configurator**

To send commands via Bluetooth you should use ADM Configurator. If earlier the tracker under configuration had a password different from 0, then ADM Configurator will ask for the password.

- **Sending commands using SMS**

To manage the tracker using SMS, it is necessary to send the SMS command "**ADD ME 0**" to the number of the SIM card installed in the tracker, where 0 (zero) is the default password (if the password has been changed, you should enter it instead of 0). The phone number from which this command was sent will be authorized in the tracker. The authorization is done only once, afterwards the tracker saves the phone number in a non-volatile memory during the whole service life. Maximum quantity of saved phone numbers is 4. Resetting the settings to the factory ones clears all phone numbers.

- **Sending commands using TCP connection**

To configure via GPRS, authorization is not required. The tracker receives the commands from the server via TCP-connection that is used for data transmission.

5.3 Configuring SIM

Enter parameters of the access point name (APN) in the ADM Configurator graphic interface for the installed SIM cards or use commands **SETGPRS0** and **SETGPRS1**, the final digit in a command name corresponds to the phone number of a holder's SIM card.

If the installed SIM card/cards is/are with enabled PIN -code, then enter this PIN-code in the ADM Configurator graphic interface or use commands **PIN0** and **PIN1**, the final digit in a command name corresponds to the phone number of a holder's SIM card. This PIN-code will be automatically entered each time a Sim card initialization is required.

There is an opportunity to select a priority SIM card when using two Sim cards. If the priority is set, then the tracker connecting to the server using a non-priority SIM card, will work via it for 30 minutes, then will switch to the priority one and, if the connection to the server is established, will work via it without time limit. The priority is set in the graphic interface of the ADM Configurator or using **SIMPRIORITY** command. By default, priority is not set.

5.4 Setting connection to the server

Configure the IP address and port of the server (host) using «**SETHOST0**» or "**DN0**" command.

Change of these parameters is possible in the graphical interface of the program "ADM Configurator".

5.5 Setting data transmission

Navigation data and data received from different sensors being transmitted from the tracker to the server, are divided on data blocks. Depending on the functionality used, it is necessary to activate the transmission of the necessary data blocks.

The configuration can be performed in the graphical interface of the Configurator in the Settings\Server window.

The setting is done in the graphic interface of the ADM Configurator or by **PROTOCOL** command.

Table 1 shows the correspondence of data blocks to the values of **PROTOCOL** command. If you need to transfer data from several blocks, the parameter of the PROTOCOL command is calculated by adding. To save the traffic it is recommended to set only the transmission of necessary data blocks.

For example:

Main data (0) +analogue inputs (8) +fuel level sensors (32) = PROTOCOL 40

Table 1. Values of the main parameters for PROTOCOL command

| Data block name | | Parameter value |
|---------------------------|-----------------|-----------------|
| Main data | NAVIGATION DATA | 0 |
| Outputs, events in inputs | OUTS | 4 |
| Analogue inputs | IN_A | 8 |
| Fuel level sensors | FUEL | 32 |
| - | - | - |
| 1-Wire | OW | 128 |
| CAN-LOG | CANLOG | 512 |
| Modbus | MODBUS | 1024 |
| ADM20/21 | ADM20 | 2048 |
| ADM BLE sensors | ADM3X | 4096 |
| BLE beacons | BEACON | 8192 |

5.5.1 Dynamic black box

The tracking device saves in a black box (non-volatile memory) only those data blocks that are selected for sending to the server. The number of records stored in the memory depends on the number of data blocks being transferred. To increase the number of stored records, do not activate unnecessary data blocks.

Information about the number of saved records with the current settings can be found in the configurator interface. To do this, open the Settings\Server window.

Also, this information can be requested with the **FLASHSTAT** command, in the response, the number of records is displayed in the **cap** field.

5.6 Setting route (track) drawing

5.6.1 Selecting presets of route drawing quality

To facilitate the process of setting the route drawing quality there are several factory presets. The preset can be selected in ADM Configurator (version 2.4.5 at least) or by **TRACKSET** command. The presets contain several sets of parameters. In total 5 presets are available. All presets allow to get a drawing of the travel path, the differences are in the degree of route details. The more detailed route is the more route points will be transmitted to the server, this increases the traffic consumption. Less detailed route reduces traffic consumption.

- **TRACKSET command description:**

TRACKSET X

X –number of route drawing preset

X = 0..4

In response a total list of set parameters will be displayed.

Answer example: TRACK 4,1000,100; (1):3,5; (2):3,5; (3):3,5

Command without parameters displays current route settings.

- **Presets description:**

TRACKSET 0

Satisfactory tracking quality, money-saving variant as regards route points and traffic consumption. The quality is enough to monitor the movement path. The drawing of road turns is simplified. Slight route changes are not drawn (expected points per km are twice less than in preset 2).

TRACKSET 1

A good tracking quality. The drawing of slight changes of direction and road turns is simplified (expected points per km are 1.3 times less than in preset 2)

TRACKSET 2

Set by default. A good tracking quality. The variant suits to the most of tasks. Is an average variant as regards tracking drawing quality and traffic consumption. Slight direction changes and road turns are drawn with details.

TRACKSET 3

Slight changes in direction are drawn with more details (expected points per km are 1.3 times more than in preset 2)

TRACKSET 4

High tracking detalization. Slight changes in direction are drawn with many details. (expected points per km are 1.6 times more than in preset 2).

5.6.2 Expert setting of tracking parameters.

It is recommended to use this method of setting only if none of the presets fit the task. The change of these parameters can lead to an increase of traffic consumption or to a decrease of the route drawing quality.

• Setting using TRACK command

To set all the parameters send TRACK command twice. The degree of road turns detalization is set by sending TRACK command with three parameters. Command format: TRACK M,A,B

The threshold values of additional circumstances of route points drawing in movement are set by sending TRACK command with four parameters. Command format: TRACK 255,X,Y,Z

• Setting the degree of road turns drawing detalization. Setting threshold values of angle change and deflection.

A route point is drawn when the threshold values are exceeded.

TRACK M,A,B

M – number of speed mode.

M=255 – apply same parameters for all the modes

M=0 – slow movement

M=1 – medium -speed movement

M=2 – fast movement

A – angle for speed mode with M number.

B – deflection for speed mode with M number.

The threshold values of angle change and deflections are set separately for three speed modes. If same values should be set for all speed modes then the command should be sent once, M parameter in this case equals to 255. If different threshold values should be set for three speed modes then the command should be sent 3 times, choose speed mode using M parameter.

Example

- **Setting same parameters for all speed modes:**

TRACK 255,10,6 – Set 10 degrees for the threshold value of route change and 6 for deflection

- **Setting different parameters for all speed modes:**

TRACK 0,20,7 – Set 20 degrees for the threshold value of route change and 7 for deflection of slow speed mode.

TRACK 1,10,6 – Set 10 degrees for the threshold value of route change and 6 for deflection of medium speed mode.

TRACK 2,5,6 – Set 5 degrees for the threshold value of route change and 6 for deflection of fast speed mode.

- **Setting minimum speed, distance and acceleration.**

If the set threshold values are exceeded, a route point will be recorded.

TRACK 255, X,Y,Z – First parameter should always be equal to 255. For all speed modes these parameters are the same.

X – minimum speed

Y – distance (meters)

Z – acceleration (km/h per second)

- **Viewing set parameters**

TRACK – Display current settings.

The response displays minimum speed, distance, acceleration, angle and deflection for three speed modes.

Response format: TRACK X,Y,Z; (M) A1,B1; (M) A2,B2; (M) A3,B3

X – minimum speed

Y - distance (meters)

Z - acceleration (km/h per a second)

M=0 – slow movement

M=1 – medium speed movement

M=2 – fast movement

A – angle for speed mode with M number

B – deflection for speed mode with M number

Answer example: TRACK 4, 1000,

5.7 Alarm mode of data record.

The tracker switches to the alarming mode of data record when the sensors data are beyond the set range. Such a mode does not affect other conditions of routes record.

Drawing of the tracking routes stays a priority. If other conditions for route points record are not performed then the points will be recorded according to the alarm period.

Such a function allows fixing the moment when sensor values are beyond the acceptable range as well as recording in more details the values changes outside the allowed range.

- **Setting the period of route points record at the alarm mode.**

ALARMPERIOD X

X – period of route points drawing in seconds

Command without parameters shows the set value

5.8 Setting the fixation (freezing) of coordinates during the parking

The margin of error in coordinates determination might cause a slight coordinates dispersion (GPS drifts) during a long-term parking of the vehicle. To prevent this effect the coordinates freezing function might be applied in the beginning of the parking. This mode is enabled automatically when the discrete level is changed at the analog input or when there is no vibration. Location fixation (freezing) according to the vibration values is chosen by default. It is impossible to use simultaneously two ways of coordinates fixation. The tracker fixes the coordinates according to the last mode.

5.8.1 Coordinates fixation according to ignition

To enable the fixation coordinates function when the vehicle ignition is switched off, it is necessary to connect to the analogue input a circuit being under voltage when the ignition is on. Activation of this mode and selection of the input are made by the **"INSTATIC"** command. For this analogue input it is necessary to activate a discrete working mode and set values range of the voltage level for the logical «1» **«INTRUE»** and the logical «0» **«INFALSE»**. Then choose the mode of coordinates fixation according to ignition and a number of the input the ignition is

connected to. In this way, when the ignition is off, an event will be formed at the input and the coordinates fixation will be initiated.

- **Examples of using INSTATIC command:**

Coordinates fixation at 0 on input AIN0 **INSTATIC 0,0**

Coordinates fixation at 0 on input AIN1 **INSTATIC 1,0**

The function is disabled by «**INSTATIC 255**» command

5.8.2 Coordinates fixation according to vibration level

In such a mode coordinates fixation is done automatically at the absence of vibration. Current level of vibration (a sum of acceleration on three axes) is determined by the acceleration meter. If the vibration level is below the threshold within 10 seconds (by default) the coordinates are fixed.

The function is enabled by **ACCELSTATIC 10** command.

The function is disabled by **ACCELSTATIC 255** command.

5.9 Operation mode

The tracker has got two modes of routes record: «Tracker» and «Beacon». The working mode is set by **BMODE** command. Mode “Tracker” is set by default.

BMODE X

X=0 – «Tracker» mode.

X=1 – «Beacon» mode.

5.9.1 “Tracker” operation mode

This mode is used to create (draw) exact path of travel.

The routes record is done using all possible criteria:

- change of speed;
- acceleration threshold exceeding;
- distance passage;
- direction change;
- regarding the period of movement;
- regarding the period of parking;
- at tracker start up;
- change of discrete state at input;

- change of device status

5.8.2 “Beacon” operation mode

This mode is used to record routes at a given time period and is not suitable for the creation of exact path of travel. Time period of routes record equals to the period of routes record while parking. The routes record is done only using the following criteria:

- at tracker start up;
- change of discrete state at input;
- regarding the parking period;
- regarding alarming period;
- change of device status

6 Connection of extra devices

6.1 Analogue inputs

The analog inputs IN0 and IN1 can be used to connect analog type sensors and voltage measurement, and can also be interpreted as discrete.

Voltage measurement range: 0...58.8 V.

Discreteness (sensitivity): 57.4 mV.

Minimum input resistance: 200 kOhm.

It is forbidden to apply voltage exceeding the upper limit of the measuring voltage range

If it is necessary to record a certain voltage level, for example, in the ignition switching circuit, activate discrete operation mode and set values of voltage level for the logical “1” with the **INTRUE** and for the logical “0” with **INFALSE**

Description of the commands:

INFALSE IN, X0, Y0

IN - number of the analog input (always specify 0)

X0 - the lower limit of the logical "0" voltage range (fixed value 0mV)

Y0 – the upper limit of the logical "0" voltage range (variable value)

INTRUE IN, X1, Y1

IN - number of the analog input (always specify 0)

X1 - the lower limit of the logical "1" voltage range (variable value)

Y1 - the upper limit of the logical "1" voltage range (fixed value of 60000 mV). When entering these commands, the voltage must be specified in millivolts.

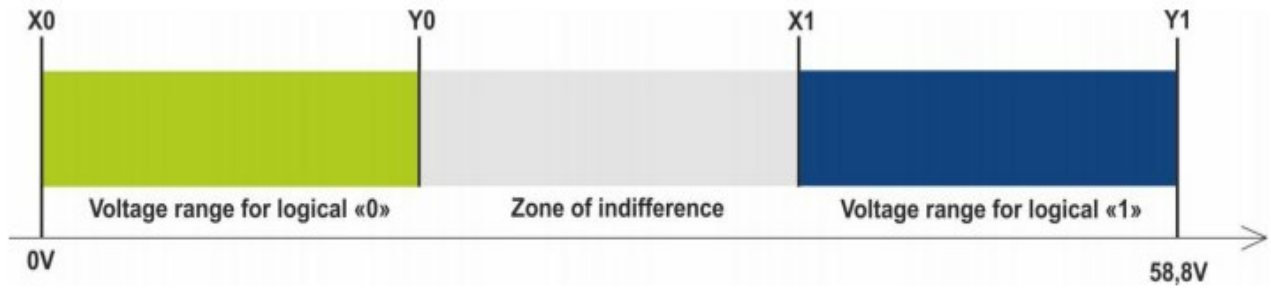


Figure 7 - Bands of discrete states

If the voltage level is in the zone of indifference, the previous discrete state is maintained until the level goes beyond the zone of indifference.

The measured voltage levels are registered by the tracker and transmitted to the server.

When changing the discrete state, an extraordinary packet is sent.

6.2 Discrete output

Output type – open collector

Maximum voltage – 45 V

Maximum commutated current – 100 mA.

Discrete output allows handling extra equipment. When switched on, the output is connected to the minus of the tracker external power supply. Connection should be done according to the scheme in Figure 8.

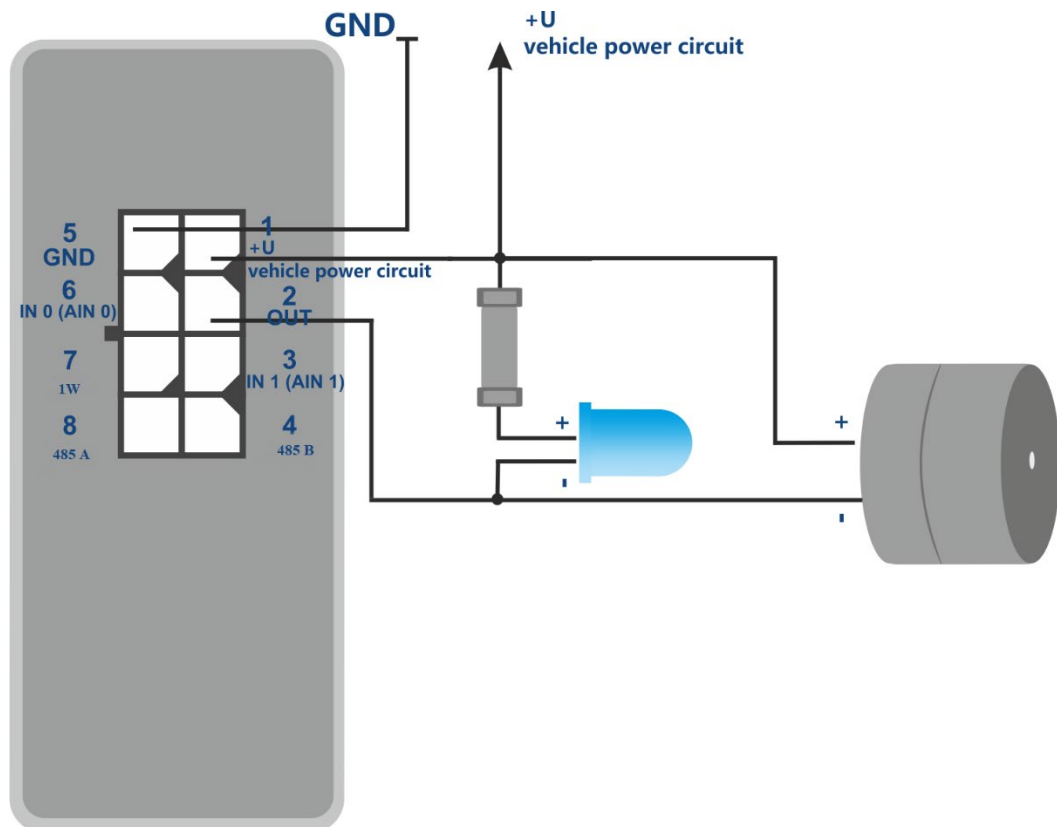


Figure 8 – Scheme of the connection of charge with the current consumption not more than 100mA.

It is allowed to connect devices with the maximum current consumption not exceeding 100mA, otherwise there is a risk to damage the tracker. When a more powerful load commutation is needed, it is necessary to use a relay.

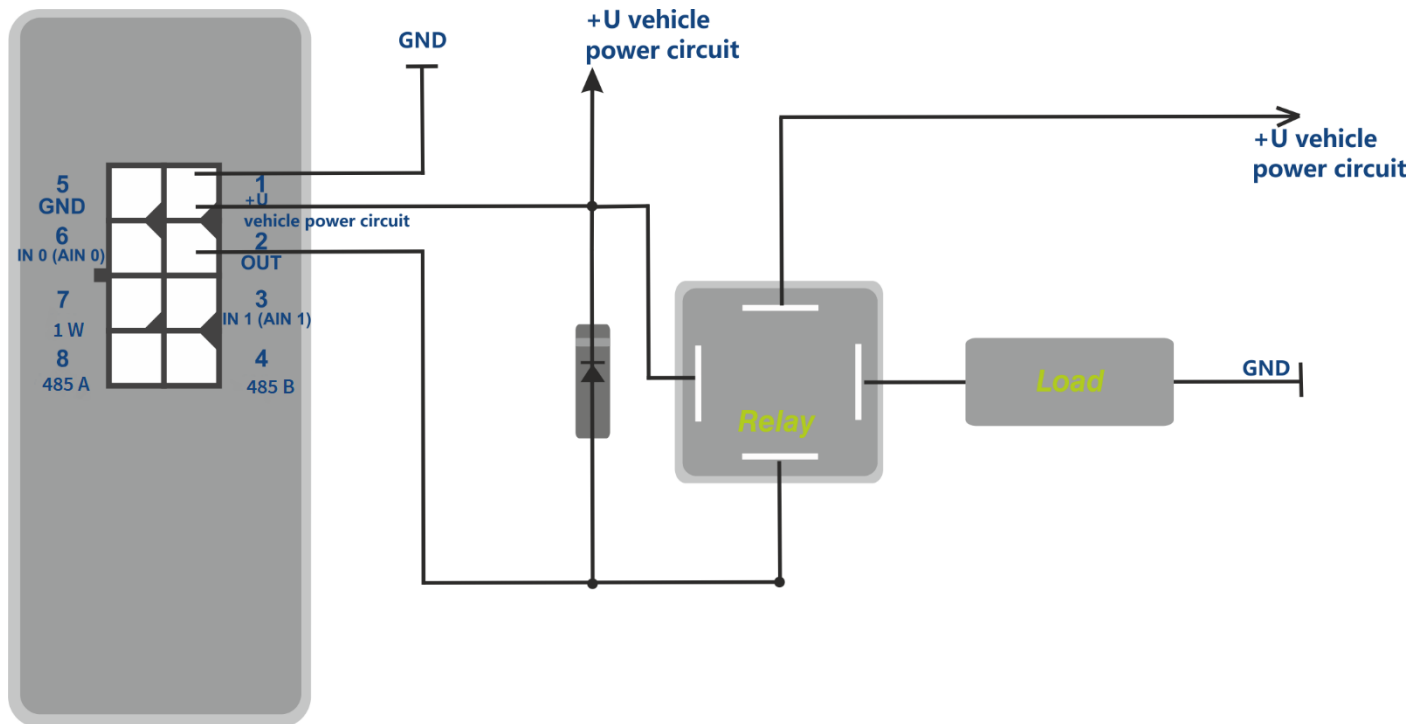


Figure 9 - Scheme of the connection of load with the current consumption exceeding 100mA

To prevent the tracker output from self-induction pulses, which appear after switching off the inductive load, including the relay coil, it is necessary to connect a diode parallelly to the relay coil in the opposite direction.

It is possible to control the output condition with the **OUTPUT X** command

X=1 – switch on (to short output to ground),

X=0 – switch off (to put output in a state of breakage).

6.3 RS-485

6.3.1 Connection of digital fuel level sensor

Up to three fuel level sensors can be connected simultaneously. The tracker alternately interrogates the sensors and transmits the values of fuel levels and temperature in the "FUEL" data block.

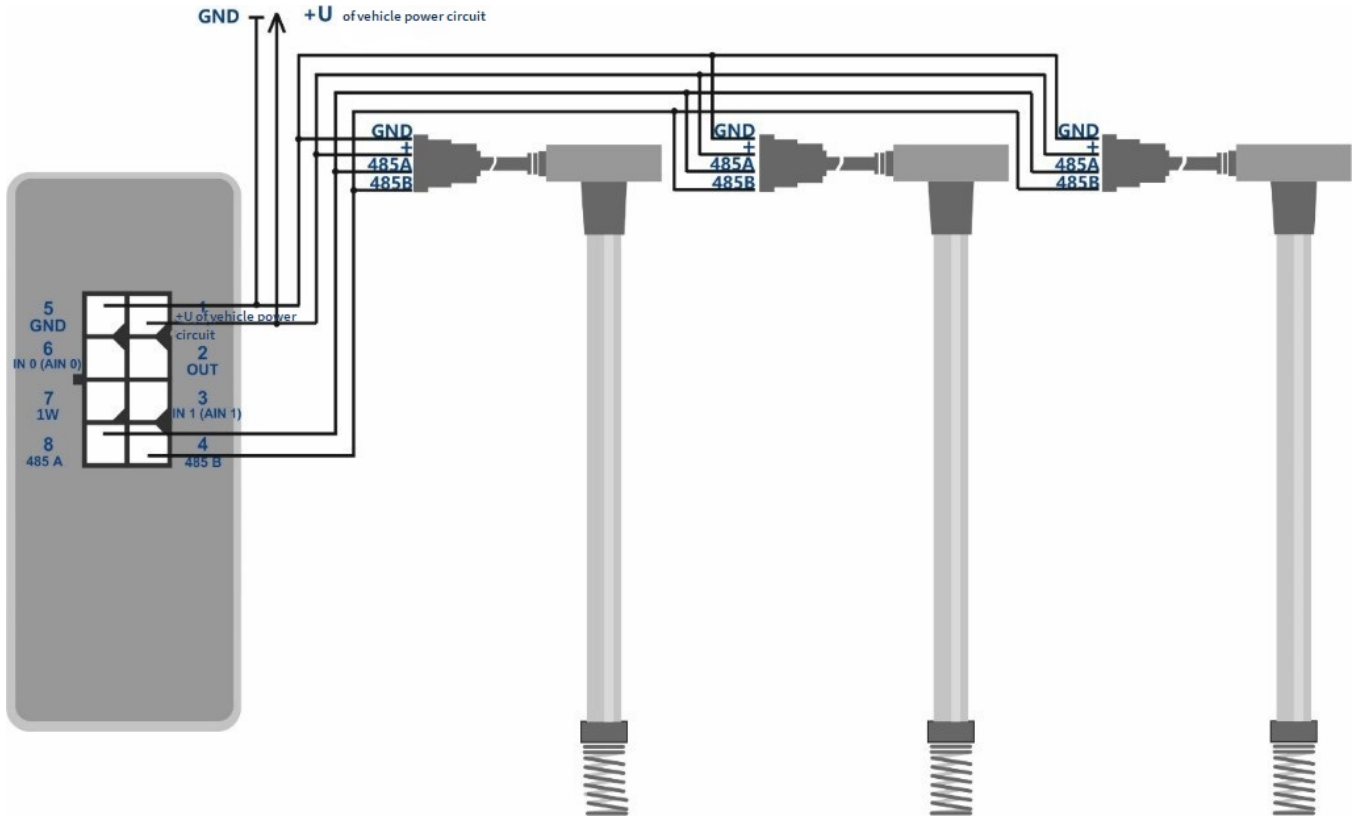


Figure 10 – Scheme of fuel level sensors connection

Connection and setting order:

- Before connecting to the tracker, it is necessary to set the sensors:
 - set network address (addresses 0,1,2 are requested by default);
 - choose interface speed of 19200 bauds;
 - disable automatic data output
- Connect lines A and B to the tracker connector pins 8 and 4. The connection scheme is given in figure 10.
- Activate "FUEL" data block transmission in the graphic interface of the ADM Configurator or use **PROTOCOL** command.

The "**FUEL**" command allows you to check the addresses of the sensors, as well as view the list of added addresses. You do not need to enter a colon when entering an address.

This command is for entering MAC addresses of BLE FLS and addresses of wired FLS, connected via the RS-485 bus. The sensor type is determined automatically according to the format of the entered address.

The tracker supports simultaneous connection of three FLS regardless of the interface used.

- FUEL Y** - add the Y address to the first free cell;
- FUEL X,Y** - add Y address to cell X, where X = 0..2;
- FUEL X, *** - clear cell X; where X = 0..2;
- FUEL *** - clear the entire list of FLS addresses;
- FUEL** - indicate the specified list added to the terminal.

Example of command input:

- FUEL 0,1** – add address 1 to cell 0;;
- FUEL 1** – add address 1 to the first free cell.

6.4 1-Wire

Up to 8 temperature sensors DS18B20 and one DS1990 iButton can be connected simultaneously.

6.4.1 Connection of temperature sensors

Connection and setting order:

- Connect temperature sensors to the 1-Wire bus using the scheme in figure 11;
- Configure the CAN using **OWCONFIG 1** command. As soon as **OWCONFIG 1** command is applied each device connected to 1-Wire receives its sequence number (the sequence number does not correspond to the order of the sensors physical location on the bus);
- Use **PROTOCOL** command to activate "1-Wire" data block transmission.

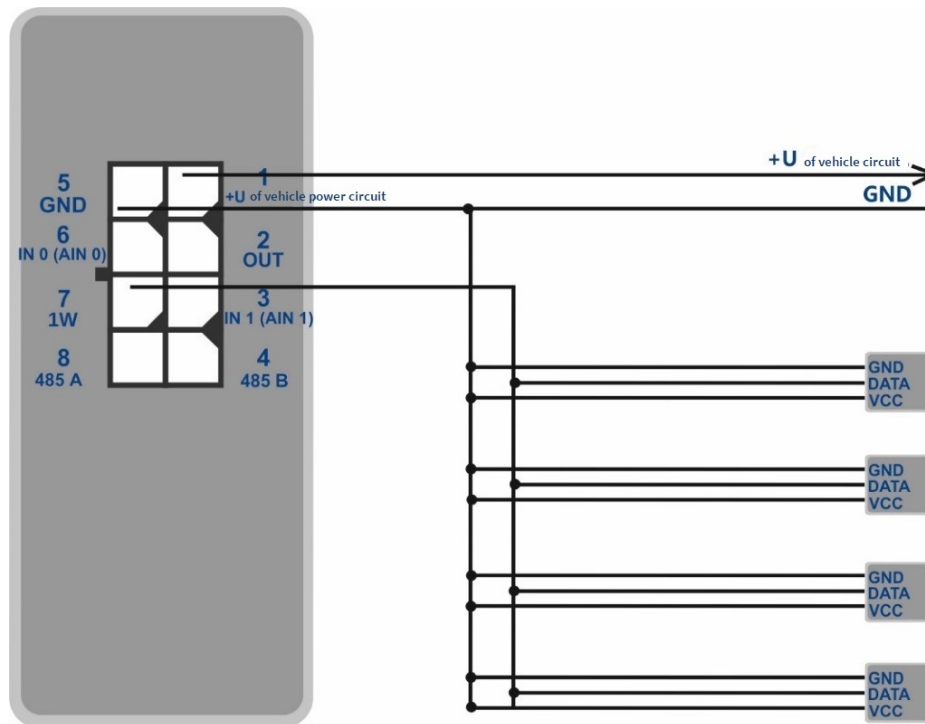


Figure 11 - Connection scheme of the sensors and iButton DS18B20 to CAN of 1-wire

Transmission of temperature sensors data is done via CAN data block.

OWCONFIG 0 command erase all the sensors list.

OWCONFIG command shows the number of connected (bound) sensors.

To see the data from any sensor connected to 1-Wire bus use **OWTEMP X** command, where X- sensor sequence number (0...7).

6.4.2 Connection of iButton

Connection and setting order:

- connect the reader of iButton DS1990 to the 1-Wire bus;
- use **OWCONFIG 1** command to configure CAN. As soon as **OWCONFIG 1** command is used each device connected to 1-Wire bus receives its sequence number;
- use **IBUTTON 1** command to activate request of the reader;
- use **IBUTTON 1,1** command to activate the discrete output upon detection of iButton (Not obligatory. The previous clause in such a case can be ignored, since this command activates the reader request and activates discrete output);
- use **PROTOCOL** command to activate “1-Wire” data packet transmission.

6.5 Connection of devices via Bluetooth Low Energy

Connection of extra devices to the tracker assumes a set of actions: to configure the device under connection, the tracker and PC at the side of the server.

The server receives correct values from the connected sensors provided all steps are performed correctly:

- Configuring the sensor/devices (in case of necessity).
- Setting communication between the tracker and the sensor. Ways of supported sensors connection are given in clause [6.5.1](#).
- Activation of necessary data transmission from a tracker to a server. For description and data transmission choice see clause [5.4](#) and clause [7.1](#).
- Setting transformation of received data on the server side. (in case of necessity). See detailed description in clause [7.1.1](#).

6.5.1 Connection of BLE sensors

The configuration of the sensor interaction with the tracker is done in the ADM Configurator graphical interface or by sending commands to the tracker via Bluetooth, GPRS or SMS. Up to 5 ADM31/32 sensors and 3 BLE fuel level sensors can be connected simultaneously to one tracker.

There are two ways of binding the sensor to the tracker - manual and automatic.

In manual mode, you need to enter the addresses of each of the sensors. This method is suitable for the situation when there are active sensors in the Bluetooth receiving area of the tracker and they shouldn't be bound to this tracker.

In automatic mode, sensors are searched for and the addresses of all the sensors found are automatically recorded. This method is suitable for a situation when only the required sensors are in the receiving area of the Bluetooth tracker.

6.5.2 Adding BLE sensors in automatic mode

The **BLEAUTOCATCH** command starts the search and automatic record of the found sensors addresses to the BLESENSOR and BLEFUEL lists. By default, the search is performed within two minutes according to the filter as regards radio signal level minus 60 dBm. Such a filter mode allows adding sensors located at the distance of 0 to 0,5 meters from the tracker.

Examples of using commands:

BLEAUTOCATCH – automatic search by default, with the filter as regards the signal level.

BLEAUTOCATCH 255,0 – automatic search of all supported sensors without filters.

BLEAUTOCATCH 0 – stop the current search

6.5.2.1 Additional parameters of automatic sensors search

In case of necessity the criteria of automatic search can be changed by entering certain parameters. **BLEAUTOCATCH** command has 4 parameters D, F, R, T.

Description of parameters of **BLEAUTOCATCH D,F,R,T** command :

- D – sensor type.

When entering such a parameter only the sensors of the indicated type will be added. Table 2. shows the correspondence of values to the BLE sensors types. In case several sensors types should be bound simultaneously then add several needed parameter values.

Table 2. Types of supported BLE sensors.

| Sensor type | Parameter value |
|---|-----------------|
| ADM31, ADM32 | 1 |
| ESCORT fuel level sensor (BLE) | 2 |
| Technoton fuel level sensor BLE (DUT-E) | 4 |
| Technoton axis load sensor BLE (GNOM) | 8 |
| All types of the supported sensors | 255 |

- R –RSSI level

Acceptable filter range from minus 1 to minus 127 dBm.

Entering value without a character is acceptable from 1 to 127.

- T – search time in seconds.

Acceptable range of search duration from 10 seconds to 120 seconds.

6.3.2.2 Usage options of «BLEAUTOCATCH» command.

- Search within 120 seconds, without the filter according to radio signal level minus 60 dBm.

BLEAUTOCATCH

- Search with the opportunity to choose the sensor type (D), without the filter according to radio signal level, search time of 120 seconds.

BLEAUTOCATCH D

- Search with the opportunity to choose the sensor type (D), to switch off the filter according to radio signal level (F), search time of 120 seconds.

BLEAUTOCATCH D,R

- Search with the opportunity to choose the sensor type (D), to set the filter according to the distance (R), search time 120 seconds.

BLEAUTOCATCH D, F, R

- Search with the opportunity to choose the sensor type (D), to set the filter according to the distance (R), to choose the search time (T).

BLEAUTOCATCH D,R,T

6.5.3 Adding sensors ADM31, ADM 32 in manual mode, viewing added sensors list

The **BLESENSOR** command allows to add sensor addresses, as well as to view the list of added addresses. The sensor address is marked on the label placed on the housing.

Don't enter a colon when entering the address.

BLESENSOR X,Y - add address Y to the cell X, where X=0..4;

BLESENSOR X,0 - clear cell X, where X = 0..4;

BLESENSOR Y - add address Y to the end of the list;

BLESENSOR 0 - clear the list;

BLESENSOR – display the list of addresses added to the tracker.

Example of commands input:

BLESENSOR 0,FC61CFEF5E31 – add address FC:61:CF:EF:5E:31 to the cell 0;

BLESENSOR FC61CFEF5E31 – add address FC:61:CF:EF:5E:31 to the end of the list.

6.5.3.1 Data receiving from connected ADM31/32 sensors

The **BLESENSORINFO** command allows to request the latest data received by the tracker from the sensor.

BLESENSORINFO X – displays the data of the sensor under number X, where X is the number of the device from the BLESENSOR sensors list.

BLESENSORINFO - command without parameter displays information about all the configured sensors;

Example of the answer:

```
BLESENSORINFO: [0]:DD9DD495C467; DT:2; PT:1; F:1; V:3.2; A:1; R:-35; LMT:20; S:0;
[1]:EE53F61FCC05; DT:0; PT:0; F:0; V:25.5; T:-300.00; L:655.35; H:255; R:0; LMT:0; S:32768;
```

Description of answer parameters:

Fields, general for all types of sensors ADM3x.

Sensor address

DT – type of the device.

PT – type of the packet.

F – software version.

V – battery voltage.

R – level of RSSI in dBm.

LMT – time passed from the receipt of the last message from the sensor.

S – sensor status.

ADM31

T - temperature.

L - illumination.

H - humidity.

ADM32

A – angle value in degrees.

6.5.3.2 Setting the acceptable readings range for ADM31/32 sensors

When the readings are beyond the acceptable range the tracker will switch to the route points record at an alarm period.

Setting the acceptable temperature range.

TEMPRANGE X, A, B

Parameter X – device number (from BLESENSOR sensors list).

Parameters A and B – limits of the acceptable temperature range.

Parameters A and B can be omitted – current range will be displayed.

Setting the acceptable humidity range.

HUMIDRANGE X, A, B

Allows to set the acceptable humidity range of the sensor.

Parameter X – device number (from sensors list).

Parameters A and B – limits of the acceptable humidity range.

Parameters A and B can be omitted – current range will be displayed

Setting the acceptable illumination range.

LIGHTRANGE X, A, B

Parameter X – device number (from BLESENSOR sensors list).

Parameters A and B - limits of the acceptable illumination range.

Parameters A and B can be omitted- current range will be displayed

Setting upper and lower sensor states. When there is a changeover between the states an extra point is drawn.

ANGLERANGE X, A, B, C, D

X – device number (from BLESENSOR sensors list).,

A, B – lower and upper limits for “lower” sensor state.

C, D – lower and upper limits for “upper” sensor state.

6.5.4 Adding BLE fuel level sensor in a manual mode, viewing added sensors list

The "**FUEL**" command allows you to check the addresses of the sensors, as well as view the list of added addresses. You do not need to enter a colon when entering an address.

This command is for entering MAC addresses of BLE FLS and addresses of wired FLS, connected via the RS-485 bus. The sensor type is determined automatically according to the format of the entered address.

The tracker supports simultaneous connection of three FLS regardless of the interface used.

FUEL Y - add the Y address to the first free cell;

FUEL X,Y - add Y address to cell X, where X = 0..2;

FUEL X, * - clear cell X; where X = 0..2;

FUEL * - clear the entire list of FLS addresses;

FUEL - indicate the specified list added to the terminal.

Example of command input:

FUEL 0, E5F2A9527B1D – add the address E5:F2 A9:52:7B:1D to cell 0;

FUEL E5F2A9527B1D – add address E5:F2:A9:52:7B:1D to the first free cell.

An example of a response to a request for a list of addresses with the “**FUEL**” command:

FUEL [0, BLE]: C0C2D56617EA, [1.485]: 0, [2]: *

Cell 0 - BLE FLS, address C0:C2:D5:66:17:EA

Cell 1 - RS-485, address 0

Cell 2 - * empty

6.5.4.1 Data receiving from connected fuel level sensors

FUELINFO command allows requiring the latest data, received by the tracker from the sensor.

FUELINFO X – display the information on the sensor with number X, where X is the device number from the list of FUEL sensors (X = 0..2).

FUELINFO – the command without parameters displays information on all configured sensors.

Example of an answer: FUELINFO: [0,485]: 43; L: 0; T: 0 [1, BLE]: C6F8FDC43558; DT: 2; F: 130; L: 1; T: 25; V: 3.7; LMT: 3; R: -96; [2, BLE]: F3AAEA4D14DE; DT: 2; F: 130; L: 1; T: 24; V: 3.7; LMT: 70; R: -98;

Decoding of the answer for ESCORT TD-BLE:

DT – device type

T - temperature

L – fuel level

V – current battery voltage value of the fuel level sensor

F – software version

LMT – time passed since the last message from the sensor was received

R - RSSI

Decoding of the answer for DUT-E:

DT - device type

F - software version

L - fuel level

T - temperature

DTC – failure mask. Fields of the mask are described in the sensor protocol

LMT - time passed since the last message from the sensor was received

R - RSSI

Decoding of the answer for GNOM:

DT - device type

F - software version

P - pressure characteristics in the pneumatic system

T - temperature

DTC – failure mask. Fields of the mask are described in the sensor protocol

LMT – time passed since the last message from the sensor was received

R - RSSI.

7 Data transmission to the server from connected sensors

7.1 Description of ADM31 sensors parameters transmitted to the server

Data from ADM31/32 sensors is transmitted in the “ADM BLE sensors” data block together with other data in each message. There are 5 CAN fields for each sensor. The correspondence of CAN fields to the transmitted data type is given in table 3. The sensor number given in the table corresponds to the number of the added sensors list.

Table 3. Description of transmitted data from ADM31 sensors

| Sensor 0 | Sensor 1 | Sensor 2 | Sensor 3 | Sensor 4 | Parameter |
|----------|----------|----------|----------|----------|--------------------|
| can1 | can6 | can11 | can16 | can21 | Temperature |
| can2 | can7 | can12 | can17 | can22 | Humidity |
| can3 | can8 | can13 | can18 | can23 | Illumination level |
| can4 | can9 | can14 | can19 | can24 | Battery voltage |
| can5 | can10 | can15 | can20 | can25 | Hall sensor |

Table 4. Description of transmitted data from ADM32 sensors

| Sensor 0 | Sensor 1 | Sensor 2 | Sensor 3 | Sensor 4 | Parameter |
|----------|----------|----------|----------|----------|-----------------|
| can1 | can6 | can11 | can16 | can21 | Angle |
| can4 | can9 | can14 | can19 | can24 | Battery voltage |

7.1.1 Conversion of incoming data at the server side

Since “ADM BLE sensors” data block is universal, calculation formulas are not applied to these fields on the servers.

To convert values to a readable format, the following calculation formulas described below should be applied to the incoming values.

To prevent values jumps when there is no communication with the sensors, it is recommended to set a range of permissible values on the software side. Or apply other filters supported by the software you use.

- **Temperature**

Use 2 formulas to calculate two ranges of incoming values:

For the range values from 0 to 32767 – apply formula $X*0.01$

For the range values from 32768 to 65535 - apply formula $X*0.01-655.36$

To display negative and positive values correctly use both formulas for the corresponding ranges.

Acceptable values range after formula calculation is -39...+150

-300 value (after formula calculation) is considered as an error code «no signal from sensor».

- **Humidity level**

Conversion is not needed.

Acceptable values range 0 – 100

255 value is considered as an error code «no signal from sensor».

- **Illumination level**

— Shortened format (by default).

There is no need for conversion in case of using a shortened format.

Acceptable values range is 0 – 65534.

65535 value is considered as an error code «no signal from sensor».

— Full format.

When using a full format apply formula $X*0.01$.

Acceptable values range after calculations is 0.00 – 83866.00

42949672.95 value (after formula calculation) is considered as an error code «no signal from sensor».

Setting the format of illumination level transmission is described in clause [7.3 Selecting the transmission format of the illumination level](#).

- **Battery voltage**

Apply formula $X*0.1$.

Acceptable values range after calculations is 0 – 4

25.5 value (after formula calculation) is considered as an error code «no signal from sensor».

- **Hall sensor (magnetic field detector)**

Conversion is not needed.

Acceptable values range is 0 – 1.

7.2 Selecting data to be transmitted to the server from ADM31/32 sensors

Depending on the functionality use of the BLE sensors ADM31/32, it is possible to disable the transmission of unnecessary fields to the server. Correspondence of the fields to parameter values of **BLEPROTOCOL** command is given in table 5. If you want to transmit data from several packets, the X parameter of the **BLEPROTOCOL X** command is calculated by addition. It is possible to use any options.

Transmission of all fields are set by default. To save the traffic activate only the transmission of necessary fields.

Table 5. Value of BLEPROTOCOL parameter

| Data type | Fields name at the server | Parameter value |
|-------------------|----------------------------------|-----------------|
| All data | | 255 |
| Temperature/Angle | CAN1, CAN6, CAN11, CAN16, CAN21 | 1 |
| Humidity | CAN2, CAN7, CAN12, CAN17, CAN22 | 2 |
| Illumination | CAN3, CAN8, CAN13, CAN18, CAN23 | 4 |
| Battery voltage | CAN4, CAN9, CAN14, CAN19, CAN24 | 8 |
| Hall sensor | CAN5, CAN10, CAN15, CAN20, CAN25 | 16 |

7.3 Selecting the transmission format of the illumination level

To save the traffic consumption a shortened range of illumination level values is transmitted by default. In case of necessity to use full range, activate it. Setting is done by **LIGHTPROTOCOL X** command.

LIGHTPROTOCOL X

X = 0,1 – transmission format of illumination values

0 – shortened value format:

Discreetness: integer value

Values range: 0...65534.

Sensor data greater than 65534 are considered to be equal to this value.

65535 value is considered as an error code «no signal from sensor».

1 – full value format

Discreetness: two decimal places

Values range: 0.00 - 83865.60

42949672.95 value (after formula calculation) is considered as an error code «no signal from sensor».

8 Commands description

Table 6. Commands description

| | Command | Answer | Parameters | Description |
|-----|---|---|---|--|
| 1 | Name X Example: Name bus8 | Device Name 'X ' Example: Device Name 'bus8' | X – tracker name | Set the name of the tracker. The name can contain only letters of the Latin alphabet and numbers. The name cannot exceed 10 digits in length. The tracker name is added to the alarm SMS messages. |
| 2.1 | ADD ME X,Y (only via SMS) Example: ADD ME 1234 ADD ME 1234,2 | PHOES (0)= (1)= (2)= (3)= Example: PHONES (0) = (1) = (2) = (3) = +7xxxxxxxxxx (1) = (2) = (3) = PHONES (0) = (1) = (2) = +7xxxxxxxxxx (3) = | X – password, the default is "0". Y=0...3 – number of the memory cell to store the number. Optional parameter. | Authorize the phone number from which the SMS was received and write it to the memory cell Y. The command is needed only to create a list of numbers to control the tracker via SMS. |
| 2.2 | ADD ME X,Y (only via Bluetooth and GPRS) Example: ADD ME +7xxxxxxxxxx,1 | PHOES (0)= (1)= (2)= (3)= Example: PHOES (0)= (1)= +7xxxxxxxxxx (2)= (3)= | X – phone number Y=0...3 – number of the memory cell to store the number | Adding a phone number from which you plan to manage the tracker via SMS. |

| | Command | Answer | Parameters | Description |
|---|---|---|--|---|
| 3 | PHONES X Example: PHONES 1234 | PHONES (0)= (1)= (2)= (3)= Example: PHONES (0)= (1)= +7xxxxxxxxxx (2)= (3)= | X – password, default is "0". | Request a list of authorized phone numbers |
| 4 | PASS X,Y Example: PASS 0,86974543 | Pass=X,Y Example: Pass=86974543 | X – old password, default X=0. Y – New password. | Change the password from the old X to the newY. The password is a number from one to eight digits |
| 5 | STATUS | Example: ID=1 Soft=0x1A GPS=9291 Time=11:21:39 25.02.10 Nav=0 Lat=57.2359 Lon=56.2593 Speed=0.0 SatCnt=5 Stat=0x0000 | Command without parameters. | Query the current state of the tracker. ID - the number of the tracker, Soft - the software version, GPS - the current number of the information packet, Time - current time and date according to Greenwich Mean Time, Nav- validity of coordinates, Lat - latitude, Lon - longitude, Speed-speed, SatCnt - number of satellites, Stat - status. |

| | Command | Answer | Parameters | Description |
|----|--|--|--|---|
| 6 | IMEI Example: IMEI | IMEI Example: IMEI 359587013832624 | Command without parameters. | Request IMEI of GSM-module installed in the tracker. The command runs 20 seconds after the tracker is switched on or restarted. |
| 7 | SN X Example: SN 123456789 | SN X Example: SN 123456789 | X –settable tracker ID | Set the tracker ID. |
| 8 | PIN0 X Example: PIN0 1234 | PIN0 X Example: PIN0 1234 | X – pin code of SIM card | Set the PIN code of the SIM card. |
| 9 | PIN1 X Example: PIN1 1234 | PIN1 X Example: PIN1 1234 | X – pin code of the SIM card | Set the PIN code of the SIM card 1. |
| 10 | SIMPRIORITY X Example: SIMPRIORITY 0 | SIMPRIORITY X Example: SIMPRIORITY 0 | X=0 – no priority. X=1 – priority of SIM0. X=2 – priority of SIM1. | Set the priority of SIM card. |
| 11 | ICCID | ICCID | Command without parameters | Request of ICCID of installed SIM cards. |

| | Command | Answer | Parameters | Description |
|----|---|--|--|--|
| 12 | SETGPRS0 X,Y,Z Example: SETGPRS0 internet.mts.ru,mts,mts | GPRS0: APN=X, user=Y, pass=Z Example: GPRS: APN=internet.mts.ru, user=mts, pass=mts | X – access point, by default X=internet.beeline.ru; Y - login, default Y=beeline; Z – password, default Z=beeline. | Set APN settings for the SIM card. A command without parameters returns the current GPRS settings for the SIM card. |
| 13 | SETGPRS1 X,Y,Z Example: SETGPRS0 internet.mts.ru,mts,mts | GPRS1: APN=X, user=Y, pass=Z Example: GPRS: APN=internet.mts.ru, user=mts, pass=mts | X – access point, default X=internet.beeline.ru; Y - login, default Y=beeline; Z – password, default Z=beeline. | Set APN settings for the SIM card. A command without parameters returns the current GPRS settings for the SIM card 1. |
| 14 | SETHOST0 X,Y Example: SETHOST0 134,236,21,2,12300 | HOST0=X,Y Example: HOST0=134.236.21.2:12300 0 | X - IP adress, Y - server port. Five numbers separated by commas. | Configuring the IP address and port of the server to which the tracker connects to transmit information. A command without parameters returns the current server address and port. |
| 15 | DN0 X:Y Example: DN0 www.test.ru:1000 | HOST0=X:Y Example: HOST0= www.test.ru:1000 | X - domain name of the server, Y - server port. | Configure the domain name and port of the server to which the terminal connects to transmit information. A command without parameters returns the current server address and port. |

| | Command | Answer | Parameters | Description |
|----|---|---|--|--|
| 16 | PROTOCOL X | PROTOCOL X | X – number determining a data set to be transmitted | Configure the set of data to be transmitted to the server. (detailed description see in clause 5.5 Setting data transmission). |
| 17 | BMODE X | BMODE X | X=0 – mode "Tracker". X=1 – mode "Beacon". | Choose the tracker working mode (mode of points record). |
| 18 | TRAFFIC X | TRAFFIC X | X=0..60- time in seconds. By default is X=6 | Set the delaying time before sending a packet to the server for points grouping. |
| 19 | ERASE FLASH | ERASE FLASH | Command without parameters | Erase all information packets stored in the memory. After executing this command, the current information packet number is reset, the tracker is rebooted. |
| 20 | ERASE EEPROM | ERASE EEPROM | Command without parameters | Restore the tracker factory settings and restart the tracker. |
| 21 | PERIOD X,Y Example: PERIOD 20,120 | PERIOD min=X, max=Y Example: PERIOD min=20, max=120 | X – the recording period during the movement in seconds, default X=30. Y – the recording period during parking in seconds, by default Y=300.The value of X must be less than Y. | Set the recording period of information packets during driving and parking. A command without parameters returns current settings. |

| | Command | Answer | Parameters | Description |
|----|--|--|--|---|
| 22 | TRACKSET X | The response displays a detailed configuration of all the set parameters of the travel drawing | X= 0...4 | Select the preset of route drawing quality. For more details see clause 5.6.1 Selecting presets of route drawing quality. |
| 23 | InTrue X,Y,Y Example: InTrue 0,10000,60000 | InTrue X,Y,Y Example: InTrue 0,10000,60000 | X=0 – input number (always 0); Y – minimum range limit in mV; Y=60000 – the maximum range limit in mV (unchanged value). | Set the voltage range of the logical “1” in the analog input. |
| 24 | InFalse X,Y,Y Example: InFalse 0,0,4000 | InFalse X,Y,Y Example: InFalse 0,0,4000 | X=0 – input number (always 0). Y – minimum range limit in mV; Y – maximum range limit in mV. | Set the voltage range of logical zero in the analog input. |
| 25 | InInfo X Example: InInfo 0 | Example: Input 0: InTrue 8000..15000, InFalse 0..3000 | X=0 – input number (always 0). | Request information about the input settings. |
| 26 | INPUT | INPUT0 = 12000 | Command without parameters | Request current measured voltage level in the analog input (mV). |

| | Command | Answer | Parameters | Description |
|----|---|---|--|--|
| 27 | INSTATIC X,Y Example: INSTATIC 1,0 | INSTATIC X,Y Example: INSTATIC 1,0 | X=0 – input number, Y=0, 1 – activation by zero or one. X=255 –disabled function; | Set the input number to enable the coordinates fixation mode. A command without parameters returns the current setting. By default, no one input is set to enable coordinates fixation mode. |
| 28 | ACCELSTATIC X,Y,Z Example: ACCELSTATIC 10 | ACCELSTATIC X,Y,Z Example: ACCELSTATIC 10 | X – timeout to enable static mode (in seconds) X=255 -disabled function Y – acceleration threshold to get out from static mode (mg) Z – timeout to get out from static mode in counting | Enabling and disabling coordinates fixation according to vibration level. Set the coordinates fixation parameters according to vibration level. |
| 29 | OUTPUT X Example: OUTPUT 0 | OUTPUT X Example: OUTPUT 0 | X=1 – output is active X=0 – disabled output. | Control of tracker output. Command without parameters returns the current output settings. |
| 30 | RESET | reset... | Command without parameters | Restart of the unit. |
| 31 | UPDATE | start update... | Command without parameters | Run the firmware update process. |

| | Command | Answer | Parameters | Description |
|----|--------------------|--|---|--|
| 32 | BLEAUTOCATCH D,F,T | BLEAUTOCATCH is started. Time: 120 sec; Dev. type: 255; RSSI filter: 1 (-60dBm) | D – sensor type F – filter T – search time | Start the search and automatically bind all found sensors ADM31, ADM32. (detailed description in clause 6.5.2.1). |
| 33 | BLESENSOR X,Y | BLESENSOR:(0): D8A05B9BEF5B, (1): , (2): , (3): , (4): , | X – cell number of the sensors list Y – sensor address | Binding sensors ADM31, ADM32 to the tracker (detailed description in clause. 6.5.3 Adding sensors ADM31, ADM32 in a manual mode and viewing the list of added sensors). |
| 34 | BLESENSORINFO X | BLESENSORINFO: [0]:D8A05B9BEF5B; DT:1; PT:3; F:5; V:3.0; T:25.35; L:412.80; H:35; R:-51; LMT:6; S:0; | X=0..4 -sensor number (from BLESENSOR sensors list) | Data request from bound sensors ADM31/32 (detailed description in clause. 6.5.3.1 Data receipt from bound sensors ADM31/32). |
| 35 | TEMPRANGE X,A,B | | X - sensor number from BLESENSOR list. A и B –range limits of acceptable temperature. | Set acceptable range for temperature sensor. |
| 36 | LIGHTRANGE X,A,B | | X – sensor number from BLESENSOR list A and B – range limits of acceptable illumination. | Set acceptable range for illumination sensor. |

| | Command | Answer | Parameters | Description |
|----|----------------------|---------------|---|--|
| 37 | HUMIDRANGE X,A,B | | X - sensor number from BLESENSOR list A and B - range limits of acceptable humidity. | Set acceptable range for humidity sensor. |
| 38 | ANGLERANGE X,A,B,C,D | | X – sensor number from BLESENSOR list A,B – lower and upper limits for the “lower” sensor state. C,D – lower and upper limits for the “upper” sensor state. | Set the range of lower and upper state of the sensor. |
| 39 | ALARMPERIOD X | ALARMPERIOD X | X – time in seconds | Set the period of information packets in an alarm mode. |
| 40 | FUEL X,Y | | X – cell number of the sensors list Y – sensor address | Binding of a fuel level sensor to the tracker. (detailed description in clause 6.5.4 Adding BLE fuel level sensor in a manual mode and viewing the list of added sensors). |
| 41 | FUELINFO X | | X – cell number of the FUEL sensors list | Data request from bound fuel level sensors (detailed description in clause 6.5.4.1 Data receiving from connected fuel level sensors). |

| | Command | Answer | Parameters | Description |
|----|-----------------|---------------|--|---|
| 42 | BLEPROTOCOL X | | X – figure detecting the set of data to be transmitted | Set the data set to be transmitted from sensors ADM31/32. (detailed description in clause 7.2 Selecting data to be transmitted to the server from sensors ADM31/32). |
| 43 | LIGHTPROTOCOL X | | X=0 – shortened X=1 – full | Select the transmission format of the illumination level (detailed description in clause 7.3 Selecting the transmission format of the illumination level). |

9 Updating tracker software

The tracker software (firmware) can be updated via Bluetooth radio channel or a GPRS channel.

9.1 Updating tracker software via ADM Configurator

The ADM Configurator program, if the computer has access to the Internet, checks the current firmware version on the update server, and, if necessary, downloads the firmware file.

To update the firmware, do the following:

establish connection between the tracker and the ADM Configurator program using the procedure described in. [5.1 «Connection to ADM Configurator»](#);

- 1) if the firmware version is found to be more up-to-date than the one installed in the tracker, ADM Configurator will notify of its presence -a notification will be displayed in the lower left corner;
- 2) click "Update available";
- 3) in the opened "Notifications" tab, click "Update";
- 4) after the update, the tracker will reboot and become available for operation.

ATTENTION! Do not switch off the tracker during the firmware upgrade until the tracker is detected by the setup program. Otherwise, it is possible to damage the software, which must be restored in the service center of the manufacturer.

9.2 Updating tracker software via ADM Configurator using a firmware file

The firmware file must be requested from the technical support.

To update the firmware via Bluetooth radio channel using the firmware file, do the following: establish connection between the tracker and the ADM Configurator program using the procedure described in. [5.1 «Connection to ADM Configurator»](#);

- 1) open the "Settings" section in the "Device" tab, click - "Flash file";
- 2) click «Update» in the pop-up window;
- 3) drag the firmware file to the appropriate field in the ADM Configurator window;
- 4) after updating the firmware, the tracker will reboot and become available for operation.

ATTENTION! Do not switch off the tracker during the firmware upgrade until the tracker is detected by the setup program. Otherwise, it is possible to damage the software, which must be restored in the service center of the manufacturer

9.3 Updating the tracker software via GPRS

To update the tracker software via GPRS, install the active SIM card in the tracker, enter the APN, user, pass of the cellular operator.

Otherwise, the tracker will be in the firmware download mode from the update server until all connection attempts are exhausted. The update process starts after the tracker receives the **"UPDATE"** command via one of the possible channels: Bluetooth, GPRS, SMS. After receiving the **"UPDATE"** command the tracker connects to the update server and downloads the current firmware. After a successful upgrade, the tracker switches to the basic mode of operation with the access point settings and server addresses that were installed before the update. The remaining settings after the update should be checked and, if necessary, reinstalled. Depending on the status of the GSM network, the upgrade process takes an average of 2 to 10 minutes. If there is no possibility to download the update, the tracker will return to operation with the available software.

10 Handling and transportation regulations

Trackers should be stored in a warehouse at a temperature of +5°C to +40°C and relative humidity at most 85 %.

After tracker transportation in sub-zero temperatures, they should be stored at room temperature within 24 hours.

11 Warranty obligations

The manufacturer guarantees the tracker proper function within 12 months from the day of its sale if consumer meets all the requirements and follows all the rules of transportation, storage, installation and handling.

The warranty does not cover:

- a tracker with mechanical damages and defects (cracks and chips, dents, signs of impacts, etc.) caused by consumer as a result of handling, storage and transportation rules violation. When there are signs of oxidation or other proofs of liquid penetration in the device housing;
- a tracker without housing;
- a tracker with signs of repair performed beyond the manufacturer's service center;

- a tracker with signs of electrical and/or other damages caused as a result of unacceptable changes in external power network parameters or improper use of the tracker;
- a tracker disabled because of an unauthorized software upgrade.

The device software is licensed, terms related to the manufacturer's limited liability in the framework of the License Agreement are provided at the web https://neomatica.com/upload/docs/license_en.pdf

12 Marking and packaging

Marking is placed on the tracker housing. The tracker is packed in an individual box, which protect them during transportation and storage. Multipack is possible.

13 Disposal

Device recycling is performed according to national and local norms and requirements.

14 Scope of supply

Table 6. Scope of supply

| Device name | Quantity | Serial number | Comments |
|---|----------|---------------|----------|
| Tracker ADM333 | | | |
| MF3-8F connector to connect power and sensors with cables | | | |
| Datasheet | | | |

15 Acceptance certificate

Trackers ADM333 GLONASS/GPS-GSM/GPRS SHAIF.464512.001-10 in quantity of _____ pcs. correspond to SHAIF.464512.001 TY and are valid for use.

Manufacture date:



Manufacturer: «Neomatica» LLC
 24a Malkova Str., office 6, 614087, Perm, Russia
 Tel: +7 (342) 2-111-500.
 E-mail: sales@neomatica.com
 website: neomatica.com/en

Appendix A. Description of the bits of the field «STATUS»

Table A.1. Description of the field bits «Status»

| Bits | Field description «Status» | Mask value |
|-------------|--|-------------------|
| 0 | Sign of the tracker restart | 1 |
| 1 | Number of active SIM card (0 – SIM0, 1 – SIM1) | 2 |
| 2 | No connection with server | 4 |
| 3 | - | 8 |
| 4 | Sign of low voltage of the internal battery | 16 |
| 5 | Sign of invalidity of coordinates | 32 |
| 6 | Coordinates are fixed at the absence of movement | 64 |
| 7 | External power supply of the tracker is switched off | 128 |
| 8 | - | 256 |
| 9 | Sign of GNSS jamming | 512 |
| 10 | GNSS jamming | 1024 |
| 11 | - | 2048 |
| 12 | - | 4096 |
| 13 | - | 8192 |
| 14 | Time is synchronized via the GSM | 16384 |
| 15 | - | 32768 |

Appendix B. Description of transmitted parameters in Wialon

Table B.1. Description of transmitted parameters in Wialon system

| Parameter | Description |
|--------------|--|
| acc | Current point acceleration module, km/h/s |
| sats_glonass | Number of GLONASS satellites involved in fixing a navigation problem |
| sats_gps | Number of GPS satellites involved in fixing a navigation problem |
| hdop | Precision reduction on a horizontal plane |
| pwr_ext | External power voltage value, mV |
| pwr_int | Voltage in built-in battery, mB |
| adc1 | Analogue input voltage value, A_IN0, mB |
| adc2 | Analogue input voltage value, A_IN0, mB |
| adc3 | GSM signal level, % |
| adc4 | |
| adc5 | |
| adc6 | |
| fuel1 | Fuel level value in sensor №0 |
| fuel2 | Fuel level value in sensor №1 |
| fuel3 | Fuel level value in sensor №2 |
| temp1 | Temperature value in sensor №0 |
| temp2 | Temperature value in sensor №1 |
| temp3 | Temperature value in sensor №2 |
| I/O | Value of device status |
| vib | |
| in1 | Discrete state on input AIN0 |
| in2 | Discrete state on input AIN1 |
| in3 | |
| in4 | |
| in5 | |
| in6 | |
| in7 | |
| in8 | |
| in9 | Sign of tracker restart |
| in10 | Number of active SIM card (0 – SIM0, 1 – SIM1) |
| in11 | No connection with server |
| in12 | |
| in13 | Sign of low battery voltage |

| | |
|-------------|---|
| in14 | Sign of invalidity of coordinates |
| in15 | Coordinates are fixed in the absence of movement |
| in16 | External power supply of the tracker is switched off |
| in17 | |
| in18 | Suspicion of GNSS jamming |
| in19 | GNSS is revealed |
| in20 | |
| in21 | |
| in22 | |
| in23 | Time is synchronized according to GSM |
| in24 | |
| can1-can25 | Fields are used to transmit data from BLE sensors. Fields description |
| can26 | Battery voltage, BLE fuel level sensor 0 |
| can27 | Battery voltage, BLE fuel level sensor 1 |
| can28 | Battery voltage, BLE fuel level sensor 2 |
| can29-can33 | MODBUS data |
| can29-can45 | CAN-LOG Data |
| can43-can62 | BLE tags (parallel transmission of several numbers) |
| can59 | ADM20: ADM21 tags |
| can60 | ADM20: RFID cards |
| can62 | BLE tags (transfer of all numbers in one field) |
| can63 | iButton |