NEOMATICA

Personal tracker ADM P50/ADM P50 LTE GLONASS/GPS-GSM/GPRS

Operation manual

Edition 1.2

Neomatica, +7 (342) 2-111-500 (ext.42), http://neomatica.com

This Guide extends to the telematic device ADM P50 (hereinafter referred as device or tracker), determines the order of its operation, and also contains a description of the tracker functioning and its management.

Installation and configuration of the tracker should be carried out by qualified specialists to ensure its proper functioning. For successful use of the tracker, it is necessary to look up the working principles of the monitoring system, and understand the purpose of all its components separately. Therefore, it is strongly recommended to study the basics of the functioning of the global navigation satellite systems GLONASS and GPS, GSM/LTE communications, the features of data transfer via short text messages (SMS), GPRS and the Internet.

Table of Contents

1 Purpose and Function

The ADM P50 tracker consists of a microcontroller, non– volatile memory, a GLONASS/GPS module, a GSM/GPRS module (GSM/GPRS/LTE module in ADM P50 LTE), an accelerometer, an alarm button and an opening of enclosure sensor.

Picture 1 — General view of the ADM P50

GLONASS/GPS module receives signals from GLONASS/GPS satellites and determines the geographical coordinates of the location (latitude, longitude and altitude), as well as the exact time (GMT), speed and moving direction.

The GSM/GPRS (GSM/GPRS/LTE module in ADM P50 LTE) module establishes and supports outgoing TCP/IP connection, periodically transmitting information packets to a dedicated server with a static IP address or domain name, and also receives and sends SMS messages by means of GPRS/LTE packet data transmission technology.

The accelerometer is used to determine the level of vibration, which manages switching of energy– saving functions in the automatic mode.

The "SOS" alarm button is used to activate a mechanism for sending an SMS message and sending an information packet with the alarm flag to the server.

After switching– on, the tracker receives information from the satellites of the GLONASS/GPS system, determines its location, speed, time and establishes a connection to the server. After establishing the connection, tracker transmits the accumulated data with given frequency to the dedicated server. Then the data can be applied for further analysis and processing with use of corresponding software on personal computers and other supported computing devices.

In case of absence of communication with the server, the tracker writes information packets to non– volatile memory, and upon the appearance of the connection, transmits them.

Depending on the selected mode of operation, it is possible to use the device as a car tracker, a personal tracker, or a beacon (bookmark). The device can be used to track the location of any mobile or stationary object – vehicle, cargo, person, animal, etc.

2 Technical specifications

ADM P50 can be used in GSM network only. ADM P50 LTE can be used in both GSM и LTE networks.

2.1 ADM P50 technical specifications

- GLONASS/GPS receiver:
  frequency ranges: GLONASS – L1 (CT– code), GPS – L1 (C/A code);
  cold start/tracking sensitivity: – 149 dBm/– 167 dBm;
  number of tracking/capturing channels: 33/99;
  accuracy of determining the coordinates, 95% of the time, no worse than: 3 m.
- Communication standard: GSM 850/900/1800/1900, GPRS Multi– slot Class 12/10.
- GSM transmitter power: 2 W.
- Number of SIM cards: 2.
- Accelerometer type: digital, tri– axial.
- Alarm button.
- Vibration signal;
- Opening of enclosure sensor;
- Li– Po battery: capacity 3300 mAh (11.1 W*h), weight 60 g.
- Number of storable entries about route: 100000.
- Wireless devices communication interface: Bluetooth Low Energy
- PC communication interface: USB Type– C.
- Operating temperature in battery discharge mode: – 20..+60°C.
- Operating temperature in battery charging mode: 0..+45°C.
- Maximum current consuming in charging mode: to 1 A.
- Charger voltage: 5 V.
- Data transfer protocol: ADM, EGTS.
- Dimensions: 89x56x25mm.
- Weight: not more than 125 g.

2.2 ADM P50 LTE technical specifications

- GLONASS/GPS/QZSS/SBAS receiver:
  Chipset: BK1661
  frequency ranges: GLONASS – L1 (CT– code), GPS – L1 (C/A.L1C), QZSS – L1 (C/A.L1C);
  cold start/tracking sensitivity: – 148 dBm/– 167 dBm;

accuracy of determining the coordinates, 95% of the time, no worse than: 3 m;

Cold start duration: 28 s. at a signal level of at least – 130dBm

Warm start duration: 1 s. at a signal level of at least – 130dBm

Tracking channels: 120

- Communication standard: GSM/GPRS/LTE;
- GSM(E, L) frequency range: 850/900/1800/1900MHz;
- LTE category: Cat1
- LTE(E) frequency range: FDD: B1/B3/B5/B7/B8/B20/B28;
- LTE(L) frequency range: FDD: B2/B3/B4/B5/B7/B8/B28/B66;
- Transmitter power class (transmitter power):
  - GSM850/900: 4 (2W);
  - GSM1800/1900: 1 (1W);
  - LTE FDD: 3 (0,25W);
- Number of SIM cards, form– factor: 2, nano– SIM (4FF);
- Accelerometer type: digital, tri– axial;
- Alarm button;
- Vibration signal;
- Opening of enclosure sensor;
- Li– Po battery: capacity 3300 mAh (11.1 W*h), weight 60 g;
- Number of storable entries about route: 100000;
- Wireless connection interface: Bluetooth Low Energy;
- PC communication interface: USB Type– C.
- Operating temperature in battery discharge mode: – 20..+60°C;
- Operating temperature in battery charging mode: 0..+45°C;
- Maximum current consuming in charging mode: to 1 A;
- Charger voltage: 5 V;
- Data transfer protocol: ADM, EGTS;
- Dimensions: 89x56x25mm;
- Weight: not more than 130 g.

3 Turning on and off

3.1 Turning on and off with the power button

To turn on the tracker, press and hold the power button at least for three seconds. When the three LEDs begin to glow, you can release the button. The blue and green LEDs will turn off, and the red LED will flash in series according to the battery charge level (watch section "Indication" – "Determining the battery charge level"). Tracker switched on.

To turn off the tracker, press and hold the Power button. When the button is pressed, the three LEDs light up, and after 3 seconds the LEDs turn off. Release the button. Tracker switched off.

3.2 Battery charging

The battery is charged with a USB charger with a voltage not exceeding 5V. The charging process is controlled by an in– built controller.

- The charging process starts automatically when the charger or PC is connected.
- The device may be on or off during the charging process.
- Fully charging duration at a temperature of 15– 40 ° C: 3 – 3.5 hours.
- Recommended ambient temperature during battery charging: 20– 30°C.
- Permissible ambient temperature during battery charging: 10– 40 °C.
- When the device temperature is below 10°C or above 45°C, the charging process slows down or shuts down.

3.3 Automatic switch– on with the charger connection

If this function is activated, the switch-on of the tracker is automatic, when it is connected to a charger or a personal computer, regardless of how the switch-off occurred - by using the Power button or because the battery is completely discharged. By default, this feature is disabled.

The configuration is performed using the configurator via the USB interface or remotely by sending commands via GPRS or SMS.

PENU X

X=0 – Automatic switching– on disabled.

X=1 – Automatic switching– on enabled.

3.4 Power button lock

If this function is activated, disabling of the tracker becomes impossible with the Power button. Switching– on the tracker and determining the battery charge level are still available. By default, the lock is disabled.

The configuration is performed using the configurator via the USB interface or remotely by sending commands via GPRS or SMS.

POFF X

X=0 – Power button unlocked.

X=1 – Power button locked.

To turn off the tracker using the button, you must disable the Power button lock.

3.5 Remote shutdown via command

If there is a need to turn the device off remotely, send the **OFF** command to it in any available way. Disabling the device with this command is equivalent to a button disabling.

After turning off the device, it will be impossible to turn it on remotely – only using the button.

4 Indication

4.1 Green LED – GLONASS/GPS module status

- flashes three times during the period – GLONASS/GPS module is on, but there is no data from it yet;
- flashes twice during the period – there is data from the GLONASS/GPS module, but the data is invalid;
- flashes once during the period – there is data from the GLONASS/GPS module and the data is valid;
- no flashes – GLONASS / GPS module is turned off or the device is in a sleeping state.

In the beacon mode, the LED does not light regardless of the GLONASS/GPS module state during sleep

4.2 Blue LED – GSM module status

- flashes three times during the period — cellular network is available, GPRS connection is not established, connection with the server is not established;
- flashes twice during the period — cellular network is available, the GPRS connection is established, the connection to the server is not established;
- flashes once during the period — cellular network is available, a GPRS connection is established, a connection to the server is established;
- no flashes — GSM/GPRS module is turned off or GSM network registration is in progress. It is also possible in case the device is in a sleeping state.

In the beacon mode, the LED does not light regardless of the GSM module state during sleep.

4.3 Red LED – battery charge process status

- LED flashes once a second — charging;
- LED lights permanently — charging completed;
- LED flashes more often than once a second — the charging process is completed abnormally. It is possible if the temperature of the device has exceeded the allowed limits, or the device's charging time has been exceeded;
- LED is not lit — there is no external power. It is possible if the USB cable is not connected or there is no contact in the USB connector.

4.4 Determining the battery charge level

To determine the battery charge level, briefly press the Power button. Thereafter, red LED would make several flashes, the number of which will correspond to the battery charge level:

- three flashes – maximum charge level;
- two flashes – average charge level;
- one flash – low charge level, charge the battery.

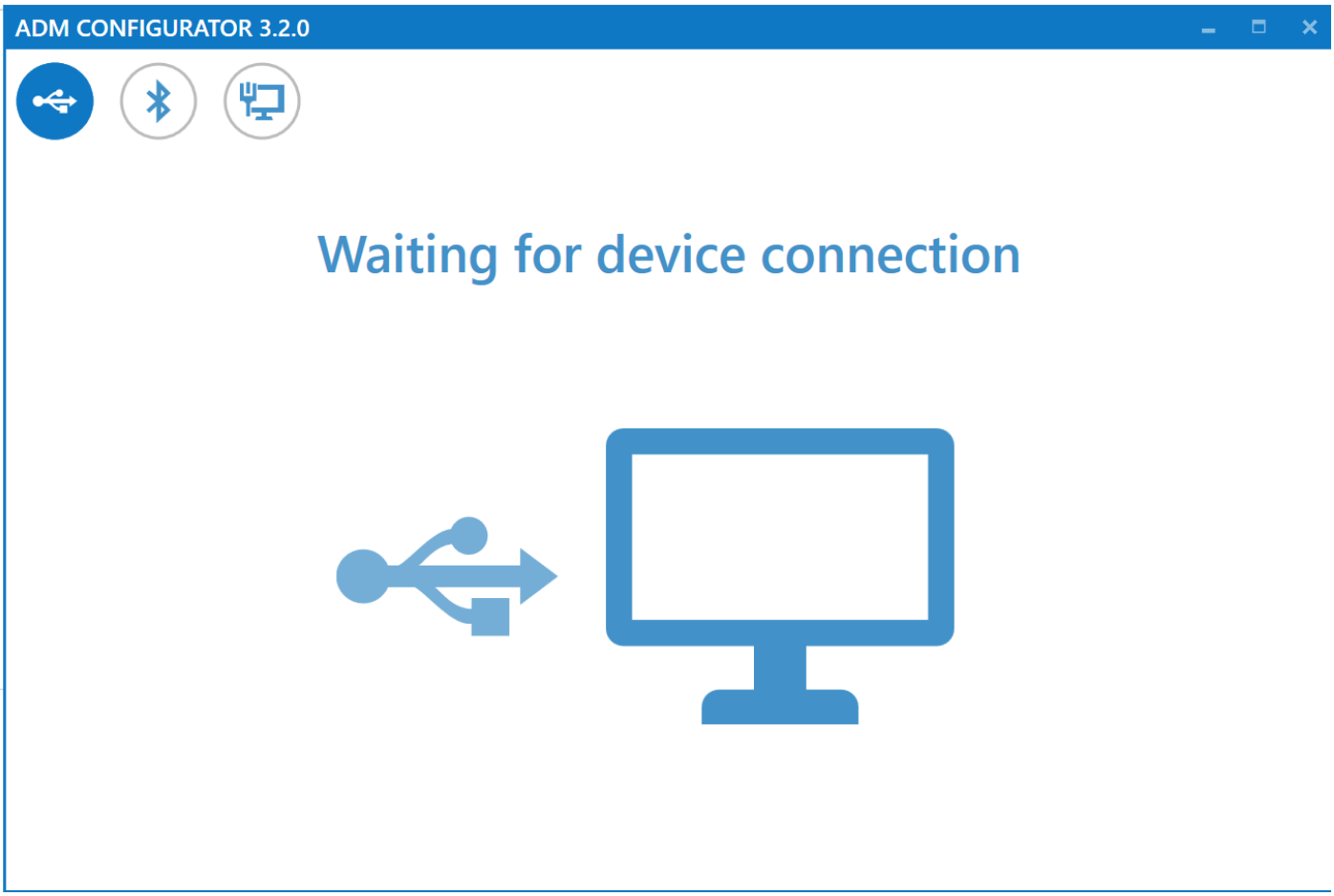
5 Tracker settings

5.1 Connection to ADM configurator

To connect the tracker to a personal computer using USB, you should do the following:

1) Download the ADM Configurator program of the version 3.2.0 or later (available on the website http://neomatica.com);

2) Switch the ADM Configurator to the USB connection mode. To do this, you need to select the way of device connection by clicking on the USB icon in the upper left corner of the ADM Configurator, as shown in Screenshot 1;



Screenshot 1. Selection of the connection method

3) Turn on the tracker;
4) Connect USB cable to the PC;
5) In a few seconds connection will be set;

If the password different from “0” was set, insert it. If there is no password settings window will be opened.

5.2 Configuration using commands

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

General rules of writing and sending commands:

- only Latin characters, numbers and punctuation may be used in commands;
- character case does not matter;

- commands syntax is the same for SMS, GPRS and USB;
- commands syntax: “CMD X1,X2,X3”, where CMD is a command, X1..X3 are commands parameters;
- commands are separated from the parameters by a SPACE;
- Parameters are separated by commas, using space between them is not allowed;

When receiving a command, the tracker performs it and sends an answer.

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.

In response to an unknown (misspelled) command, an “unknown command” error message is sent.

Recommendation: Commands can be added during the development of the device firmware. If you receive an error about an unknown command, sometimes you need to update the device's firmware to solve this problem.

- **Sending commands using ADM Configurator**

To send commands via USB you should use ADM Configurator.

- **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 tracker saves the phone number in a non–volatile memory during the whole service life. Maximum saved phone numbers - 4. Resetting the settings 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.

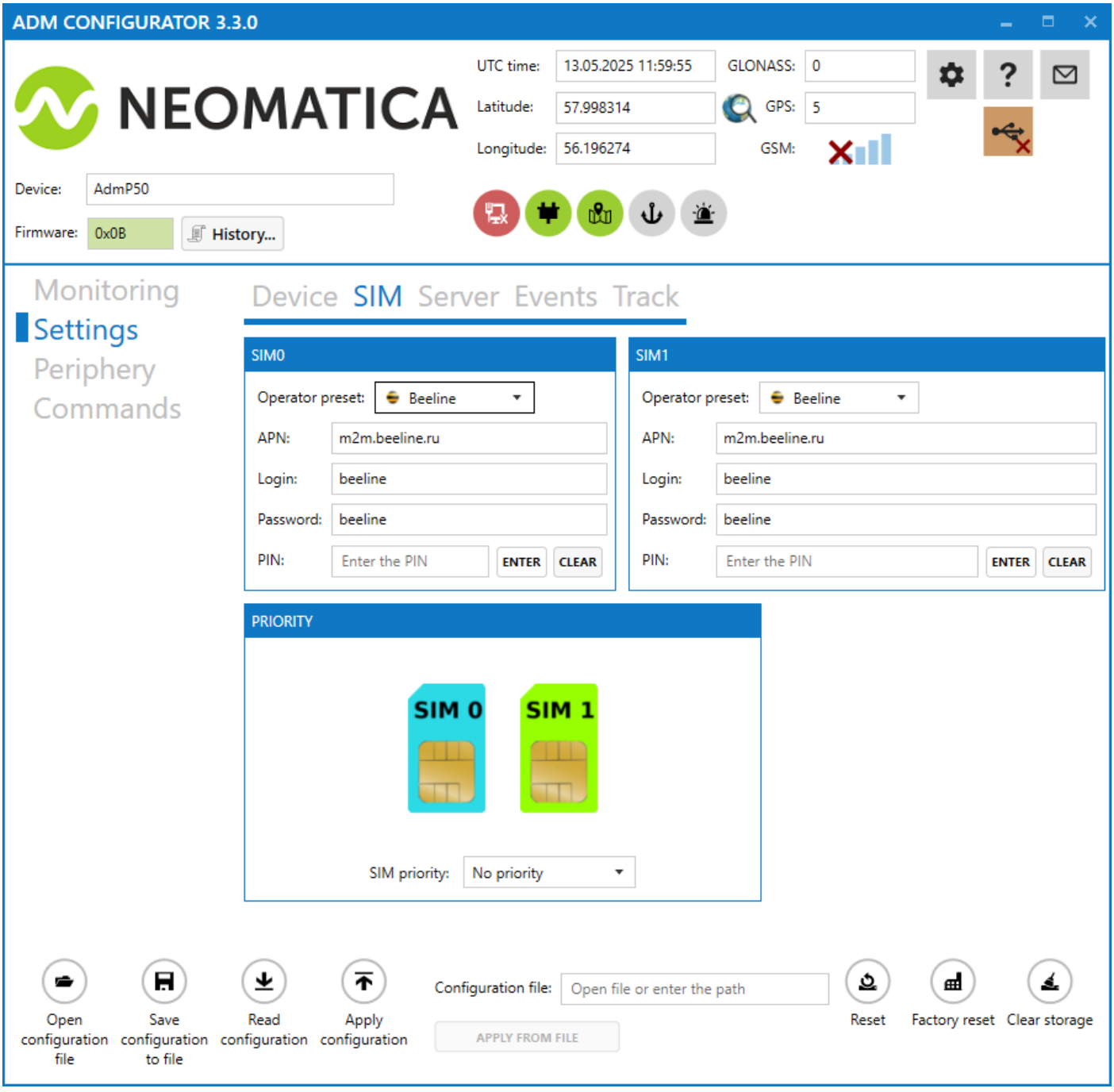
5.3 Main settings

5.3.1 SIM– card settings

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 SIM-card in each holder.

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 figure in a command

name corresponds to the SIM card in each holder. This PIN– code will be automatically entered each time a SIM-card initialization is required.



Screenshot 2. ADM Configurator / Sim– card settings

It is possible to select a priority of SIM-cards when using two Sim cards. If the priority is not set, the device will use the first SIM-card that acquired connection to the server. The SIM-card will be switched if the connection is disrupted. If the priority is set, the device will try to select the priority SIM-card during the working time. The priority is set in the graphic interface of the ADM Configurator or using **SIMPRIORITY** command. By default, priority is not set.

Setting by commands:

• **Access point**

SETGPRS0 access point,login,password – SIM0 access point setting;

SETGPRS1 access point,login,password – SIM1 access point setting;

if there is no login and password, two commas should be placed instead:

SETGPRS0 access point,,

• **PIN code**

PIN0 XXXX setting of SIM0 pin code;

PIN1 XXXX setting of SIM1 pin code;

XXXX – pin code;

PIN0 0000 – erase the pincode.

• **Priority of simcards**

SIMPRIORITY X

X = 0 – no priority.

X = 1 – SIM0 priority.

X = 2 – SIM1 priority.

5.3.2 Configuring the network type (ADM P50 LTE modification only)

For ADM P50 LTE, it is possible to select the type of network in which the device is planned to operate. By default, the automatic network type selection mode is set, with the selection of the best available one. If there is a need to work only in GSM or LTE network, it is necessary to select the appropriate mode.

Setting by command:

NET X,Y

X=0 – setting the network type for SIM0.

X=1 – setting the network type for SIM1.

Y=0 – Automatic selection of the network type.

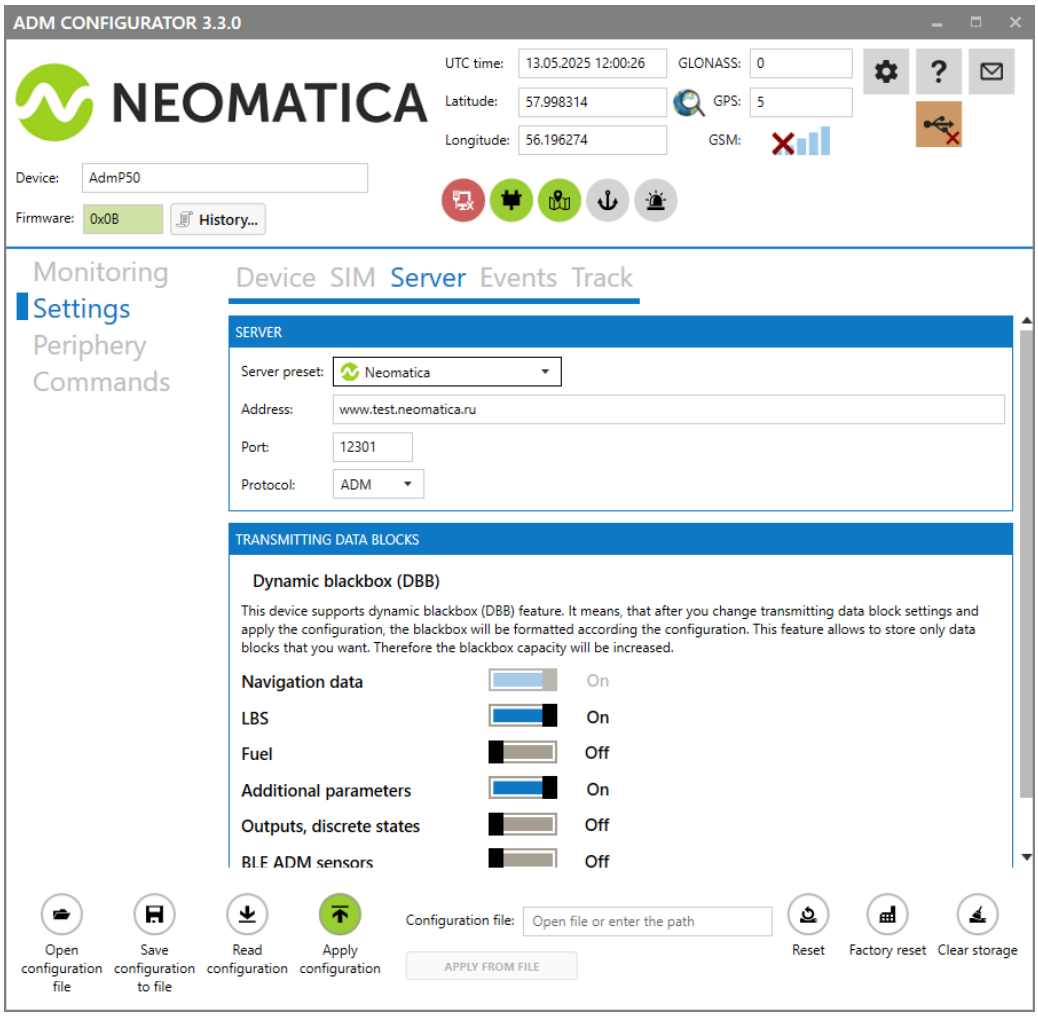
Y=1 – GSM only.

Y=2 – LTE only.

5.4 Server connection settings

In the Settings\Server window (Figure 3), enter the address, port and select the data transfer protocol.

Addresses in the format of IP and domain name are supported.



Screenshot 3. ADM Configurator / Server settings

Setting by commands:

Set Server Address

Example of entering address 111,222,333,444 and port 55555:

SETHOST0 111.222.333.444:55555

Example of www.test.neomatica.ru address entry: 12301

SETHOST0 www.test.neomatica.ru:12301

Data Protocol Setup:

SETPROTOCOL0 X

X = 0 – ADM protocol

X = 1 – EGTS protocol

5.5 Data transmission setting

The data transmitted from the device to the server is divided into blocks. You need to enable transmission of required data blocks. It is recommended to disable unused data blocks to reduce traffic consumption. Configuration of transmitted data blocks is performed in the Settings\Server window (See Screenshot 3).

Setting by commands:

PROTOCOL X

X – bit mask

The correspondence of data blocks to the values of the PROTOCOL command parameter is given in the table. If multiple data blocks are to be included, the X parameter is computed by addition.

For example, include the transmission of data blocks "main," "additional" and "ADM34 tags": main data (0) + additional data (8) + BLE sensors (4096) = PROTOCOL 4104

Table 1. Values of the main parameters for PROTOCOL command

Data packet name		Parameter value
Main data	NAVIGATION DATA	0
Outputs, events in inputs	OUTS	4
Additional data	IN_A	8
LBS	LBS	16
Fuel level sensors	FUEL	32
BLE sensors	ADM3X	4096
ADM34 BLE tags	BEACON2	32768

5.5.1 Additional parameters

The "Additional parameters" data block is used to transmit the following parameters:

- AIN0: Temperature inside the enclosure;
- AIN1: Battery charge level percentage;
- AIN2: Cellular network signal strength percentage;

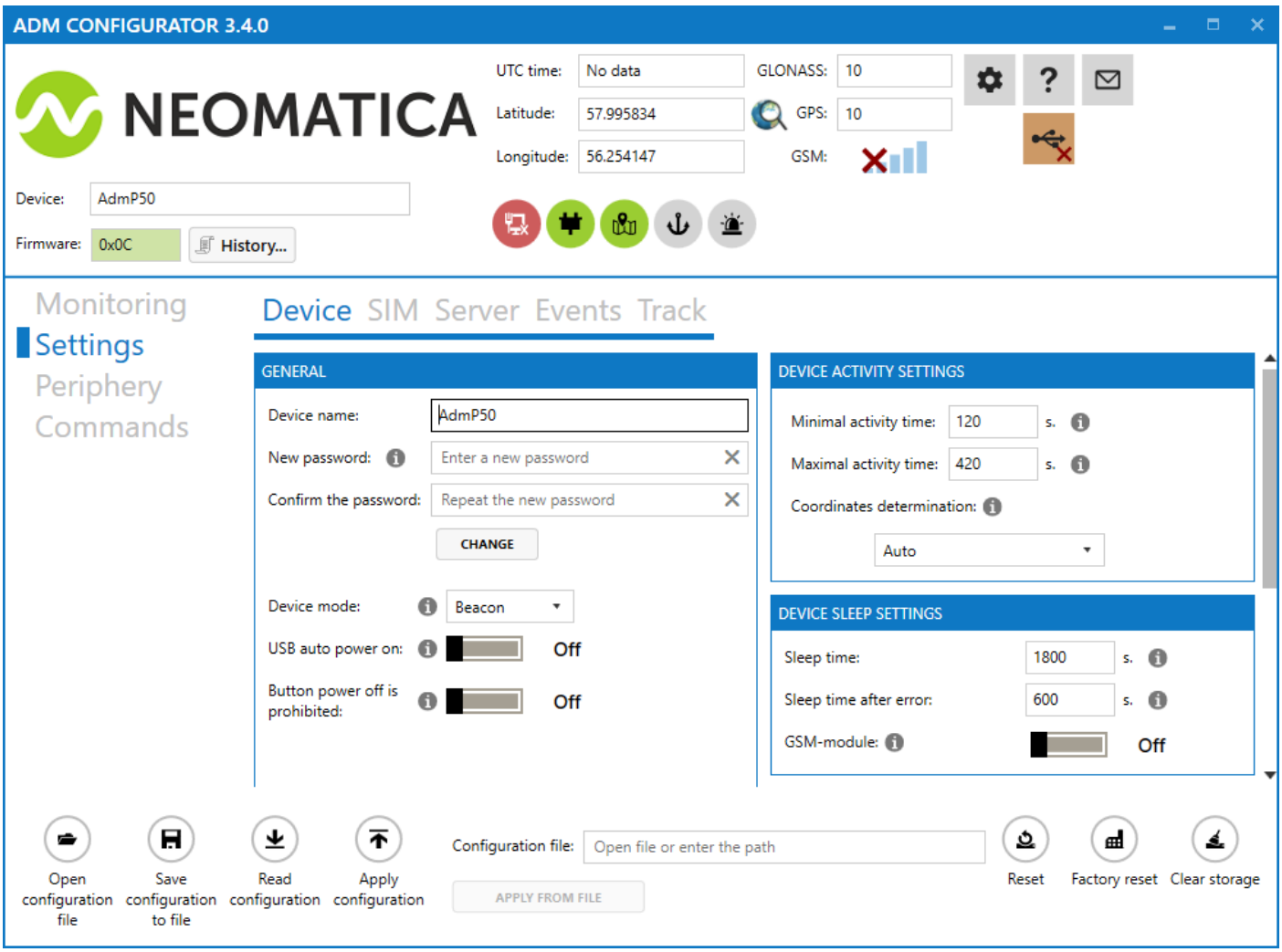
In most monitoring platforms, the incoming values in these fields are divided by 1000. In this case, the multiplication operation by 1000 must be applied to convert the values to the normal form.

6 Operating Modes

The device can operate in one of two main modes: beacon or tracker, as well as switch between these modes automatically in the hybrid mode. The operating parameters of these modes are independent; they can be configured simultaneously.

By default, the mode settings can be used without modification. The tracker mode is set by default.

The operating mode is selected in the Settings/Device window of the configurator (figure 4).



Screenshot 4. ADM Configurator / Device settings

Setting by commands:

DMODE X

X=0 – Beacon Mode ;

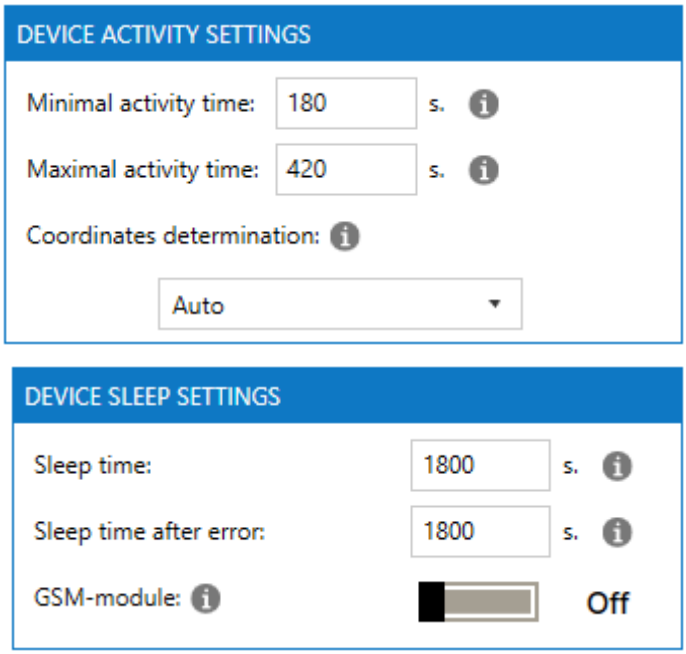
X=1 – Tracker Mode ;

X=2 – Hybrid Mode.

6.1 Beacon Mode

In the beacon mode, the device periodically enters the active state and performs certain actions, such as: determining coordinates, waiting and processing incoming SMS, and others. Between activity periods the tracker enters the sleep state (energy saving).

- **minimum activity time** – the time during which the device will guaranteed be in the active state, even if all the necessary actions were performed. This time allows to wait for an incoming SMS containing the command;



- **maximum activity time** – This parameter affects successful data transmission. If the value is too small, the probability of sending data successfully will decrease, and an overestimated value will entail a decrease in the duration of operation only in poor signal reception conditions.

- **sleep time after successful activity** — the time for which the device will be in sleep state, if all the necessary actions were performed during the device activity;

- **sleep time after error** — the time for which the device will be in sleep state, if during the activity were not executed all the tasks or errors occurred, for example, it was not possible to establish connection to the server.

- **status of the GSM/GPRS module during sleep** – this parameter determines the possibility of receiving an SMS command during sleep;

- **determination of coordinates during activity** – this parameter determines the need to determine the coordinates during the activity and their source.

“Disabled” – determination of coordinates is not performed; the mode is used for maximum energy saving. That allows to determine the coordinates only on request. The tracker establishes a connection to the server during waking, but does not send packets – only waits for GPRS or SMS command.

“GLONASS/GPS”– determination of coordinates performs only via GLONASS/GPS system.

“GSM base stations” – determination of coordinates performs only via LBS technology. This mode of determining the coordinates has lower accuracy than navigation using GLONASS/GPS systems, but significantly saves battery power.

“Auto” – selecting the source of coordinates is in automatic mode. The priority system is GLONASS/GPS. In the case if signal strength from satellites is low and the coordinates are not valid, the location is determined by GSM base stations.

The recommended option is “Auto”. Disabling LBS does not result in a reduction in power consumption.

• **Using a black box.**

By default, data is not uploaded from the black box in the beacon mode. The data generated only during the current activity session is sent to the server.

When the option to use the black box in the beacon mode is enabled, all unsent data will be searched and uploaded during the current activity session.

If there is a large amount of data in the upload queue, the duration of the activity session will be limited by the maximum activity time, and the rest of the data will be uploaded during subsequent activity sessions.

• **Data collection from BLE devices during sleep.**

This function allows you to log data received from BLE– linked sensors and ADM34 tags during sleep without turning on the navigation system and GSM system. This allows you to increase the refresh rate of readings with moderate power consumption. In this case, data is recorded in the database, and uploaded to the server during the next transition to activity mode. The option to use the black box in the beacon mode must be enabled, otherwise the data recorded during sleep will not be uploaded.

"BLE wake– up period" is the time after which the BLE receiver and transmitter will be turned on and data will be collected from BLE sensors. From the point of view of saving energy, it is not recommended to set the frequency of waking up too often. It is recommended to select a value of 300 seconds or more. If necessary, you can set up a wake– up once per minute, but you cannot

set less than the duration of data collection. An increase in the wake– up frequency leads to an accelerated discharge of the battery.

"Data collection duration" is the time during which the BLE receiver and transmitter will be kept active. It is recommended to set the duration slightly longer than the frequency of the sensor broadcast. (for example, the ADM35 BLE sensor broadcasts every 15 seconds by default). In conditions of low signal strength from BLE devices or with a rare BLE wake– up period, it is possible to increase the duration of data collection by 2– 3 times in relation to the frequency of sensor broadcasting, this will increase the probability of receiving data.

Setting by commands:

BTIME *X,Y,Z,A*

X – minimum activity time;

Y – maximum activity time;

Z – sleep time after successful activity;

A – sleep time after error,

Where X, Y, Z, A set in seconds.

BMODE *X,Y,Z*

X – GSM module status during sleep: 0 – off., 1 – on.;

Y – GLONASS/GPS module status during sleep: 0 – off or 1 – on.;

Z – determination of coordinates during activity:

0 – Disabled;
1 – GLONASS/GPS;
2 – LBS;
3 – Auto;

BBOX X

X =0 – Black box disabled in the Beacon Mode;

X =1 – Black box enabled in the Beacon Mode.

TMIDDLE X,Y

X – BLE module wake– up period, seconds;

Y – data reception duration, seconds.

BWAKEUP

The command carries out an extraordinary switching the tracker into the beacon mode activity state. If this command is intended to be used, GSM/GPRS must be turned on during sleep to ensure prompt reception of commands.

6.2 Tracker Mode

The tracker mode is designed for detailed drawing of the route. In the tracker mode the device determinates coordinates every second. The obtained coordinates are checked for validity and then processed in accordance with the track drawing algorithm. As a result, device forms data packets ready for sending. The data is sent in real time when there is a connection to the server. In the absence of connection with the server, data is stored in non– volatile memory (black box) and is uploaded automatically after connecting to the server.

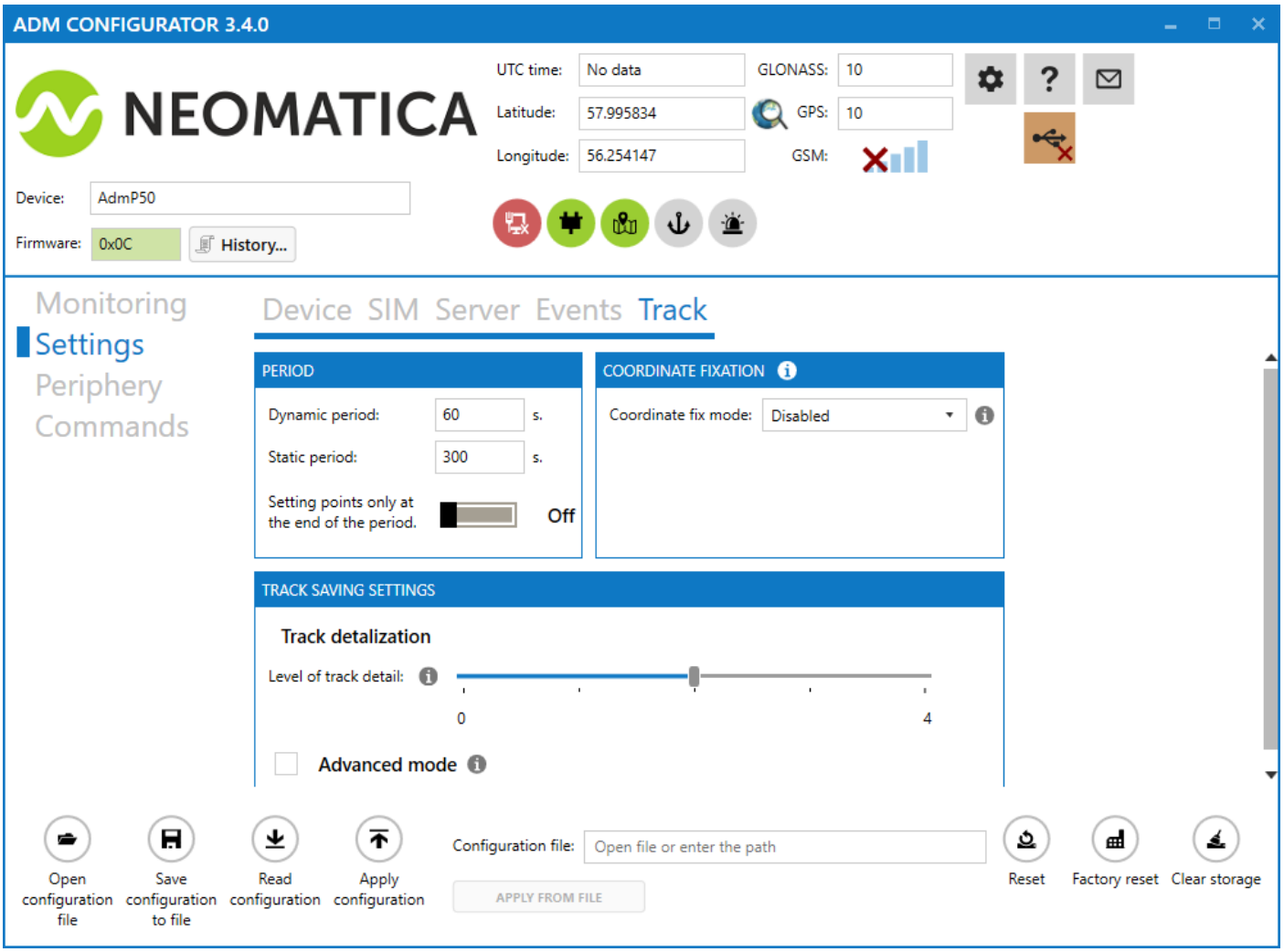
In the tracker mode, the priority is to ensure high – quality drawing of the route. Recording of route points in motion is carried out in accordance with the track drawing algorithm, and compliance with a certain frequency of recording points in motion is not carried out.

The tracker mode contains energy– saving functions “coordinate fixation” and “deep static”. These energy – saving functions are activated when there is no movement (vibration). If there is movement (vibration), the device in the tracker mode never switches to the energy saving mode.

It is possible to completely disable all energy– saving functions with one "coordinate freezing" parameter. If coordinate freezing is disabled, deep static will also be disabled. The device will be fully functional under any conditions; this can be useful when testing functionality. In other cases, except for testing, turning off coordinate freezing is not recommended.

By default, the tracker mode is fully configured and ready for use without changes. The optimal track rendering quality has been set; deep static is disabled.

6.2.1 Operating parameters of the tracker mode



Screenshot 5. ADM Configurator / Track settings

• **Track saving settings.**

It is the main parameter of the algorithm for recording track points (trajectory).

It is recommended to use preset 2, this preset provides good track detail, has balanced power consumption and traffic consumption.

• **Dynamic period.**

If no point recording condition is met in the motion, the point will be recorded after this time. It is a secondary parameter of the point recording algorithm.

The recommended value is 60 seconds. It is not recommended to set this parameter for less than 30 seconds.

• **Static period.**

It is the main parameter of the algorithm for recording points in the absence of movement.

If no point recording condition is met in the stationary state, the point will be recorded after this time.

The recommended value is 300– 600 seconds or more.

Setting periods in parking and in motion less than the recommended ones is not advisable in most cases and leads to frequent recording of unnecessary route points and a significant decrease in operating time.

• Description of presets of the of track details degree:

Preset 0. Satisfactory track quality, economical option in terms of the number of points and traffic consumption. The quality is sufficient for trajectory monitoring. Easier to draw rotations. Minor course changes are not drawn. (the expected number of points per km is 2 times less than the preset 2)

Preset 1. Normal track quality. The render of small changes in course and turns is simplified. (the expected number of points per km is 1.3 times less than preset 2)

Preset 2. Active by default. Good track quality. This option is suitable for most tasks. It is average in terms of track rendering quality and traffic consumption. Small changes in course and turns are drawn in sufficient detail.

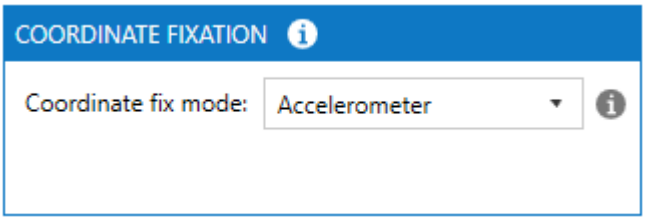
Preset 3. Improved detailing of even a slight change in course. (The expected number of points per km is 1.3 times higher compared to preset 2)

Preset 4. High track detailing. Improved render of a slight change in course. (Expected number of points per km is 1.6 times more than preset 2)

6.2.2 Energy– saving features in the tracker mode

- **Coordinate fixation.**

Fixed device mode. In this mode, the last coordinate at the time of entering this mode is frozen, and all subsequent coordinates are ignored until the movement begins. This function allows you to filter the "stars" on the track and slightly reduce traffic.



- **Deep static.**

Fixed device mode, in which GSM/GPRS and/or GLONASS/GPS nodes can be turned off. This function allows you to save energy and increase the duration of the device work.

When you select the "full sleep" mode, GSM/GPRS and GLONASS/GPS will turn off.

In the "disabled" mode, the transition to deep statics will not be performed.

When GLONASS/GPS is off, the coordinates are not calculated, immediately after the start of movement, the navigation receiver will start and the calculation of coordinates will be resumed.

When GSM/GPRS is turned off, the device will disconnect from the server and will not receive SMS commands, immediately after the start of movement, it will register on the network, receive SMS commands and connect to the server.

• **Time for turning deep statics mode on.**

The time until the transition to the "deep static" mode begins to be counted from the moment the coordinates are frozen. It is not recommended to set the time to less than 3– 5 minutes to prevent premature transition to this mode.

• **Economical navigation**

With the option activated, power consumption is dynamically adjusted, reduced during parking, slow and straight movement. This mode allows you to increase the operating time during inactive movement. Track detail is reduced when using this mode, but remains at an acceptable level for tracking the object.

This mode is not related to track drawing settings and track drawing presets and has additional battery savings.

To get maximum energy efficiency in the tracker mode, you can simultaneously activate the GLONASS/GPS, GSM/GPRS shutdown options in deep static and economical navigation mode.

Setting by commands:

Choosing a preset for track drawing options:

TRACKSET X

X – track settings preset number

X = 0..4

The answer should contain all the set parameters (the number of the selected preset is not displayed in response).

Example of response: TRACK 4,1000,100; (1):3,5; (2):3,5; (3):3,5

The TRACKSET command without parameters displays the current track settings (the number of the selected preset is not displayed in response).

Setting point recording frequency.

PERIOD X,Y

X – recording period during movement in seconds,

Y – recording period during parking in seconds,

The PERIOD command without parameters displays the current settings.

Setting deep static.

STATICPOWER X, Y X = 0.. 3 – state in deep static.

Y – time in minutes, after which the deep static mode is activated in the absence of movement

X = 0 – transition to deep static is disabled

X = 1 – disabling GSM in deep static

X = 2 – disabling GNSS in deep static

X = 3 – disabling GSM and GNSS in deep static

Note: when remote setting of deep static in a stationary state, it is recommended to configure the rest of the parameters first and then configure deep static, because in a stationary state, a transition to deep static can occur and the device will stop receiving commands, and the exit to the working mode will occur only after the start of movement.

6.3 Hybrid mode

This mode combines the tracker and beacon modes. While moving, the device is in the tracker mode, and when stationary, it switches to the beacon mode. Switching occurs automatically, and motion or stationary state is determined based on data from the built– in accelerometer.

In the hybrid mode, the settings of the tracker and beacon modes are used.

6.4 Requesting a link with a location by the command

The WHERE command requests a hyperlink to Yandex.Maps or Google Maps (depending on the configuration of the device). The response to the command will be received in the form of an SMS text message containing a hyperlink with the last valid coordinates.

The map provider is configured using the MAPS command.

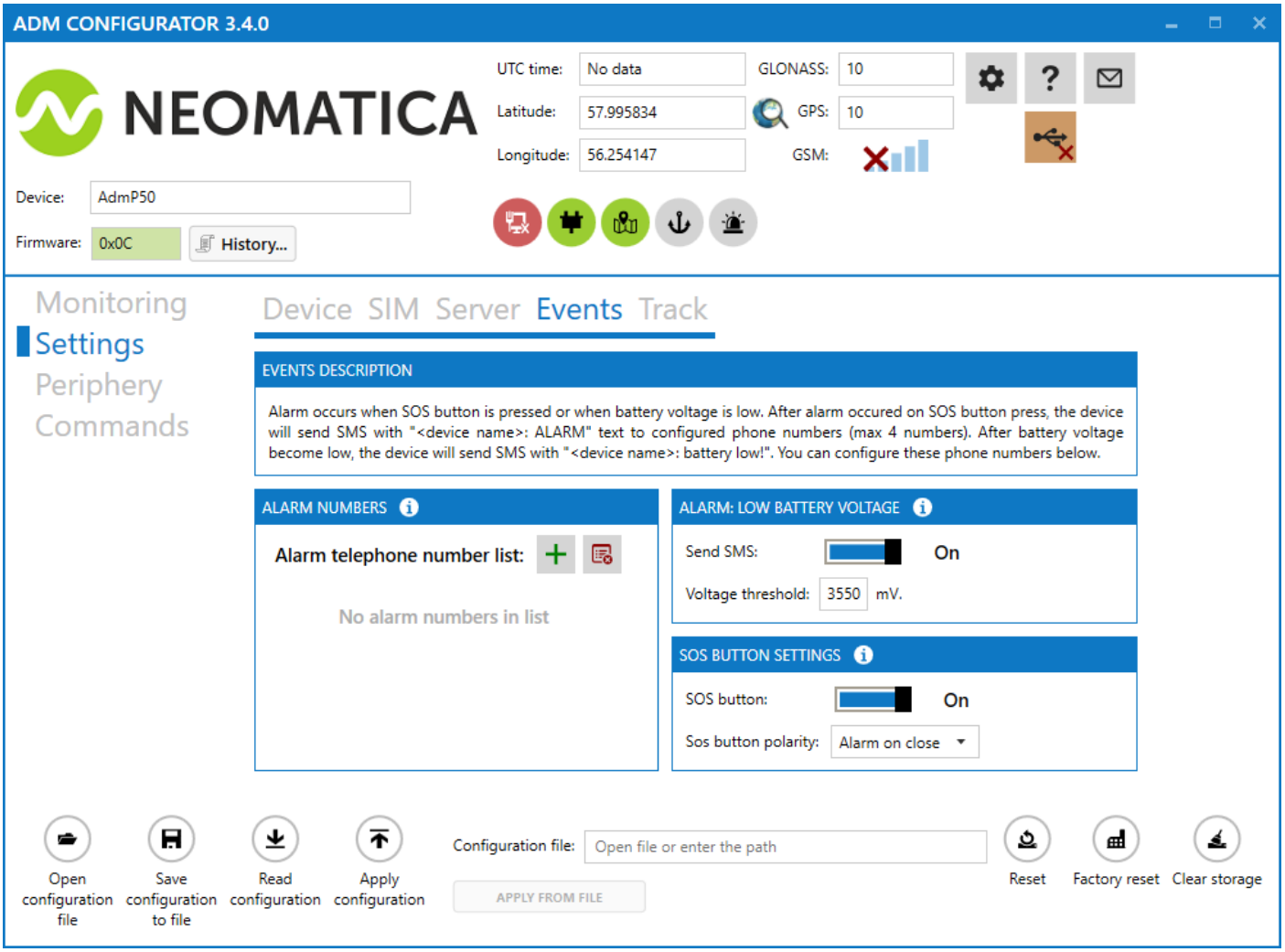
MAPS X

X=0 – Yandex Maps

X=1 – Google Maps

7 Alarm messages

The SOS button, low battery alerts, and the list of alarm numbers are configured in the configurator in the Settings/Events window.



Screenshot 6 – ADM Configurator/Events settings

7.1 List of alarm numbers

SMS messages are sent to the numbers in this list when the following events occur:

• The SOS button is triggered

• The battery is discharged below the set threshold.

The list of alarm numbers is configured in the configurator in the Settings/Events window (screenshot 6).

The list of alarm numbers is not linked to the list of authorized numbers. The numbers added to the alarm list do not have access to the device settings.

Setting up the emergency list with the command:

EVENTLIST 7xxx.... – add the number 7xxx.... to the list of alarm numbers;

EVENTLIST – show the list;

EVENTLIST 255 – clear the list.

7.2 "SOS" button

When the "SOS" button is triggered, the script is activated, which includes:

- Emergency switch to activity mode. If conditions do not allow the rapid calculation of coordinates or sending data in the "Beacon" mode, the maximum activity time will be increased automatically, but not more than three times. After the SOS script is executed, the device returns to its normal state.
- Sending SMS to the numbers listed in the emergency list. The text of the message: "SOS device name! TIME(UTC): "GMT time and date" POS: "link with coordinates".
- Sending an alarm flag packet to the server. The execution of the "SOS" script has no effect on the sleep timers of the "Beacon" mode.

The SOS button can be triggered by pressing (closing) or releasing (opening).

The SOS button can be blocked if it is not planned to be used. The button lock can prevent false alarms and wake– up from sleep mode when the case is squeezed.

The SOS button is configured in the configurator in the Settings/Events window (screenshot 6).

Setting by commands:

Button lock.

SOFF X

X=0 – the SOS button is active;

X=1 – the SOS button is locked.

Inversion of the button.

SOSPOL X

X=0 is triggered by pressing the button (closing),

X=1 is triggered by releasing the button (opening).

7.3 Low Battery Warning

Upon reaching the set voltage level on the battery, an SMS message with the text “device_name: battery low!” will be sent to emergency list phone numbers.

In tracker mode, the default threshold (3550 MV) will allow the device to stay connected for 8 hours or more. In the beacon mode with this threshold, the notification may be too early. The trigger threshold for your specific circumstances can be calculated experimentally: discharge the device

with the required operating parameters and plot a battery discharge graph in the monitoring software.

The low battery alert is configured in the configurator in the Settings/Events window (screenshot 6).

The activation of the function and the setting of the critical voltage level is performed using the command:

BATALARM X,Y

X=0 – alert function disabled,
X=1 – function enabled.
Y – critical battery voltage level, mV.

8 Indoor navigation

It is possible to implement indoor positioning based on data received via the BLE radio channel from the ADM34 BLE tags (hereinafter referred to as the BLE tag) in two ways.

8.1 Transfer of BLE tag identifiers to the monitoring software

The BLE tag IDs are sent to the server, sorted by signal strength. Further processing of the tag identifiers to convert them into the location of the object should be performed in the monitoring software (from the server side). The monitoring software should have the appropriate capabilities.

To ensure the transfer of tag identifiers to the server, you must enable the transfer of the BLE tag data block in the Settings/Server window.

8.2 Substitution of satellite coordinates for coordinates obtained from a tag

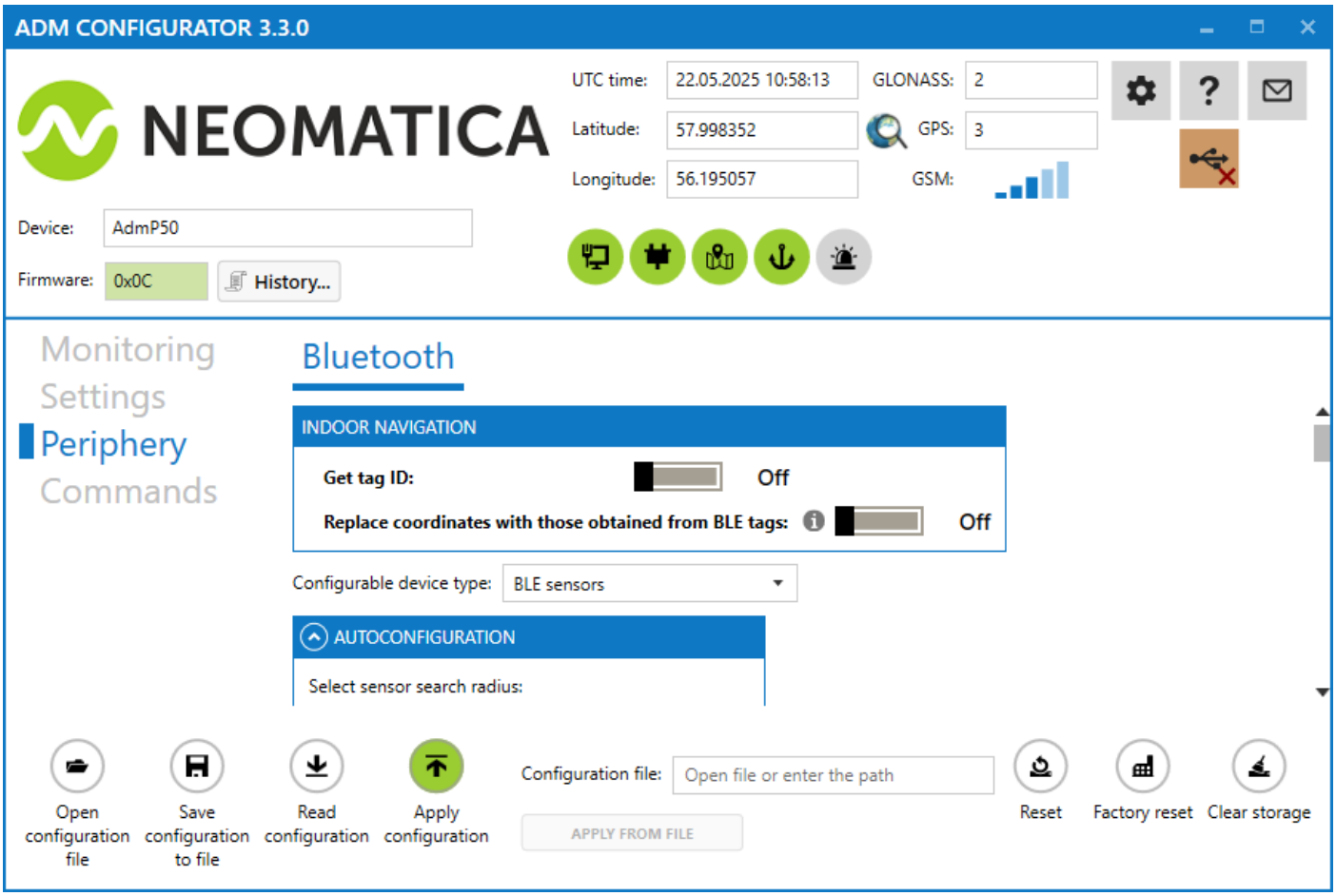
In this case, the device transmits "regular" data to the server, ensuring compatibility with monitoring software that does not support indoor navigation. The coordinates received from the BLE tag are recorded in the main data block, replacing the coordinates received from the satellite navigation system. BLE tags must be pre– configured accordingly: the "coordinates" mode should selected and altitude, latitude and longitude should be specified.

No additional settings are required from the monitoring software.

In messages with substituted coordinates, the number of satellites is set to 10+10.

It is possible to use both options at the same time. In this case, both the substituted coordinates and tag IDs will be transmitted to the server.

The indoor navigation settings are configured in the configurator in the Peripheral/Bluetooth window.



Screenshot 7. ADM Configurator/Periphery/Bluetooth settings

Setting by commands:

Activation of coordinate substitution.

INDOOR 0 – coordinate substitution is disabled.;

INDOOR 1 – coordinate substitution is enabled.

Activating the transmission of tag IDs.

BEACON 0 – ID reception is disabled.;

BEACON 1 – ID reception is enabled.

9 Connecting BLE sensors

There are two ways to bind the sensor to the device – manual and automatic.

In automatic mode, sensors are searched for and the addresses of all found sensors are automatically recorded in free cells until all cells are filled. The sensor type is determined

automatically. This method is suitable for a situation where only the necessary sensors are located in the receiving area of the device. In manual mode, you need to enter the addresses of each of the sensors. This method is suitable for a situation where there are active sensors in the receiving area of the device that do not need to be connected to this device.

The device allows you to bind 3 FLS and 5 ADM31/32/35 sensors.

9.1 Automatic search and connection of sensors

The sensor search process is started by pressing the "Start Autosearch" button. The search will be performed within two minutes, without filtering by sensor type and signal strength. The found sensors are recorded in free cells. Previously occupied cells are not overwritten; if necessary, they should be cleared before performing the search.

If there is a large number of sensors next to the device, the desired sensor may not be connected. In this case, it is necessary to clear all cells and bind the sensor manually.

Starting the sensor search with the command:

BLEAUTOCATCH – automatic search without a filter based on signal strength.

BLEAUTOCATCH 0 – stop the current search.

The **BLEAUTOCATCH** command starts the search process and automatically records the addresses of the found sensors. By default, the search is performed for two minutes without a filter based on signal strength.

9.2 Adding the ADM31, ADM32, ADM35 sensors manually and viewing the list of added sensors.

The **BLESENSOR** command allows you to add sensor addresses, as well as view the list of added addresses. The address of the sensor is indicated on the sticker placed on the case. You do not need to enter a colon when entering an address.

BLESENSOR X,Y – add address Y to 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 device.

Example of entering a command:

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

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

After adding sensor addresses by the command, the list of sensors in the configurator interface is not updated automatically. To view the list of sensors in the graphical interface, click the "read settings" button.

9.2.1. Requesting information from tethered ADM31 sensors/32/35/ with command

The **BLESENSORINFO** command allows you to request the latest data received by the device from the sensor. The command can be used during the diagnostic process.

BLESENSORINFO X outputs of sensor information under the number X, where X is the device number from the list of BLESENSOR sensors.

The **BLESENSORINFO** command outputs information about all configured sensors without parameters.

Response example:

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 the response parameters:

Fields common to all types of ADM3x sensors:

A sensor address

DT – device type.

PT – package type.

F – firmware version.

V – battery voltage.

R – RSSI level in dBm.

LMT – the time elapsed since the last message from the sensor.

S – the status of the sensor.

ADM31/35

T – temperature.

L – luminosity.

H – humidity.

9.2.2 Description of the parameters transmitted to the server from the ADM31/32/35 sensors.

The readings of the ADM31/32/35 sensors are transmitted in the "BLE ADM sensors" data block along with the rest of the data in each information message. There are five CAN fields allocated for each sensor. The correspondence of the CAN fields to the transmitted data type is indicated in Table 3. The sensor number shown in the table corresponds to the number of the list of linked **BLESENSOR** sensors.

Table 3. Description of the parameters transmitted to the server from the ADM31/35 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	Luminosity
can4	can9	can14	can19	can24	Battery voltage
can5	can10	can15	can20	can25	Hall sensor

Table 4. Description of the parameters transmitted to the server from the ADM32 sensors

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

9.2.3 Server– side conversion of incoming values.

Due to the universality of the "CAN" data block, calculation formulas are not applied to these fields on servers.

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

To prevent spikes in readings during loss of communication with sensors, it is recommended to set a range of acceptable values on the software side or apply other filters supported in the software used.

• **Temperature**

2 calculation formulas are used for two ranges of incoming values.
For the range of values from 0 to 32767, use the formula X*0.01.
For the range of values from 32768 to 65535, use the formula X*0.01– 655.36.
For the correct display of negative and positive values, it is necessary to use both formulas for the corresponding ranges.
The acceptable range of values after calculation according to the formula is – 39...+150.
The value of – 300 (after calculation using the formula) is the error code "no signal from the sensor".

• **Humidity level**

No conversion is required.
The acceptable range of values is 0– 100
The value 255 is the error code "there is no signal from the sensor".

• **Luminosity**

— Abbreviated format (selected by default).

No conversion is required when using the abbreviated format.
The acceptable range of values is 0 – 65534.
The value 65535 is the error code "no signal from the sensor".

— Full format.

When using the full format, the formula X*0.01 must be applied.
The acceptable range of values after calculation is 0.00 – 83866.00.
The value 42949672.95 (after calculation using the formula) is the error code "no signal from the sensor".

• **Battery voltage**

The formula X*0 must be applied.1.
The acceptable range of values after calculation is 0– 4.
The value 25.5 (after recalculation according to the formula) is the error code "no signal from the sensor".

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

No conversion is required.
The acceptable range of values is 0 – 1.

9.3 Adding BLE FLS in manual mode and viewing the list of added sensors

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

This command is used to input BLE MAC addresses. The sensor type is determined automatically.

The device supports simultaneous connection of three FLS.

FUEL Y – add address Y to the first available cell;
FUEL X,Y – add address Y 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 – display the list of addresses added to the device.

Command input example:
FUEL 0,E5F2A9527B1D – add E5:F2:A9:52:7B:1D address to cell 0;
FUEL E5F2A9527B1D – add an E5:F2:A9:52:7B:1D address to the first available cell.

Example of a response to a request for a list of addresses with the FUEL command:
FUEL [0,BLE]: C0C2D56617EA, [1,BLE]: *, [2]:*
Cell 0 – BLE FLS, C0:C2:D5:66:17:EA address
Cell 1 – * empty
Cell 2 – * empty

9.3.1 Requesting data from the connected FLS with command

The **FUELINFO** command allows you to request the latest data received by the device from the sensor. The command can be used during the diagnostic process.

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

FUELINFO – The command without parameters outputs information on all configured sensors.;

Response example: FUELINFO: [0,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 the response for ESCORT TD– BLE:

DT – device type;

T – the temperature;

L – fuel level;

V – battery voltage;

F – firmware version;

LMT – the time elapsed since receiving the last message from the sensor;

R – RSSI.

Decoding the response for DUT– E:

DT – device type;

F – firmware version;

L – fuel level;

T – the temperature;

DTC – error mask. The mask fields are described in the sensor protocol;

LMT – the time elapsed since receiving the last message from the sensor.;

R – RSSI.

Decoding the response for GNOM:

DT – device type;

F – firmware version;

P – pressure characteristic in the pneumatic system;

T – the temperature;

DTC – error mask. The mask fields are described in the sensor protocol;

LMT – the time elapsed since receiving the last message from the sensor.;

R – RSSI.

10 Updating the device software

The device's software (firmware) can be updated via a USB interface using a configurator program or via a GPRS channel.

10.1 Updating the software via USB

The configurator checks the current firmware version on the update server and downloads the firmware file if necessary if the computer has Internet access.

To update the firmware, perform the following steps:

– Connect the USB cable to the device and the USB port of the personal computer;

– run the "ADM CONFIGURATOR" program on your personal computer;

– if a firmware version installed on the device is not up– to– date, the ADM CONFIGURATOR will notify you;

– click "Update Available";

– in the "Notifications" tab that opens, click "Firmware update via USB";

– After the update, the device will reboot and switch to operating mode.

ATTENTION! Do not turn off the device's power during the firmware update process until the device is detected by the setup program. Otherwise, the software may be damaged, which must be fixed at the manufacturer's service center.

10.2 Updating the device's software via GPRS

To update the device's software via GPRS, you must install an active SIM card in the device, configure the access point, user, and password (APN, user, pass) of the mobile operator. Otherwise, the device will be stuck in firmware download mode from the update server until all connection attempts are exhausted.

The update process begins after the device receives the "**UPDATE**" command via one of the possible channels: USB, GPRS, SMS. After receiving the "**UPDATE**" command, the device connects to the update server and downloads the most up– to– date firmware.

After a successful update, the device switches to the main mode of operation with the access point and server address settings that were set before the update. The remaining settings must be checked after the update and, if necessary, reinstalled.

If it is not possible to download the update, the device will return to operation with the existing software.

10.3 Updating the device's software via USB using the firmware file

The firmware file must be requested from the technical support department.

To update the firmware via the USB interface using the firmware file, perform the following steps:

– Connect the USB cable to the device and the USB port of the personal computer;

– run the "ADM CONFIGURATOR" program on your personal computer;

– after connecting the device to the program, open the "Settings" section, in the "Device" tab, click "Upgrade firmware";

– click "Yes" in the pop– up window;

– drag and drop the firmware file into the appropriate field in the configurator window;

– After updating the firmware, the device will reboot and switch to operating mode.

ATTENTION! Do not turn off the device's power during the upgrade process until the device is detected by the setup program. Otherwise, the software may be damaged, which must be repaired at the manufacturer's service center.

11 Storage and transportation requirements

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

After transportation in sub– zero temperatures devices should be put at room temperature during 24 hours.

12 Warranty

The manufacturer guarantees the tracker’s proper functioning within 12 months (built– in battery - 6 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 device 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 device without housing;
- a device with signs of repair performed beyond the manufacturer's service center;
- a device 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 device;
- a device 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 site http://en.neomatica.ru/upload/files/license.pdf

13 Marking and packaging

Marking is placed on the device’s housing. The devices are packed in individual boxes, which protect them during transportation and storage. Multipack is possible.

14 Disposal

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

15 Scope of supply

Name	Quantity
ADM P50/ ADM P50 LTE Tracker	1
Power Supply – Charger	1
Datasheet	1

Manufacturer: Neomatica LLC 24a
Malkova, office 7, Perm 614087, Russia
Phone: +7 (342) 2– 111– 500 (ext. 42).
E– mail: sales@neomatica.com
Web– site: http://neomatica.com

Appendix A. Description of bits of the "Status" field

Bits	Description of field «Status»	Mask value
0	The device was turned on using the power button	1
1	Active SIM-card number (0 – SIM0, 1 – SIM1)	2
2	No connection to the server	4
3		8
4	Sign of low battery voltage	16
5	Sign of invalidity of coordinates	32
6	Coordinates were fixed within absence of movement	64
7	External power of the terminal is disconnected	128
8	Button "SOS" is pressed	256
9	Suspected GNSS jamming/spoofing	512
10	GNSS jamming	1024
11		2048
12	The device was turned off using the power button	4096
13	Coordinates are obtained from a BLE tag	8192
14	Time is determined using GSM base stations	16384
15		32768