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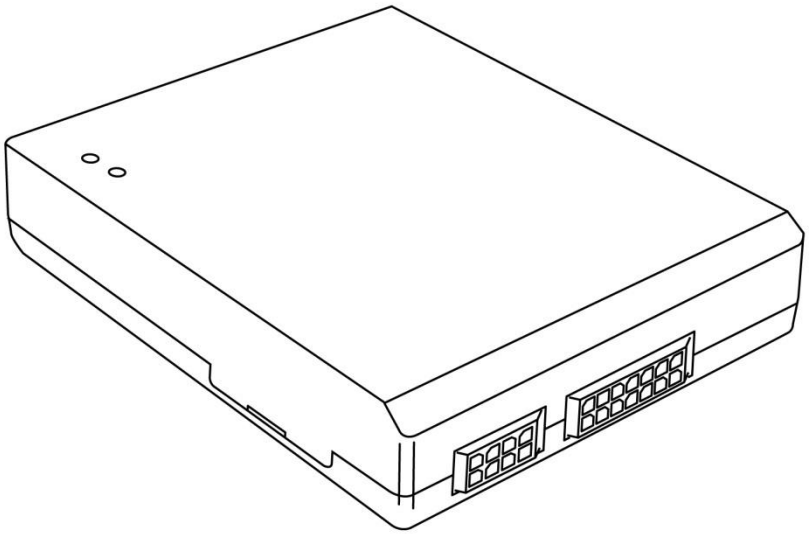
Moving object tracking device

BI 450 TREK



Operating manual

Version 2024.9.1

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Contents

Device description

The BI 450 TREK device is designed to determine the location of a moving object, receive information from connected sensors and then send the received data via mobile communication.

The device is intended for installation on vehicles in order to:

- remote reading of Tachograph DDD files;
- determination of geographical coordinates, speed and direction of movement;
- ensuring the collection of data coming from external devices;
- control of actuators;
- data transmission to the monitoring system.

The data transmission channel is the LTE/GSM 850/900/1800/1900 standard mobile operator network. The GPS/GLONASS/GALILEO/BDS system is used to determine the coordinates. Only 3 navigation systems can operate simultaneously.

The device must be installed in a place inaccessible to the driver. The device is not designed for use in water transport.

IMPORTANT! <u>This device is fundamentally different from previous device models:</u>

- the device does not have the usual commands for configuration;
- the device operates **IPS v.1.1 protocol** only. The binary protocol is not supported;
- the device is configured using a **separate software**;
- the minimum speed that the device can detect is **2 km/h;**
- the device does not work without a battery.

More detailed information is presented below.

Main technical characteristics

GSM/GNSS module specifications

Transmission standard: LTE, GSM

Frequency bands:
- LTE: B1/B3/B5/B7/B8/B20
- GSM: 850/900/1800/1900 MHz

Transmitter power:
- GSM850/EGSM900: 33 dBm
- DCS1800/PCS1900: 30 dBm
- LTE-FDD: 23 dBm

Automatic band selection

GPRS class – 12
LTE category – Cat.1
Type of navigation system: GPS, GLONASS, Galileo, BDS, SBAS
Number of simultaneously working navigation systems – 3

Power supply and interfaces

Power supply type and voltage: DC, 9 – 36 V
Average current consumption (12 V): 60 mA
Maximum current consumption (12 V): 200 mA
1 digital input (active "plus")
2 digital inputs (active "minus")
2 analog inputs
2 digital outputs
Voltage range of digital inputs: from 0 to 40 V
Type of digital outputs: open collector
Maximum load current of digital outputs: 0,5 A
Analog input voltage range: 0 – 36 V
Digital interfaces:

- CAN 11/29 bit x 2 (Vehicle CAN + Tachograph CAN)
- RS-232 x 1 (CAN-Log support)
- RS-485 x 1 (Support RFID, Fuel Level Sensors)
- 1-Wire x 1 (Support DS18B20 temperature sensors and DS1990 identification)
- Bluetooth Low Energy 4.0

Other features

Built-in rechargeable battery: 130 mAh
Type of GSM and GPS antennas: internal
Motion sensor: accelerometer
Number of SIM cards: 1
Black box: 4 MB (or 120000 records)
Operating temperature: from -30 ° C to +60 ° C
Relative air humidity: Up to 80% at +30 °C
Overall dimensions: 95 x 80 x 18 mm
Net weight: 100 gr.

Preparation for operation, commissioning

Installing a SIM card

A Micro-SIM card must be installed in the device to operate in a GSM network. The SIM card phone book must be empty and the PIN code must be removed.

To install the SIM card, disconnect the power connector and the auxiliary connector from the device, open the case as shown in the figure below and insert the SIM card into the slot:

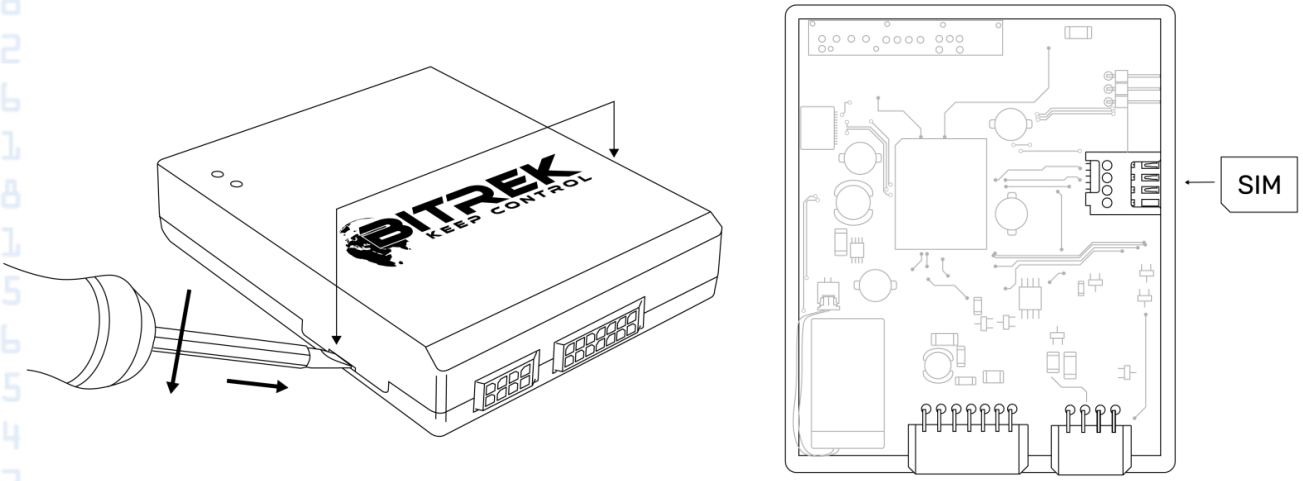

Figure 1. SIM card installation

Please note that if there is no SIM card, the tracker automatically attempts to detect the card once a minute. The modem manufacturer limits the number of such attempts. Accordingly, long-term operation of the device without SIM is not allowed and can lead to damage to the modem.

Connecting power and peripherals

The device is equipped with power and peripheral connectors. The pin assignments of the main and auxiliary connectors are shown in Figure 2.

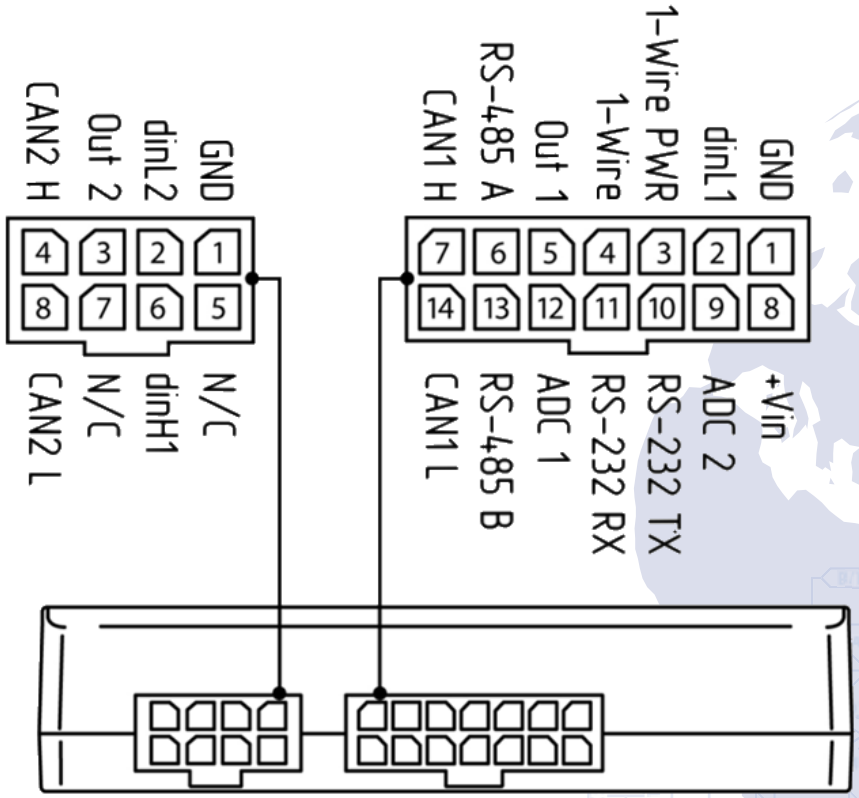

Figure 2. Pin assignments

Table 1. Designation of the main connector (14-pin)

No.	Color	Contact name	Signal type	Contact assignment
1	Black	GND	Power	Common cable (ground)
2	Brown	dinL1	Input	Digital input with active "0" No.1
3	Red/ Black	1-Wire_PWR	Power	1-Wire power
4	Yellow/ Green	1-Wire	In/Out	1-Wire data
5	Violet	Out 1	Output	Digital output No.1 (can be used to connect the interlock relay)
6	Orange	RS-485 A	Input	Signal "A" of RS-485 interface
7	White	CAN1 H	Input	Signal «H» of CAN1 interface
8	Red	+V_in	Power	"+" onboard power supply (rated voltage 12 V or 24 V)
9	Black/ White	ADC 2	Input	Analog input No.2
10	Yellow	RS-232 TX	In/Out	Signal "TX" of RS-232 interface
11	Pink	RS-232 RX	In/Out	Signal "RX" of RS-232 interface
12	Grey	ADC 1	Input	Analog input No.1 (can be used to connect the ignition signal)
13	Green	RS-485 B	Input	Signal "B" of RS-485 interface
14	Blue	CAN1 L	Input	Signal «L» of CAN1 interface

Table 2. Designation of the additional connector (8-pin)

No.	Color	Contact name	Signal type	Contact assignment
1	Black	GND	Power	Common cable (ground)
2	Brown	dinL2	Input	Digital input with active "0" No.2
3	Violet	Out 2	Output	Digital output No.2
4	White	CAN2 H	Input	Signal «H» of CAN2 interface
5	-	N/C	-	Not connected
6	Yellow	dinH1	Input	Digital input with active "1"
7	-	N/C	-	Not connected
8	Blue	CAN2 L	Input	Signal «L» of CAN2 interface

Description of the LED indication

The device is equipped with two status LEDs:

Red – blinks when the device is not communicating with the main server; solid when the device is connected to the main server.

Green – off – the device does not receive GPS signal; blinks – the device receives GPS signal.

Device settings. BI 450 Configurator

This device has a new configuration principle, which is completely different from the configuration principle of past models.

Setting is possible in two modes:

- **Online mode** (recommended). An activated SIM card is inserted into the device, the tracker connects to the internet and automatically establishes a connection with the configuration server. Further settings are made using the online configurator.

- **Offline mode**. The device is connected to a PC via USB type C. Further settings are made using the configurator in offline mode.

In order to fully work with the configurator program, the PC must have access to the Internet. CAN, CAN-LOG and BLE sensors scan are not available while the configurator is in offline mode.

The Configurator v.2.5.10 or later program is used to configure the device. To run the program, you need a PC with Windows 10 or higher, necessarily 64 bit. The resolution of the screen must be at least 1280x720.

After the first launch of the program, you need to go through the registration process and remember the data for authorization (Figure 3). Further work with the program will take place in your registered account.

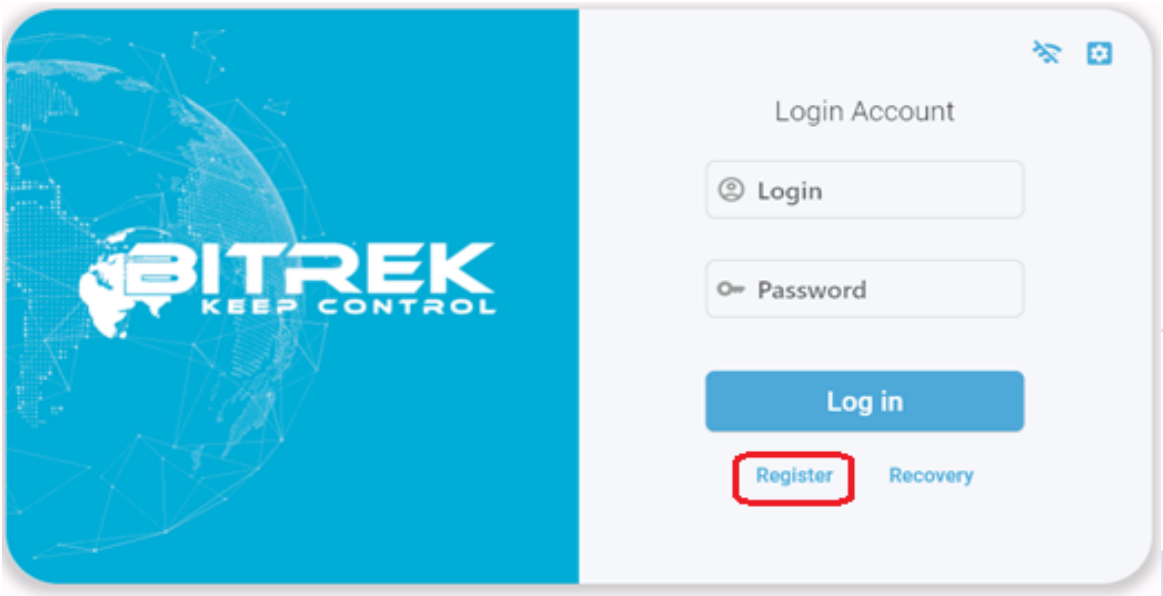

Figure 3. Account registration

After completing the registration process, you will be taken to the main interface of the program. As long as no device is connected, the application workspace will be empty. In the upper part of the window (Figure 4), there are buttons for calling the main menu of the program (on the left) and displaying data for login (on the right). In the data panel for authorization, there is an option to select the interface language: Ukrainian and English are available.

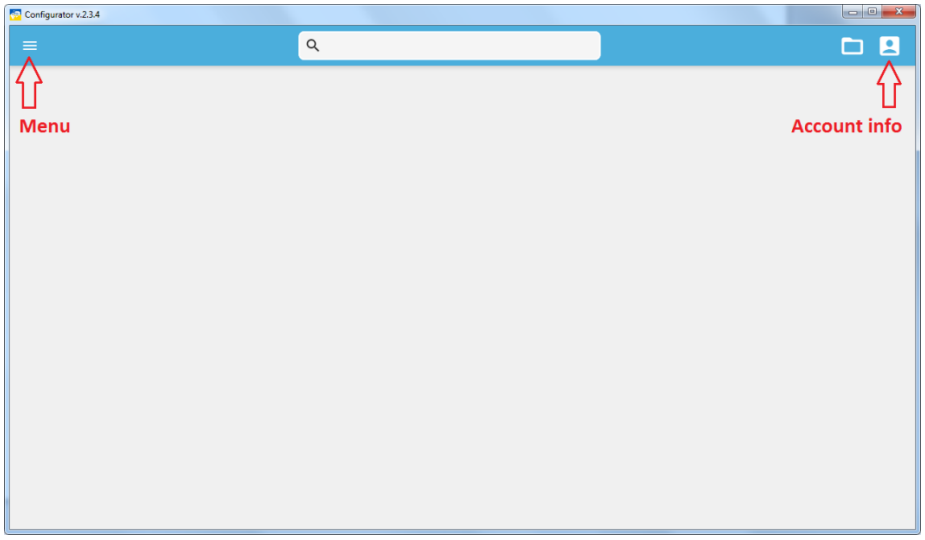

Figure 4. Configurator workspace

The next step is to add the tracker that needs to be configured. Depending on the offline and online modes described above, there are two ways to connect to the device.

Online mode

To connect to the device in online mode, it is necessary to install an activated SIM card in the tracker, with the ability to connect to the Internet and the activated SMS function. The access point specified in the device settings by default is ***internet***, so most cards of mobile operators of Ukraine will work in the device immediately. After installing the SIM card, it is necessary to supply power to the device.

The next step is to add the device to your account in the configurator. To do this, you need to select the "Add device" option in the configurator menu, as shown in the Figure 5 below:

Before adding the device to your account, make sure that the red status LED is on to indicate that the device has accessed the Internet and connected to the Bitrek test server.

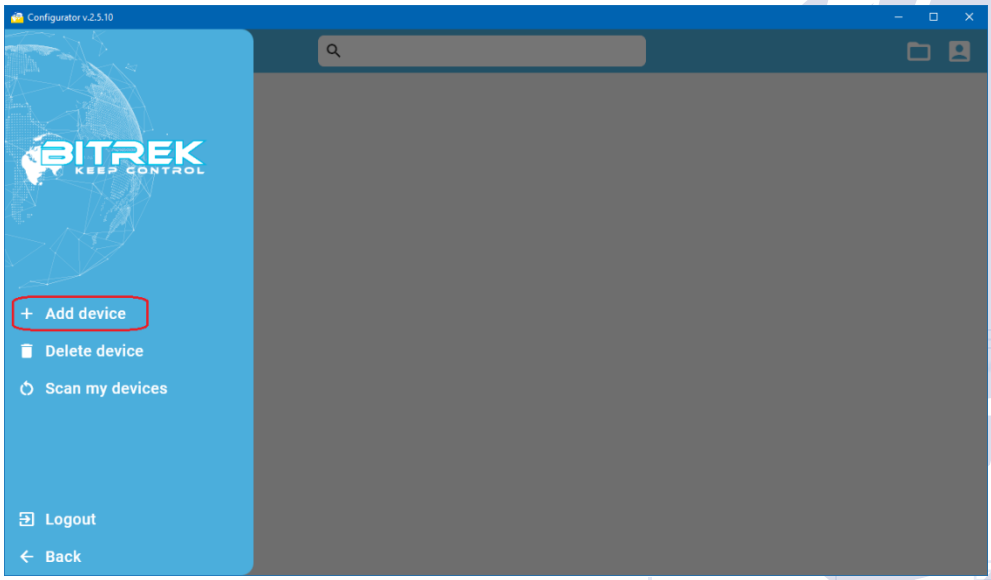

Figure 5. Adding the device to account

In the window that appears, you need to enter the full IMEI of the device, as shown in the Figure 6 below:

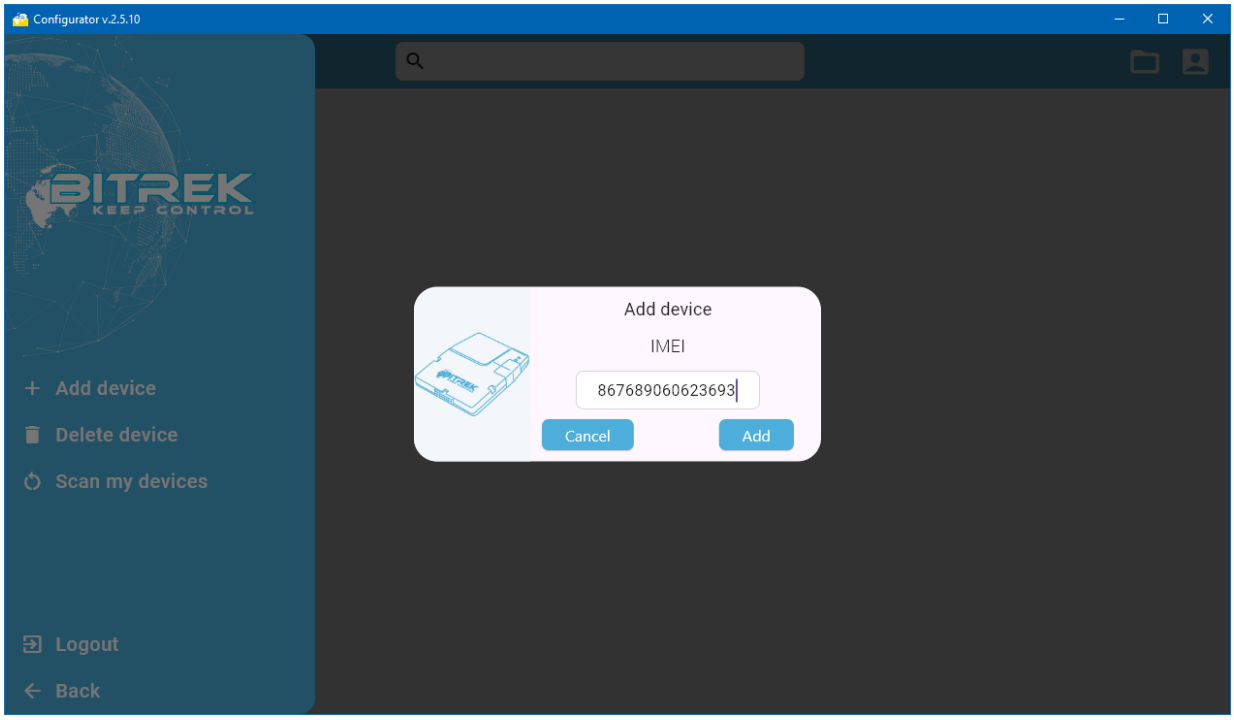

Figure 6. Entering the IMEI

After confirming the addition of a new device, wait some time (5 – 15 seconds), click Scan my devices button from the side menu and the device will appear in the list. The configurator icon includes the following information:

- IMEI of the device;
- software version;
- connection type (server/USB).

Figure 7. The device is available for configuration

From the moment a device is added to your account, the device is locked to it. Attempts by other users to add this device to other accounts will be rejected.

The main window of the configurator will display all devices that were connected to the configuration server at the time of logging into the account. Obtaining information about the current status of devices, as well as changing their settings, are available online.

After a successful connection, you can go to the device settings interface.

Offline mode

This mode assumes that the tracker does not have an Internet connection. The tracker is connected to a PC using a USB Type C cable.

For the device to work correctly, you need to install the appropriate drivers, which can be downloaded from the Bitrek support portal.

To connect to the device, you need to disassemble the device and plug the cable into the connector.

The operation of the Configurator program is possible in two scenarios:

- the PC has access to the Internet. In this case, after launching the program, you must enter your login/password and log in to your account.
- there is no Internet access on the PC. To get the ability to connect to the tracker without the ability to log into the account, you need to click the "Offline mode" icon at the authorization stage (figure 8).

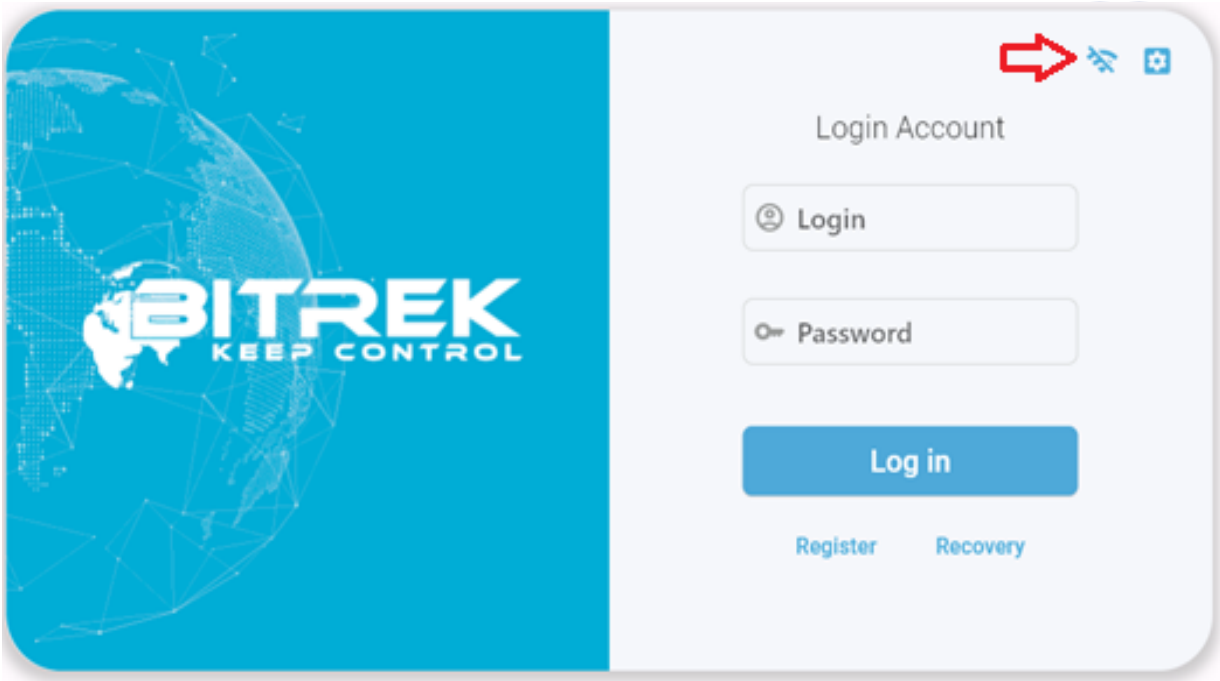

Figure 8. Switch to offline mode

After entering to the program, you need to go to the main menu and select the "Scan my devices" option (Figure 9):

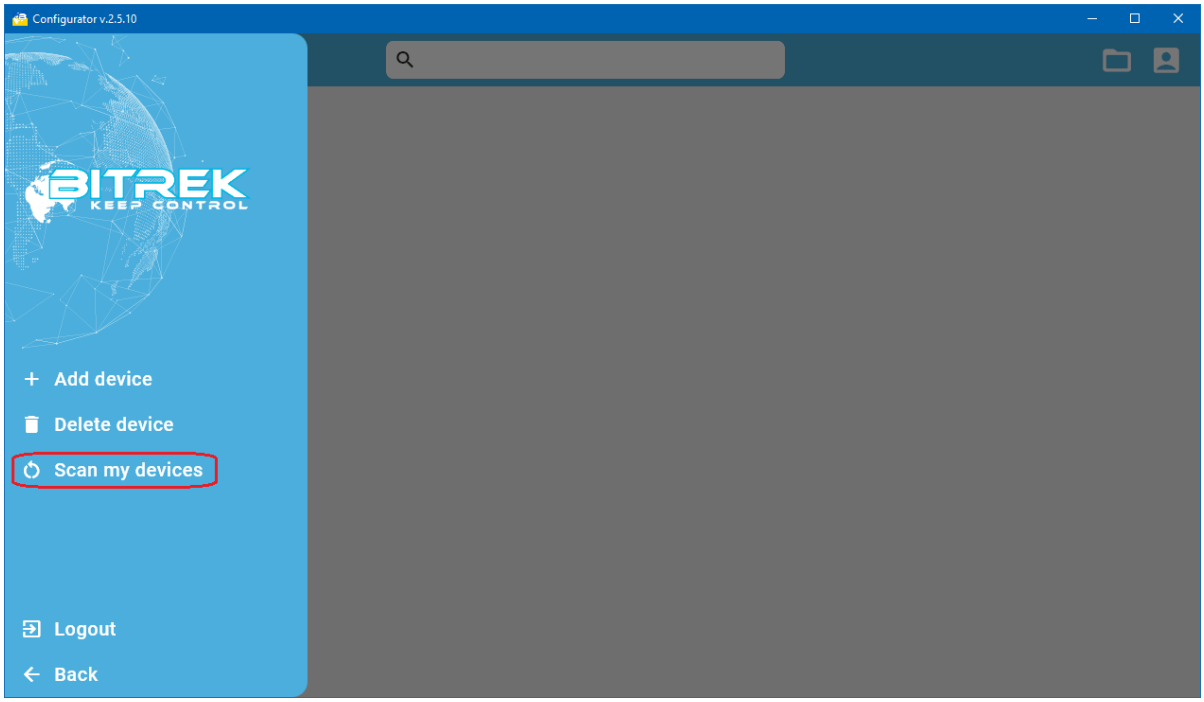

Figure 9. Device scanning option

When the scan is complete, the connected device will appear in the main configurator window. In this case, the connection type will be defined as USB (Figure 10):

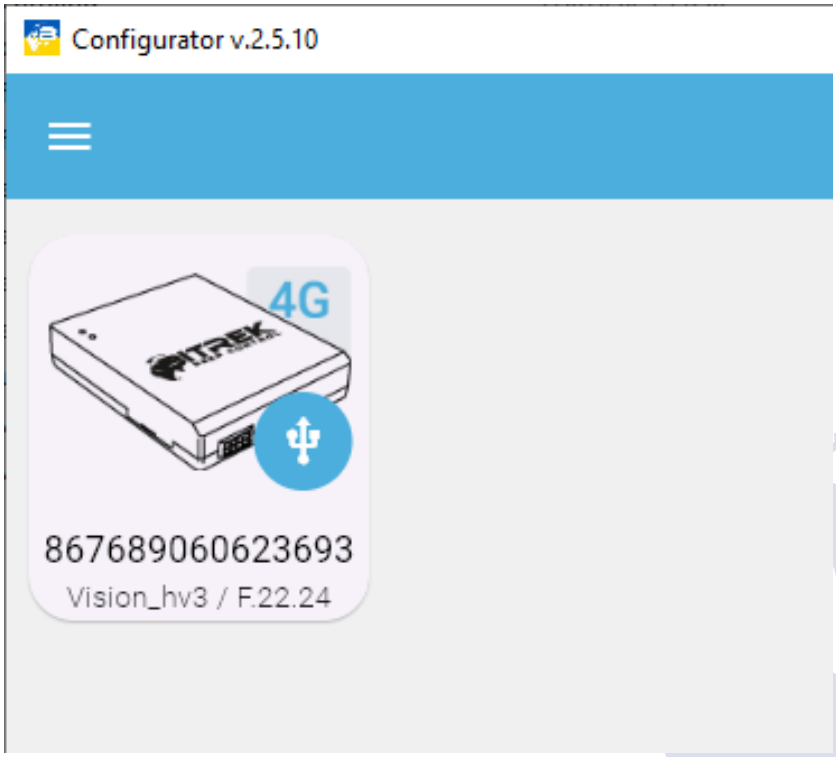

Figure 10. Device connected via USB

If the PC has Internet access and you are logged in to your configurator account, the device connected via USB in offline mode will be displayed first in the list of connected devices:

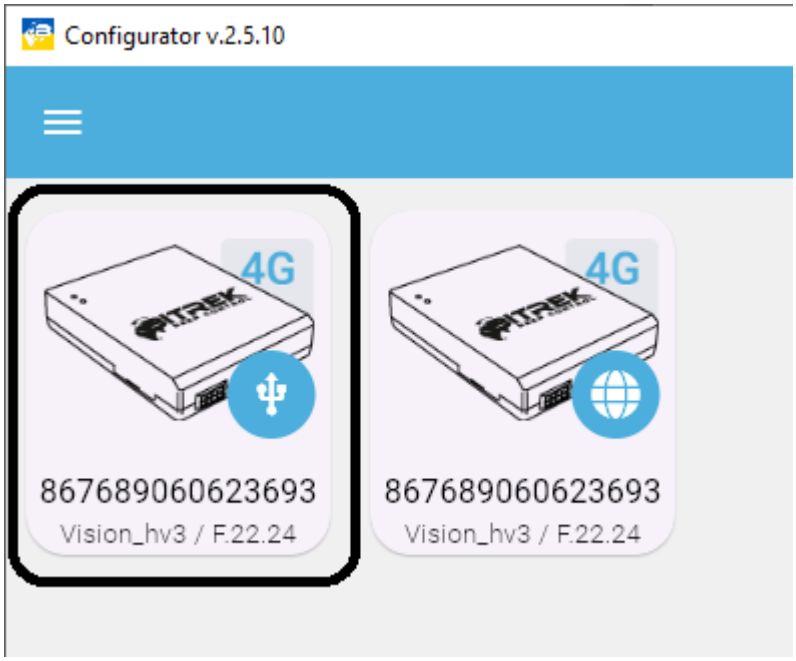

Figure 11. The device connected via USB

Adding a device to your account is only possible when the Configurator is in "Online" mode. Working in offline mode allows you to perform only basic settings of the tracker connected via USB.

After successful connection, you can go to the device settings interface.

Device settings interface

To go to the device settings interface, click the device icon you need to work with in the main configurator window. After selection, the device settings interface will be displayed, in which a section with current statuses of the selected device will automatically open (Figure 12):

Figure 12. Status of the device

In total, the following sections are available in the device interface menu:

- State;
- Settings;
- Sensors;
- Tools;
- Export;
- Sync;

You can work with only one selected device at a time. Below is a description of each section.

State

This section displays current information about the device:

- IMEI of the device;
- SIM card ICCID;
- Software version. If the below button is available to the right of the version:

it means that a new version of the device software is currently available. By clicking on this button, the **firmware will be updated**.
- Displayed statuses: SIM card, GSM, GPRS, connection to the main server;
- Current operator and GSM signal RSSI/RSRP* level;
- Main server address;
- Current date and time in UTC;
- Device operation time since reboot/turn on. If the device is online, the following button will be available to the right of the specified operating time:

This button is used to reboot the device.
- Current location;
- Number of visible satellites, HDOP value and validity of current coordinates.
- Traffic counter indicators. Please note that when updating the tracker software, the traffic counter does not work, so the traffic consumed during the update will not be taken into account.

Use the mouse scroll wheel to view all information. To update information, use the “Update information” button in the lower right corner of the program:

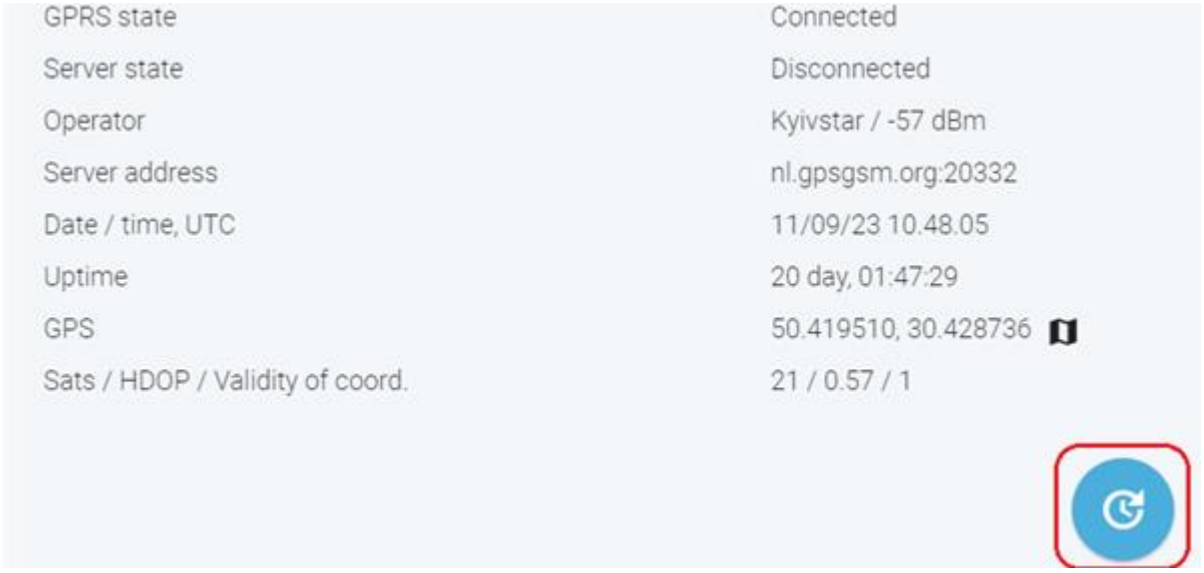

Figure 13. Update the information about current statuses

** - The device operating in GSM and LTE networks operates with different models for determining the quality of communication. For GSM, the quality is determined by RSSI and is 50….-95 dBm. For LTE networks, RSRP is used, which is in the range of 75….-110 dBm. In this case, the sensor is one and is called RSSI.*

The lower left corner of the program contains information about the IMEI of the current device, its software version, and the status of connection to the configuration server. Next to the status, **the time during which the device is connected to the configuration server** is displayed. Important – this is not the device operating time since the reboot (uptime).

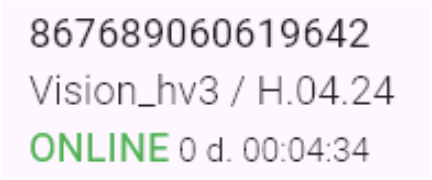

Figure 14. Displaying the connection status of the device with the configuration server

Settings

This section displays a list of tracker settings. When connected to the device, the current settings are automatically loaded (Figure 15).

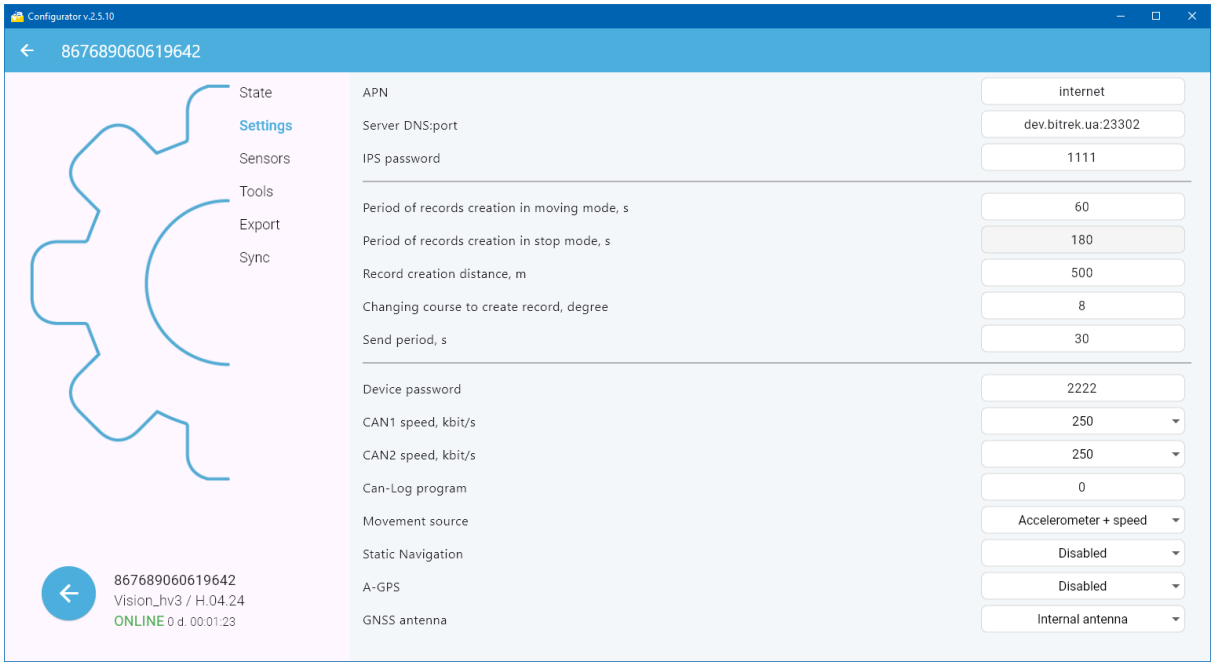

Figure 15. Device settings section

The following settings are available for the device:

- **Access point name (APN).** By default – *internet*. It depends on the selected operator and is required for correct access to the Internet. In cases where you need to use a login and password, they are set in this field in the following format – *internet:login:password*. The maximum length of the string is 35 characters. The field must contain the ":" character separating DNS/IP and port.
- **Server DNS and port**. Primary server DNS and Port settings. It is specified in the format DNS/IP:port.
- **IPS password**. By default it is 1111. This is the device's access password to the main server, regulated by the IPS protocol.
- **Period of records creation in moving mode**. The parameter is set in seconds, by default it is set to 60 seconds. This means that if the tracker detects movement, a point will be created every 60 seconds. Valid values are from 1 to 65535 seconds.
- **Period of records creation in stop mode**. The parameter is set in seconds, by default it is set to 180 seconds. This means that if the tracker is in stop mode, a point will be created every 180 seconds. Valid values are from 1 to 65535 seconds.
- **Record creation distance**. The parameter is set in meters, by default it is 500 m. This means that every 500 meters of the traveled path, the device will create a point. Valid values are from 1 to 65535 meters.
- **Changing course to create a record**. The parameter is set in degrees, by default it is 8 degrees. This means that when the course is changed by 8 degrees from the current one, a new point will be created. Valid values are from 1 to 65535 degrees.
- **Send period**. The parameter is set in seconds and determines the period with which the device will send the created points to the server. The range of possible values is 1 to 180 seconds.

- **Device password**. This password is used to control access to the device settings. By default the value is 2222. If this password is changed, the settings of the device cannot be changed both with the help of SMS settings and with the help of the configurator.
- **CAN 1 speed**. It is configured for connection to the Tachograph or to the CAN bus of the vehicle without using CAN Log. The default value is 250 kbps.
- **CAN 2 speed**. It is set for connection to the CAN bus of the vehicle. The default value is 250 kbps.
- **CAN-Log program number**. Set when using the CAN-Log device to work with the CAN bus of the respective vehicle. The test program for the CAN-Log test has the number 11188.
- **Movement source**. The method of determining the motion mode. There are the following options for determining the movement mode of the device:

  - *Accelerometer + speed* (by default). In this mode, the device will determine the movement mode in the case when the accelerometer will detect the physical movement of the device and the GPS speed will be higher than 5 km/h for at least 5 seconds.

  - *External power supply*. In this mode, the device will determine the motion mode in the event that the device's power supply voltage is higher than the threshold set in the "Voltage motion sensor activation threshold" parameter and the GPS speed will be higher than 5 km/h.

  - *Connection to ADC1*. In this case, the moving mode will be determined in the event that a voltage greater than 8 volts appears at the ADC1 input (for example, an ignition signal). GPS speed should also be above 5 km/h.

If the method of determining the movement mode is not configured correctly, the device will constantly transmit only one static coordinate, even when the device is actually moving. For example, if you choose the "Connect to ADC1" option, and at the same time do not connect the ignition signal to the tracker – the coordinate will not be updated when moving.

- **Voltage threshold**. Threshold for triggering the motion sensor by voltage. Determines the voltage (in millivolts) threshold of the external power supply, upon reaching which the device will switch to motion mode. This parameter is relevant only if the method of determining the driving mode is specified as "External power".
- **Static navigation**. Static Navigation mode is a filter, which filters out track jumps when the object is stationary. If static navigation filter is disabled, it will apply no changes to GPS data.

- **A-GPS.** This function allows the device to download Extended Prediction Orbit (EPO) files containing information about current ephemeris maps via GPRS. If this function is enabled, the time for fixing the first coordinates is significantly reduced. ***IMPORTANT*** – after changing this parameter and saving the configuration to the device, you **need to reboot the device** to apply the parameter. This can be done either by SMS or by using the corresponding button in the "State" section.

If A-GPS is enabled, the device will periodically download additional EPO files from the GPS module manufacturer's server. This, in turn, will increase traffic consumption. This feature is ***disabled*** by *default.*

Please note that after changing the settings in this section, the changes are not applied immediately. To apply them, it is necessary to write the configuration to the device. This procedure is described in the appropriate section of this manual.

Sensors

This section displays a list of created sensors whose values are transmitted by the device to the main server. The new device does not have any added sensors (except for HDOP), so the table will be empty. To add a new sensor, click the "Add" button in the lower right corner of the program. After selecting this function, the user will be prompted to select one of the following sections:

- Simple sensors
- CAN scanner 1
- CAN scanner 2
- BLE scanner
- CAN Log scanner
- Constructor FLS
- Tacho Sensors

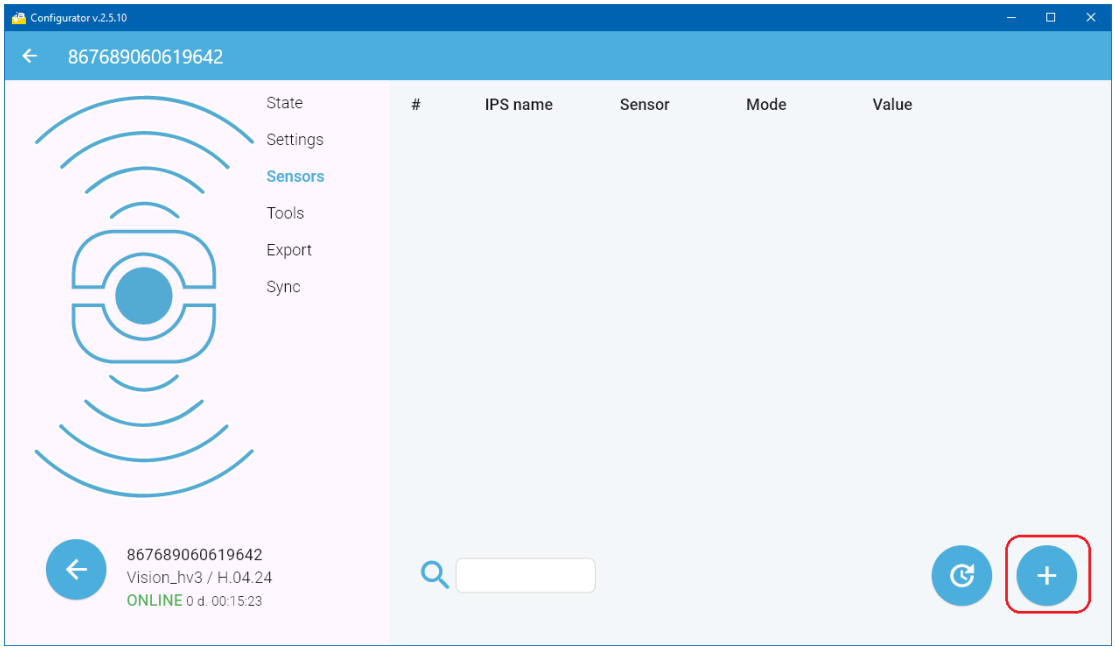

Figure 16. Adding a new sensor

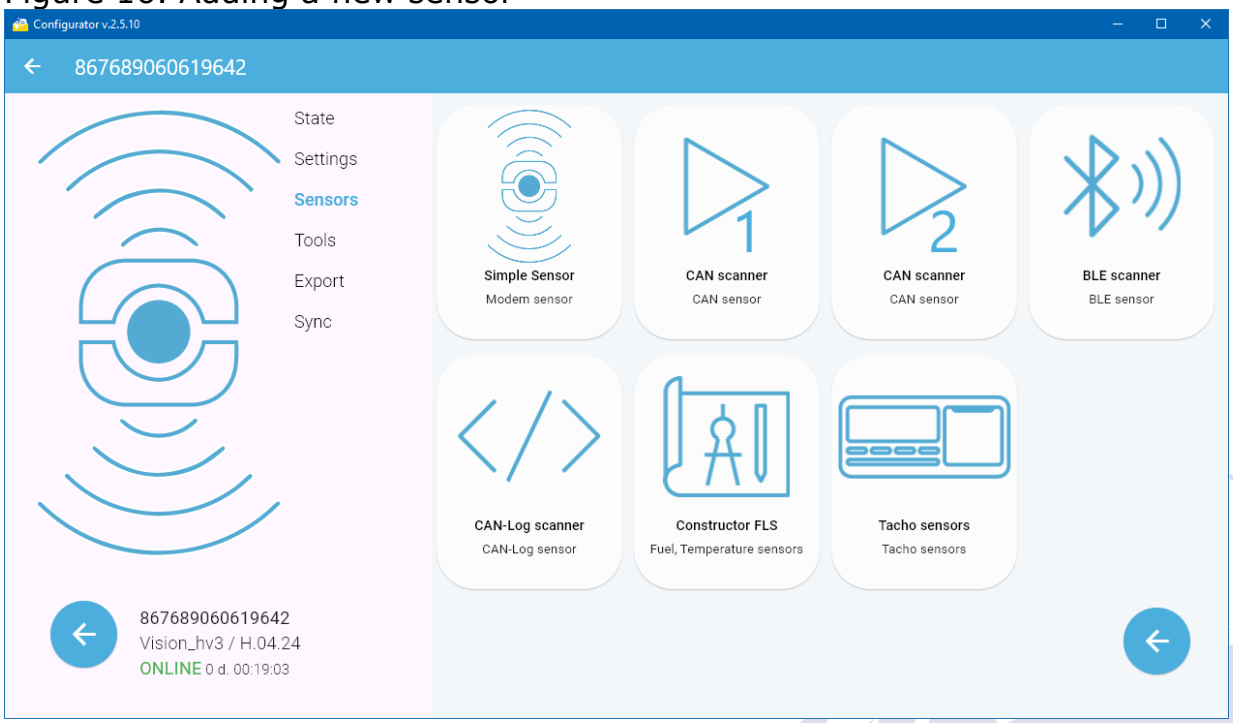

Figure 17. Add sensors by their type

Each type of sensor is described below.

Simple sensors

Simple sensors are a set of internal device sensors and some external sensors that can be connected to the device. When you go to the Simple Sensors section, a list of sensors that can be added to the device is displayed. Once added, the device will transmit the current values of the selected sensors to the main server.

Below is a table of simple sensors that can be added:

No.	IPS name	Sensor	Description
1	reboot	Reboot counter	Transmits the number of reboots of the

			device since its manufacture
2	A_odo	Absolute odometer	Transmits the traveled distance in meters. The counter is constantly incremented
3	R_odo	Relative odometer	Transmits the traveled distance in meters between the created points. After creating a new point, it is resets to zero
4	pointCs	Point creation source	Transmits information about the reason for creating the record. Possible options: 1 – the first point with coordinates after switching on; 2 – by time; 3 – stop; 4 – start of movement; 5 – course change; 6 – distance traveled; 7 – sensor activation;
5	VPWR	Tracker supply voltage	Transmits the current value of the tracker supply voltage
6	dinH1	State of digital input dinH1	Displays the current state of the digital input dinH1. Status: 1 – input is active (wire is physically connected to "+" power supply); 0 – input is not active (wire is not physically connected to "+" power supply or is connected to "-" power supply)
7	parking	Parking status	Transmits the current motion status: 1 – parking; 0 – motion is detected.
8	VBAT	Battery voltage	Transmits the current voltage value of the tracker battery
9	adc1	Adc1 voltage	Displays the voltage on adc1
10	adc2	Adc2 voltage	Displays the voltage on adc2
11	dinL1	State of digital input dinL1	Displays the current state of digital input dinL1. Status: 1 – the input is active (the wire is physically connected to the "-" power supply); 0 – the input is not active (the wire is not physically connected to the "-" power supply, or is connected to the "+" power supply)
12	dinL2	State of digital input dinL2	Displays the current state of digital input dinL2. Status: 1 – the input is active (the wire is physically connected to the "-" power supply); 0 – the input is not active (the wire is not physically connected to the "-" power supply, or is connected to the "+" power supply)
13	temp0	Temperature sensor 0	Temperature transmission of DS18B20 sensor with address 0
14	temp1	Temperature sensor 1	Temperature transmission of DS18B20 sensor with address 1

15	temp2	Temperature sensor 2	Temperature transmission of DS18B20 sensor with address 2
16	temp3	Temperature sensor 3	Temperature transmission of DS18B20 sensor with address 3
17	temp4	Temperature sensor 4	Temperature transmission of DS18B20 sensor with address 4
18	ibut	iButton key	Transmission the iButton ID key number (DS1990)
19	rfid9	RFID 9 key	Transmission of the key number of the identifier connected via RS-485, operating under the SOVA protocol and having a network address of 9.
20	rfid10	RFID 10 key	Transmission of the key number of the identifier connected via RS-485, operating under the SOVA protocol and having a network address of 10.
21	countL1	Absolute pulse counter	The number of pulses applied to the dinL1 input is transmitted. The number is constantly accumulated and stored in memory before turning off the device
22	countL2	Absolute pulse counter	The number of pulses applied to the dinL2 input is transmitted. The number is constantly accumulated and stored in memory before turning off the device
23	cntL1_d	Relative pulse counter	The number of pulses that are fed to the d_Low1 input is transmitted. Each entry will contain the number of pulses that have been counted since the last entry was created.
24	cntL2_d	Relative pulse counter	The number of pulses that are fed to the d_Low2 input is transmitted. Each entry will contain the number of pulses that have been counted since the last entry was created.
25	freqL1	Frequency meter	The value of the frequency of the signal supplied to the d_Low1 input is transmitted
26	rssi	GSM signal quality	Transmitted RSSI/RSRP signal strength of GSM/LTE signal in dBm
27	codNet	Operator code	The code of the current mobile operator is transmitted
28	lock	Out1 state	The current state of the digital output 1 is transmitted: 1 – the output is activated; 0 – the output is not activated.
29	Out2	Out2 state	The current state of the digital output 2 is transmitted: 1 – the output is activated; 0 – the output is not activated.
30	acc_max	Maximum acceleration	Differential sensor of the maximum linear velocity increase in the direction of movement. The value is transferred in g.
31	brk_max	Maximum breaking	Differential sensor for maximum reduction of linear velocity in the direction of movement. The value is transferred in g.

32	crn_max	Maximum corner acceleration	Differential sensor of the maximum increase in angular velocity in curved motion. The value is transferred in g.

To add simple sensors, select them from the list and then click the Add button, as shown in the figure below:

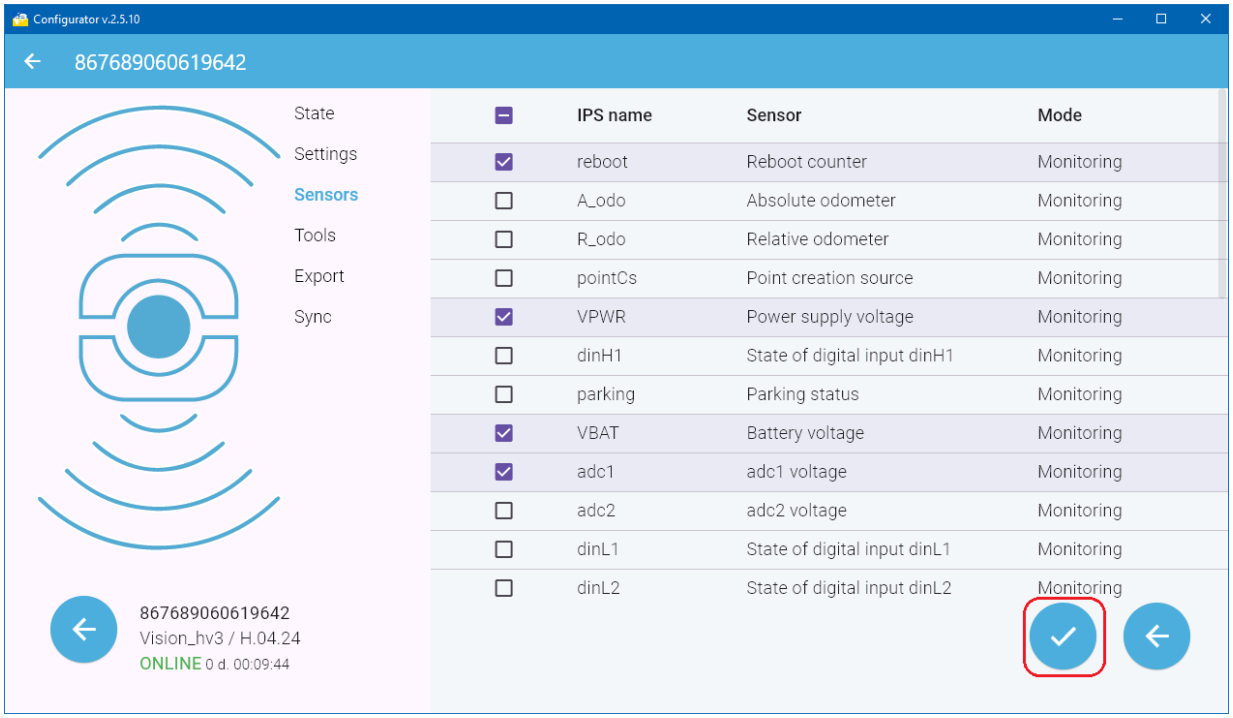

Figure 17. Simple sensors adding

After performing these operations, the added sensors will appear in the list of sensors of the device. Please note that the selected sensors have been added only to the working field of the program, the sensors have not yet been added to the tracker. To apply the changes, you need to save the configuration to the device. This procedure is described in the corresponding section.

#	IPS name	Sensor	Mode	Value
1	reboot	Reboot counter	Monitoring	0.0
2	VPWR	Power supply voltage	Monitoring	0.0
3	VBAT	Battery voltage	Monitoring	0.0
4	adc1	adc1 voltage	Monitoring	0.0

Figure 18. List of added sensors

Constructor FLS

The constructor is designed to create sensors that transmit data on fuel level and temperature. The information is taken from the fuel level sensors that are connected to the device via the RS-485 interface. It is possible to flexibly configure the network addresses of the sensors to be

polled, as well as the type of sensor (fuel level or temperature). It is possible to enable filtering of the data received from the sensor, as well as saving the last valid data received from it.

The appearance of the "Constructor FLS" section is shown in the figure below:

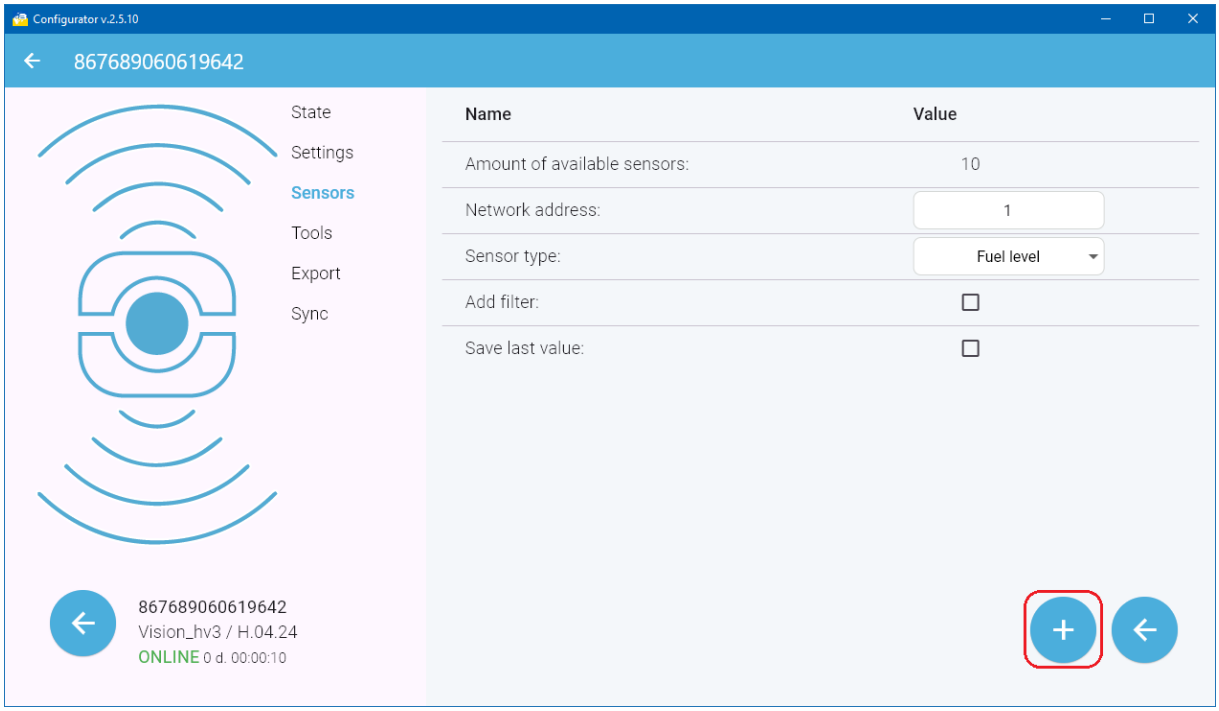

Figure 19. Constructor FLS. Sensor adding

You can add up to 10 sensors in total. For example, if temperature and filtered fuel level sensors are created for a sensor with 1 network address, then 8 free sensors will remain for other sensors to configure.

After selecting the required parameters of the sensor to be created, click the "Add sensor" button. The new sensor will be added to the list of sensors of the device, and the number of sensors available in the designer will decrease by 1.

CAN1 and CAN2 scanner. Connection to the CAN bus

Both sections of the configurator (CAN1 Scanner and CAN2 Scanner) have the same logic. These sections are used to configure the vehicle CAN bus sensors.

The implementation of two separate CAN buses allows simultaneous connection to both the vehicle bus and the tachograph – in this case, the tachograph is connected to CAN1 and the vehicle CAN bus to CAN2. The principle of operation with the Tachograph is described in a separate appendix to the Operation Manual. If you need to connect one or two vehicle CAN buses, they can be connected to both CAN1 and CAN2.

The configuration can be performed in scanning mode and in manual mode. Before you start working with the CAN sensors, make sure that the connection to the respective bus is correct and that the correct speed for the respective bus is selected in the "Settings" section.

In case of direct connection to the CAN1 bus, make sure that the tracker has a 120 Ohm terminating resistor, which can be connected or disconnected using a special switch installed on the device board:

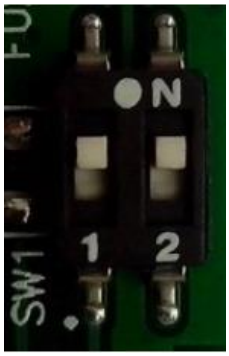

Figure 20. CAN and RS-485 bus terminating resistor switch

Switch 1 is responsible for CAN1, Switch 2 is for the RS-485 bus. The terminating resistors are connected if the switches are set to "ON".

Direct connection means connecting the tracker directly to the CAN bus wires without using contactless readers.

Please note that the device does not have a built-in 120 Ohm terminating resistor for the CAN2 bus. The possibility of connecting them is implemented exclusively for CAN1 and RS-485.

When connecting directly to the CAN1 bus, it is not necessary to include a terminating resistor as it may affect the resulting resistance of the vehicle's CAN bus.

When you first go to the "CAN scanner" section, the table of SPNs available for configuration will be empty. To start the scanning process, press the Refresh button (Figure. 22).

The device will automatically read all available CAN IDs transmitted in the vehicle bus. If the read data contains parameters described by the FMS standard, the program will automatically generate a list of SPNs available for configuration.

Important: to get the list of recognized FMS SPNs, the PC must have Internet access and Configurator 2.5.10 must be running in Online mode.

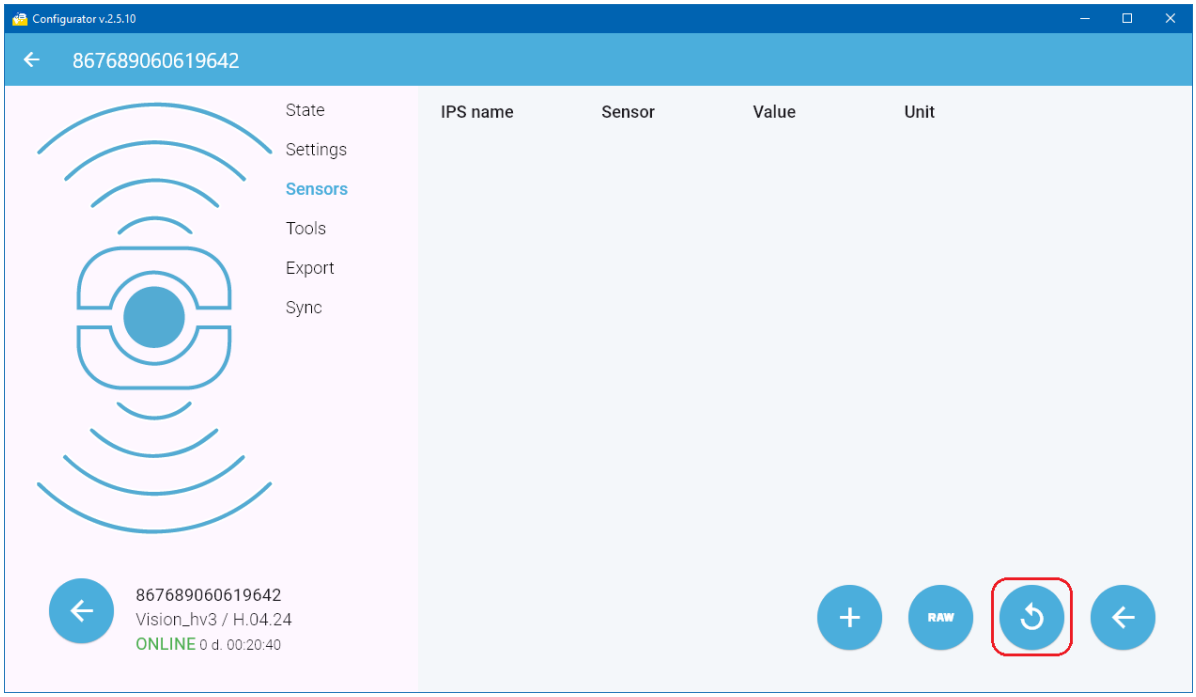

Figure 22. Starting the scanning process

To add the selected parameter, click on the "+" opposite the desired SPN. After adding, the sensor will appear in the list of sensors to be transferred to the server.

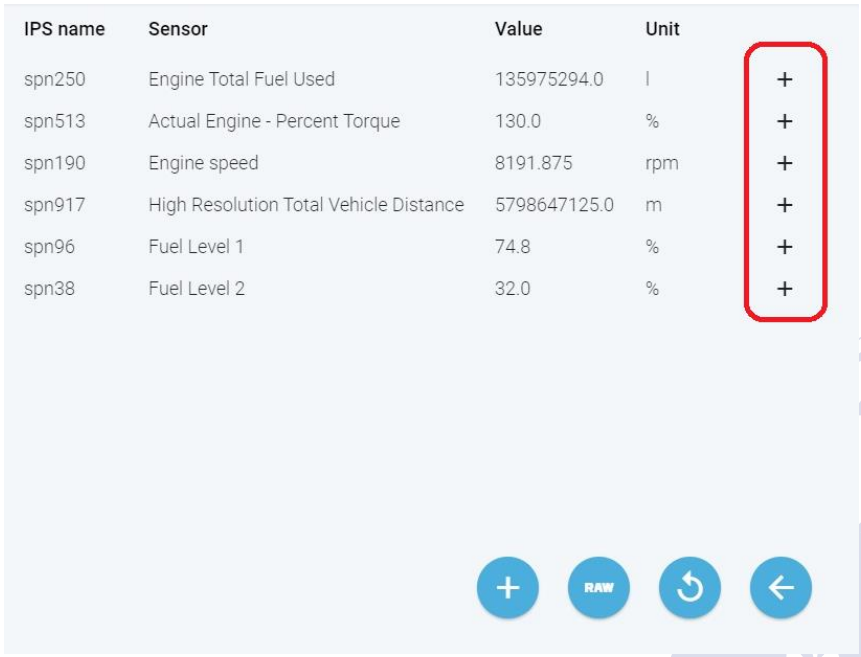

Figure 23. CAN parameters adding

If you need to configure a CAN sensor that is not part of the FMS standard and, accordingly, it was not recognized automatically, you need to go to the full list of all read CAN IDs by pressing the "RAW" button. In this mode, the entire list of CAN IDs and the current data of each of them becomes available to the user. Select the desired CAN ID from the list and click the "edit" button (Figure 24).

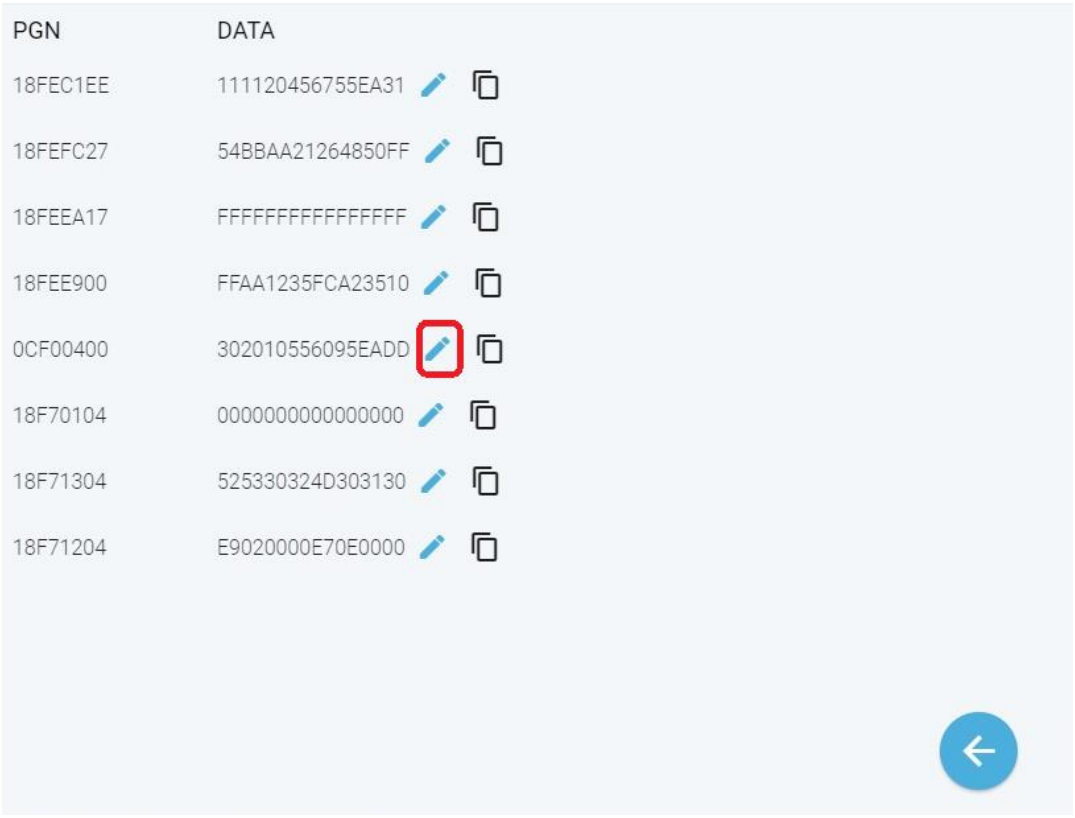

Figure 24. Setting up a custom CAN sensor

In the window that appears, you need to specify the starting position and the number of bits to be read. This can be done either manually by entering ready-made values in the corresponding fields, or you can use the graphical mode by selecting the required range of data to be read. Additionally, it is possible to edit the IPS name of the sensor. The maximum number of IPS characters in the name is 7.

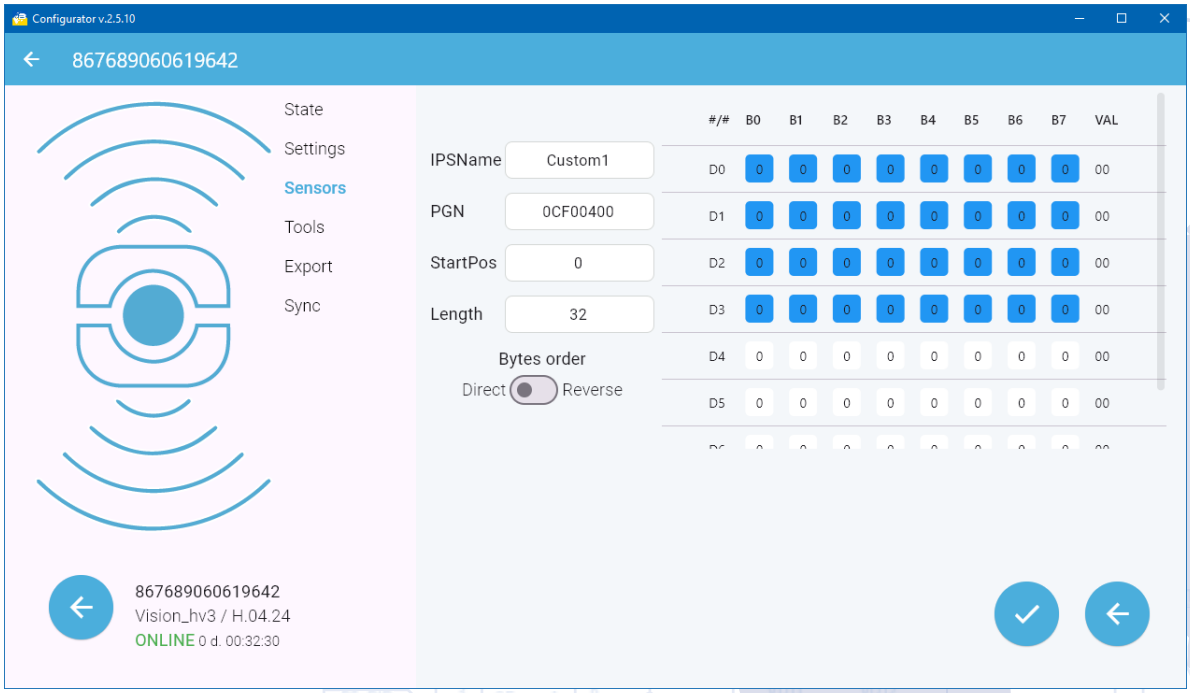

Figure 25. Adding a custom CAN sensor

If the data to be read is transmitted in reverse order (big-endian instead of little-endian), you can use the Bytes Order switch: in the Direct

mode, the data is transmitted to the server in the order in which it is in the CAN bus; in the Reverse mode, the data order is reversed.

If you need to configure the sensor with the reverse order, perform the following sequence of actions:

- First, set the “Data order” switch to “Reverse”.
- Then select the data range using the graphical mode only. After selecting the range, the program will automatically calculate the starting position (StartPos) and the data length (Length) for the reverse order.

If it is necessary to configure the CAN sensor before installation, when the user knows the exact CAN ID of the bus to which the connection will be made, you can use the “manual” mode of sensor configuration. To do this, click the “+” button in the “CAN scanner” section.

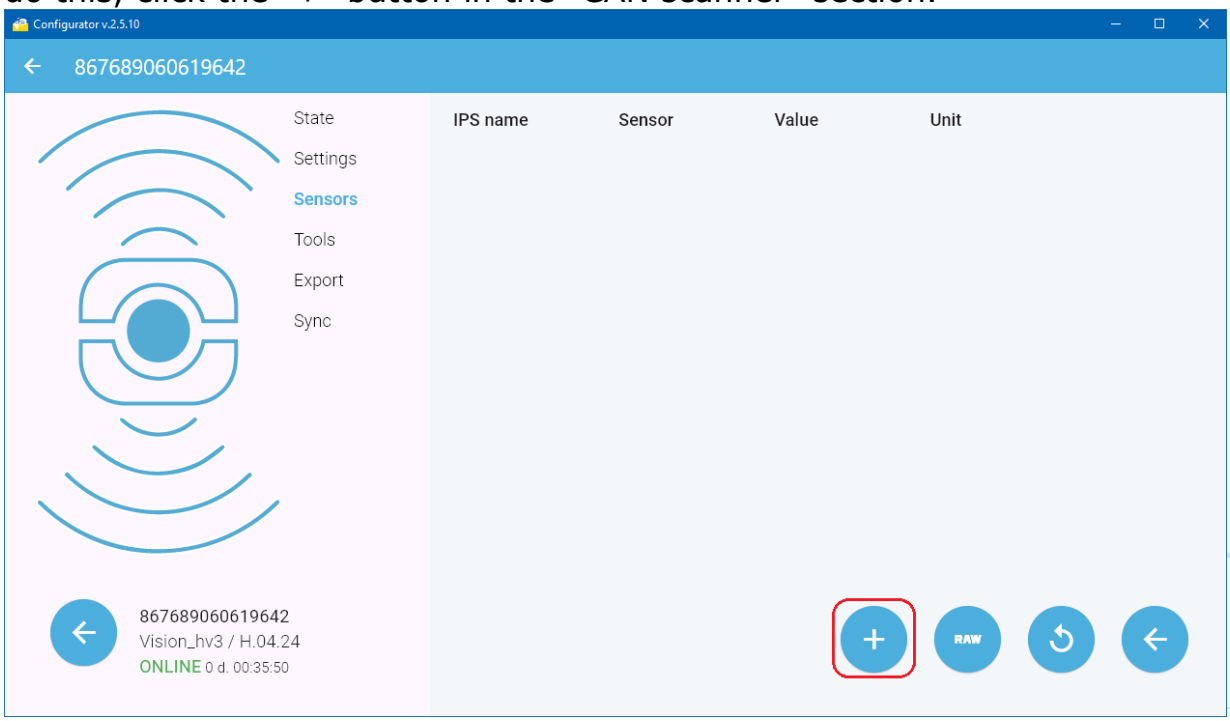

Figure 26. Adding a CAN sensor in manual mode

In the window that appears, you need to manually enter all the necessary parameters, similarly to the one shown in Figure 25 above.

After entering all the parameters of the new sensor, click the Add Sensor button. After that, the new CAN sensor will appear in the list of sensors of the device.

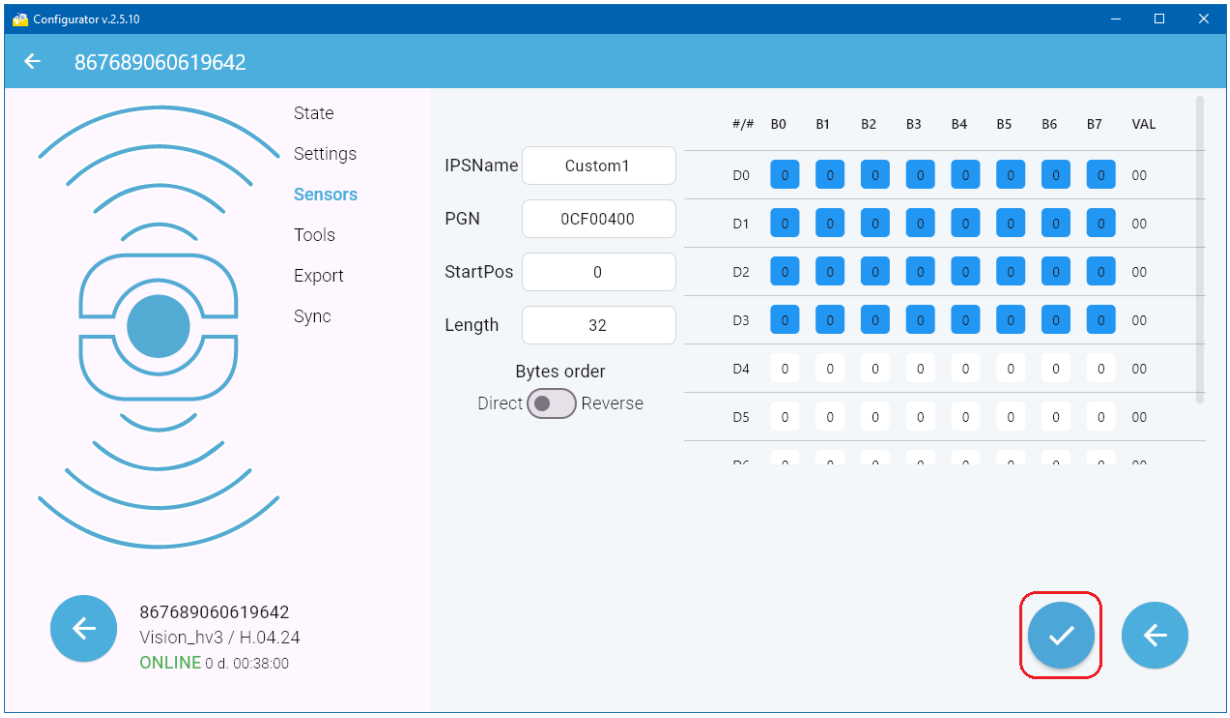

Figure 27. Sensor saving

BLE scanner

This section of the program is intended for scanning the BLE sensors around. Sensors produced by Bitrek™ will be recognized automatically.

When you go to this section, the list of found sensors will be empty. To search for active sensors, click the "Update" button (Figure 28):

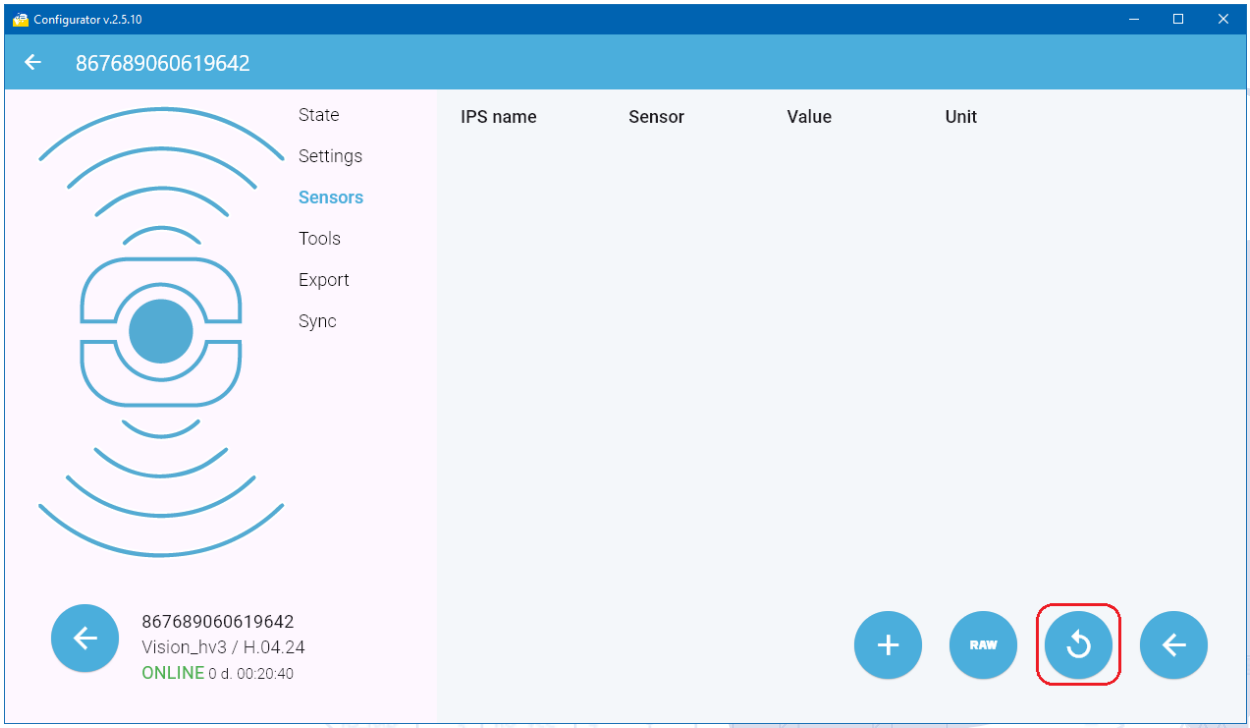

Figure 28. BLE sensors scanning

After some time (about 30 seconds), the list of found sensors and the parameters that can be obtained from them will be displayed in the table (Figure 29).

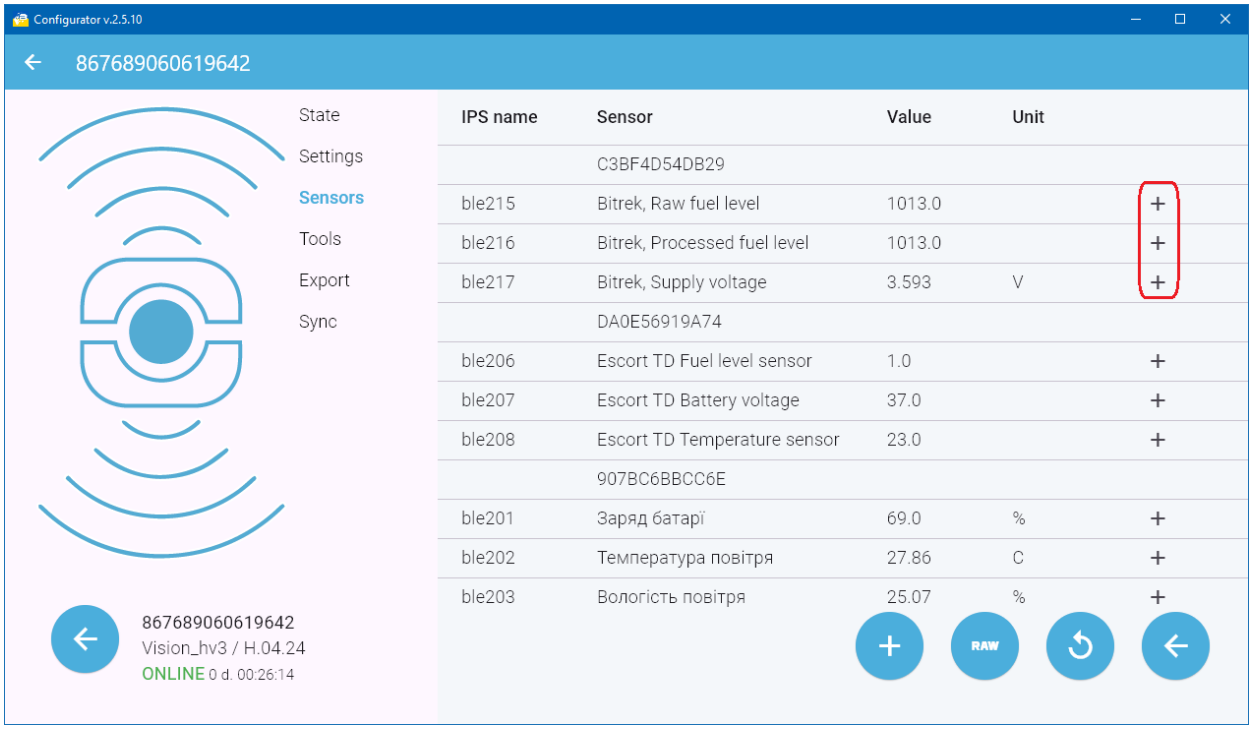

Figure 29. Adding available BLE sensors

To add the desired sensor, click on the "+" sign and it will appear in the list of device sensors.

If you need to configure a sensor that is not automatically parsed by the program, you can click on the "RAW" button after the scanning process. In this mode, a list of all BLE sensors currently available to the device is displayed. Opposite the MAC address of the required sensor, click the "edit" button.

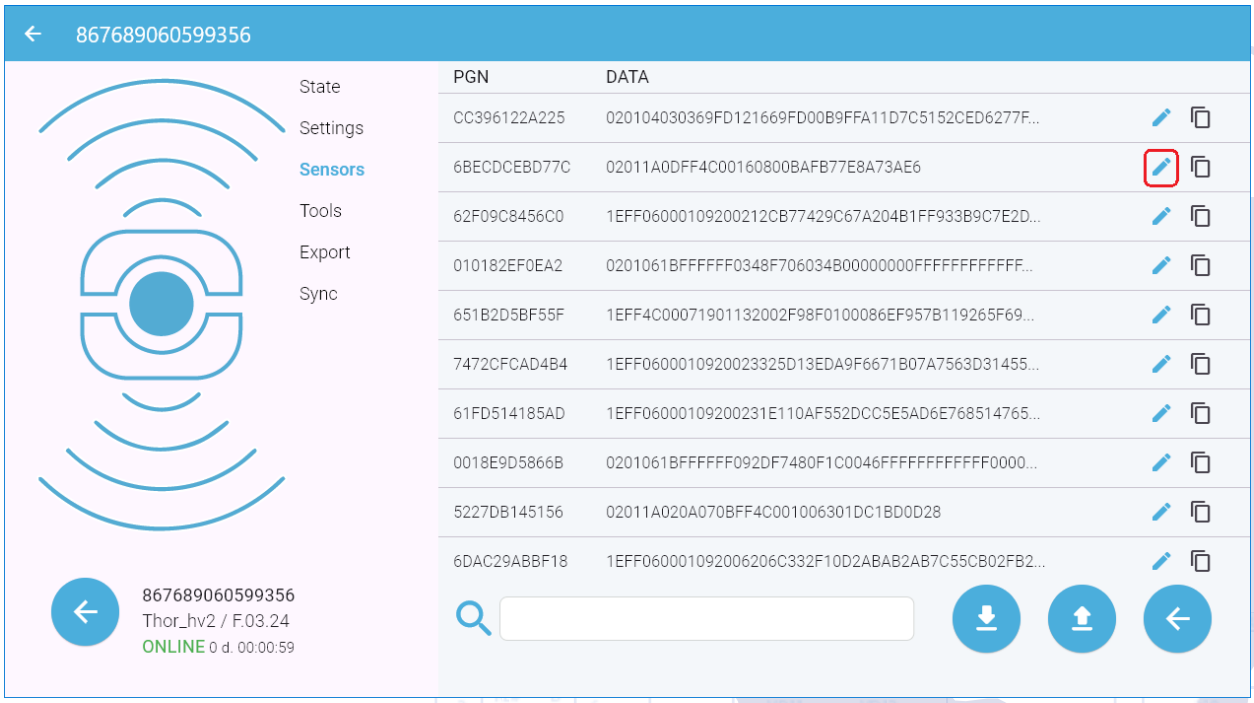

Figure 30. Configuring a custom BLE sensor

In the window that appears, you need to specify the starting position and the number of bits to be read. This can be done either manually by entering ready-made values in the corresponding fields, or you can use the

graphical mode by selecting the required range of data to be read (Figure 31). Additionally, it is possible to edit the IPS name of the sensor. The maximum number of IPS characters in the name is 7.

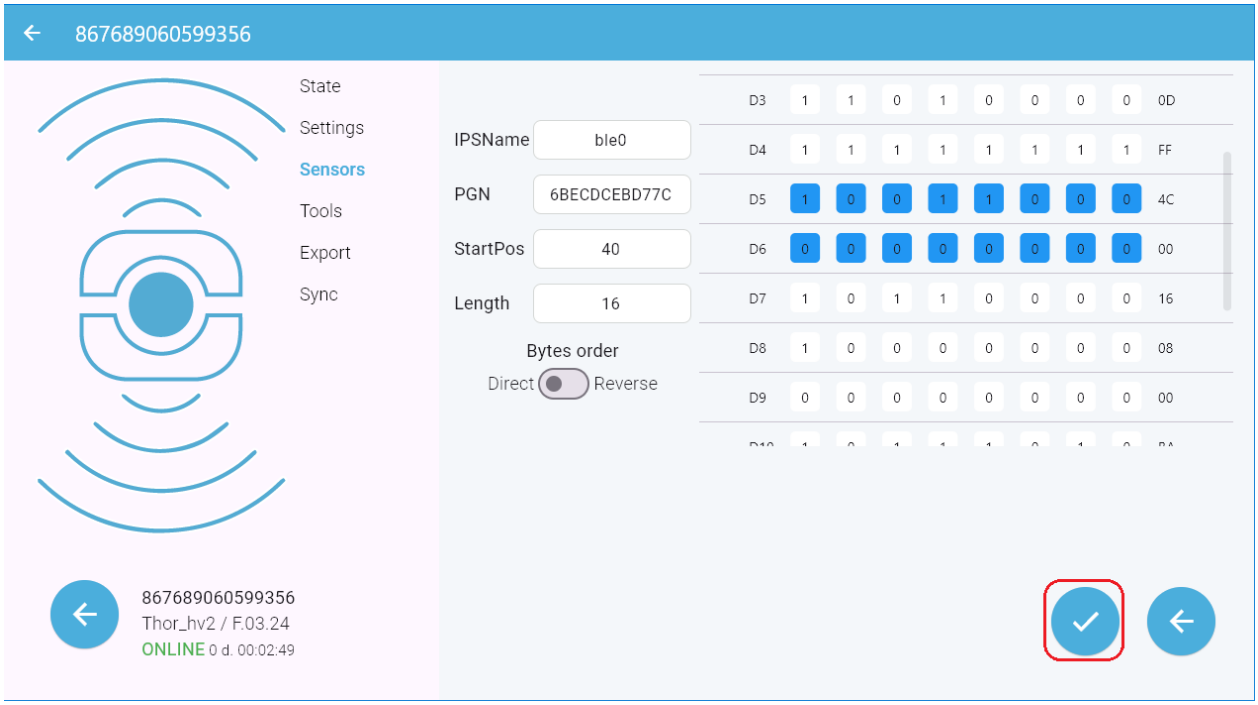

Figure 31. Adding a custom BLE sensor

If it is necessary to configure the BLE sensor before installation, when the user knows the MAC address of the sensor, as well as the starting position and data length of the desired parameter, you can use the "manual" configuration mode of BLE sensors. To do this, press the "+" button in the "BLE scanner" section (Figure 32).

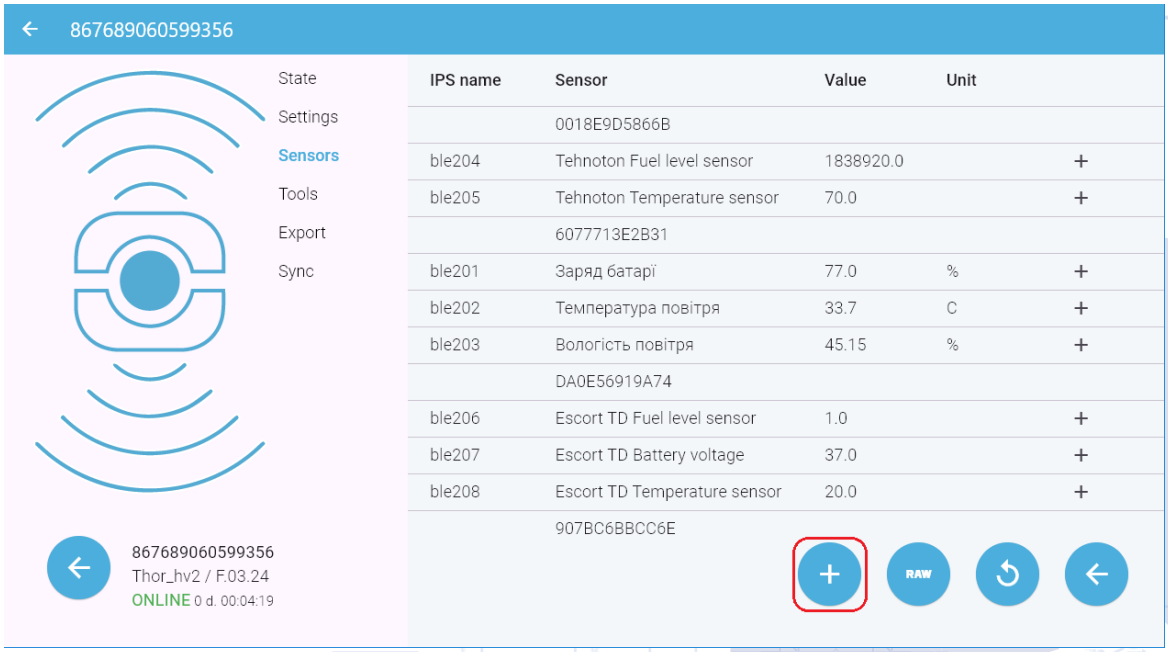

Figure 32. Manual adding of BLE sensor

Next, let's look at two examples of adding sensors.

Suppose you need to configure a BLE sensor manually, since it is not automatically recognized by the configurator. At the same time, its MAC

address and the order of the data to be sent are known. For example, here are the parameters for the "EYE-Sensor":

Temperature (big-endian)
StartBit – 168
Length – 16

Humidity
StartBit – 184
Length – 8

Movement and counter (big-endian)
StartBit – 192
Length – 16

Movement sensor angle (big-endian)
StartBit – 208
Length – 24

Battery voltage
StartBit – 232
Length – 8

Some of the parameters transmitted by the sensor have a big-endian byte order, which means that in order to read the information correctly, you need to "reverse" the byte order in the message. This can be done in two ways: on the monitoring platform, if it has this capability or by using the Byte Order setting of the tracker. Below is an example of setting up temperature transmission (big-endian).

To add a Temperature sensor, you need to switch to manual mode (Figure 33) and in the window that appears, enter the MAC address of the sensor in the PGN field, specify the name of the sensor (no more than 7 characters). Next, before entering the starting position and data length, switch the Bytes Order switch to the Reverse mode, as shown in the Figure 33.

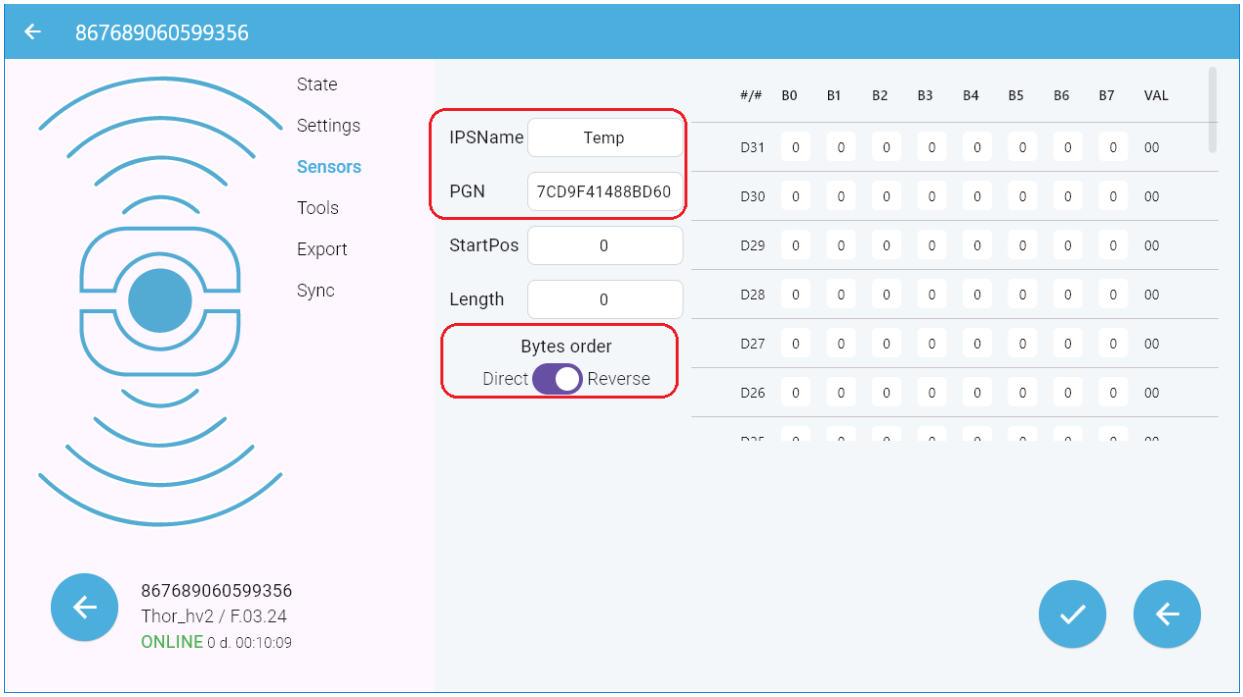

Figure 33. Manual BLE sensor configuration

The name of the sensor can be any, but should not exceed 7 characters.

The next step is to specify the range of data to be taken from the advertise packet. *Important: when choosing a reverse byte sequence, the start position should be set only in the graphical field on the right*. Also, keep in mind that in the device configurator byte count starts from 0, not 1. In the example with the temperature, we have a starting position of 168 bits. To determine the starting byte, you need to divide 168 bits by 8 and we get 21 bytes. That is, we skip 21 bytes and start reading data from the beginning of the 22nd byte. The length of the field in the example is 16 bits, which is 2 bytes. Given that we count bytes from 0, in this case we read bytes 21-22. Selecting the appropriate data as shown in the figure 34.

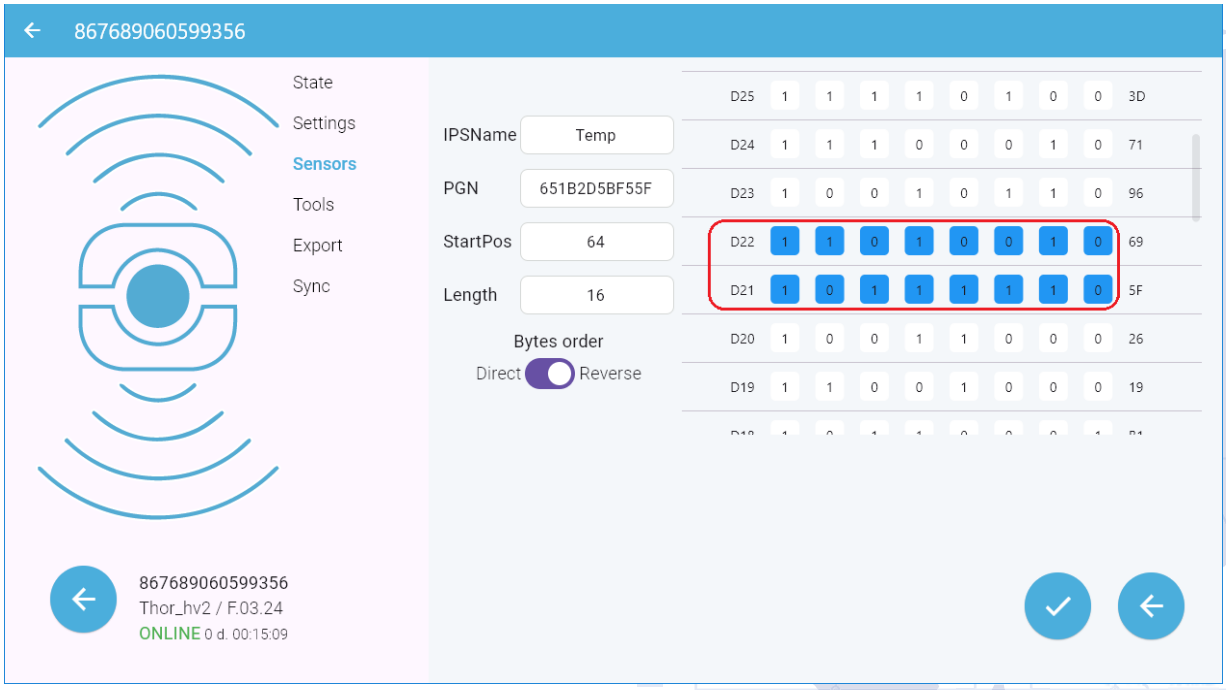

Figure 34. Data field choosing

The next example is adding a sensor with a normal data order (little-endian). For example, let's add the Humidity sensor. To do this, switch to the manual mode and in the window that appears enter the MAC address of the sensor in the PGN field and select the data range to be read. When using the direct order, the data range can be set both in the text fields (StatrtPos and Length) and in the graphical field on the right. When working in the graphical field, select the 23rd byte, respectively, calculating it according to the principle shown above. The name of the sensor can be arbitrary, but should not exceed 7 characters. Adding a sensor is shown in Figure 35.

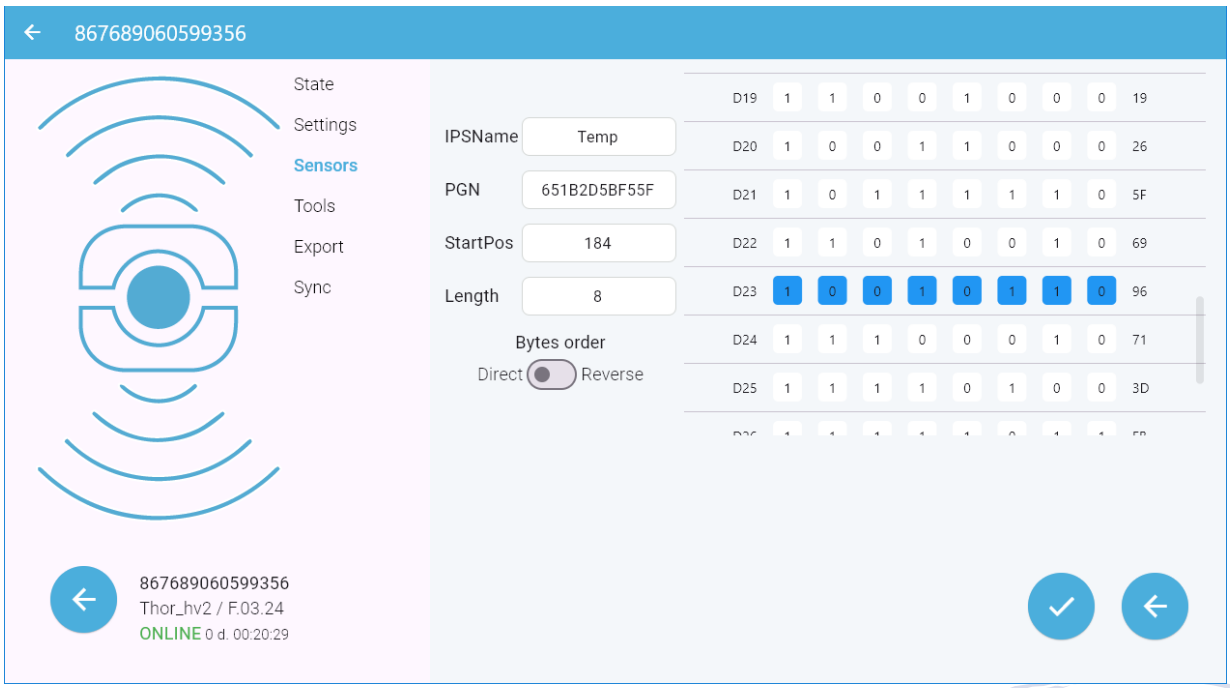

Figure 35. Sensor addition with direct data byte order (little-endian)

After adding the sensor and saving the configuration to the device, the sensor will be available in the sensor list (Figure 36).

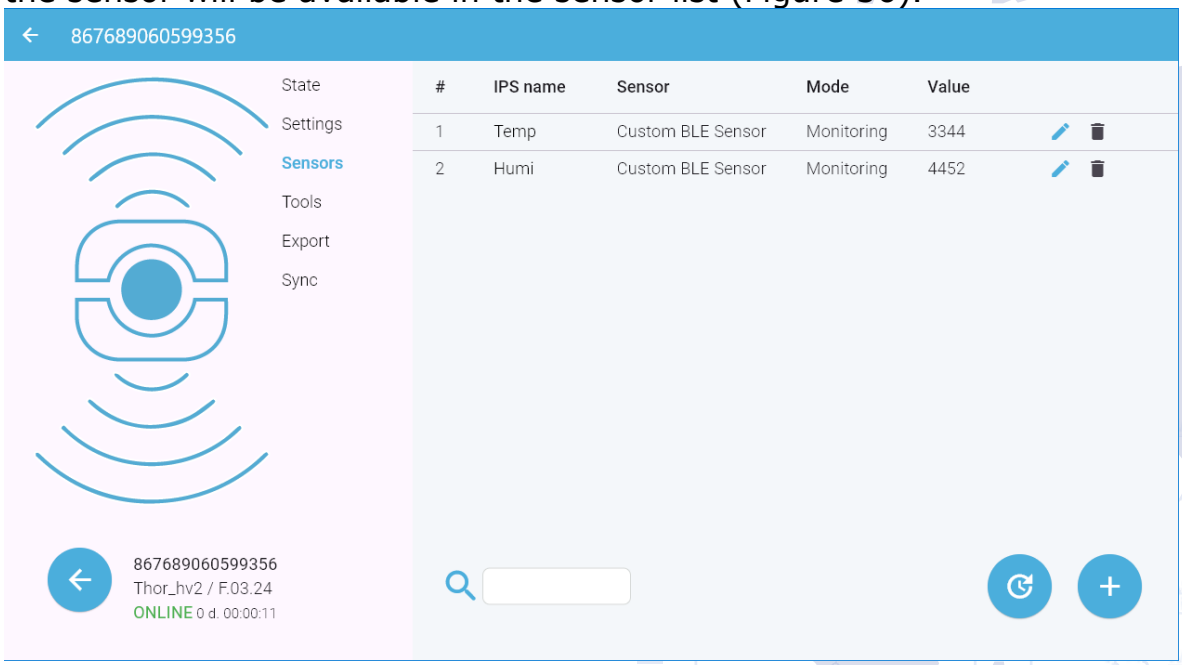

Figure 36. Added BLE sensors

CAN-Log scanner

This section of the program is intended for reading the parameters transmitted by the CAN-Log device and adding the selected parameters to the device's sensor list. Before starting work, you need to make sure that the connection to the CAN bus is made correctly, and that the correct CAN-Log program number corresponding to the vehicle model is specified in the "Settings" section. At the time of scanning, it is necessary to start the engine of the vehicle.

After going to the "CAN-Log scanner" section, the list of sensors will be empty. To start the scan, you need to click the "Refresh" button (Figure 37).

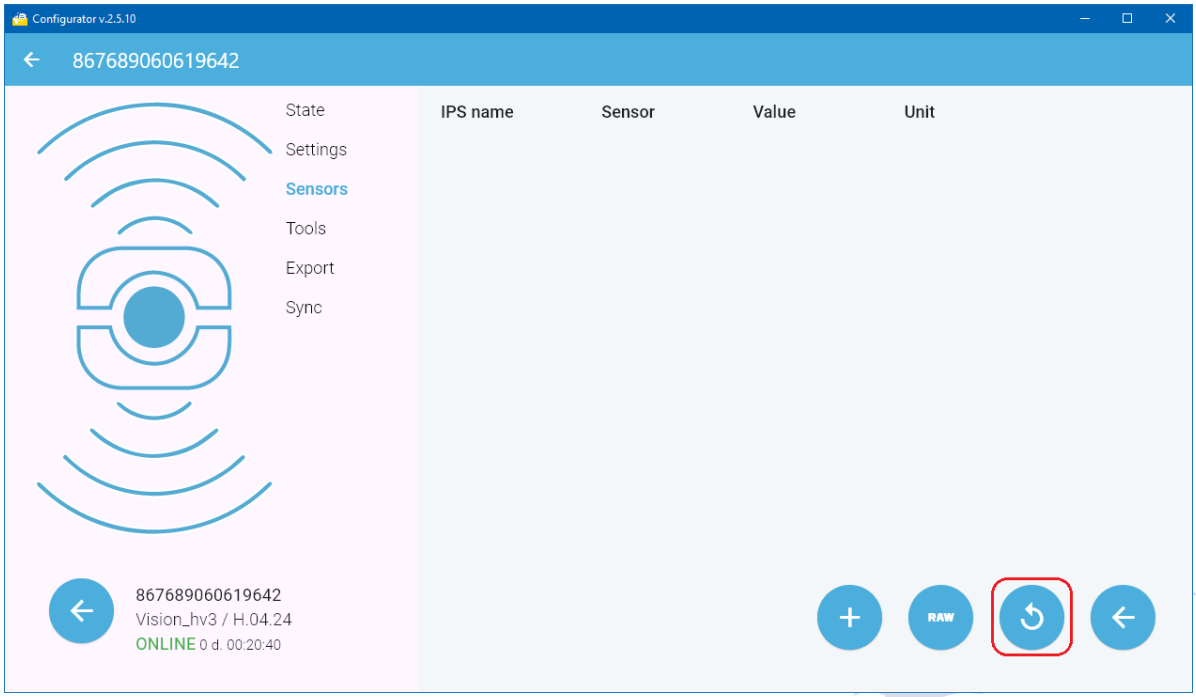

Figure 37. CAN-Log sensors scanning

If the connection is made correctly, the list of sensors transmitted by CAN-Log should be displayed in the program. To add the desired sensor, click on the "+" sign (Figure 38) and it will appear in the list of device sensors.

If you need to check the serviceability of the equipment or adjust the sensors before connecting to the CAN bus of the vehicle, you can use the "test" program CAN-Log under the number 11188. To do this, you need to enter the number of this program in the "Settings" section.

To save settings and sensors, you need to download the current configuration to the device.

Figure 38. CAN-Log sensors adding

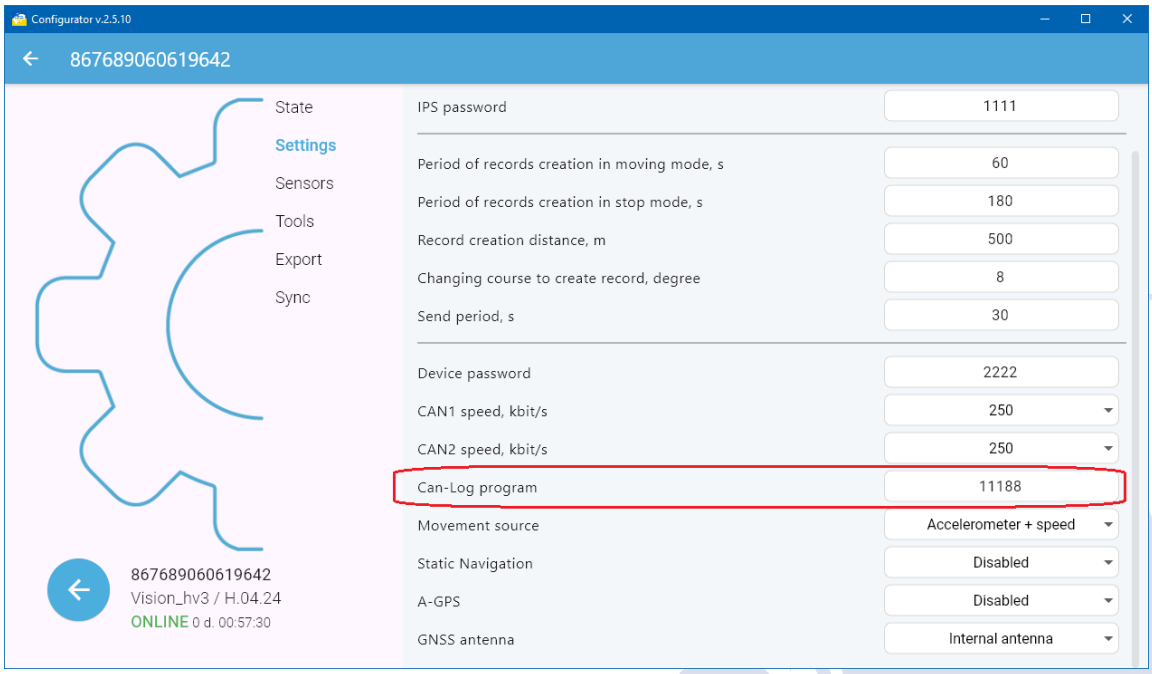

Figure 39. Setting the CAN-Log program number

Tools

This section has a set of additional tools, which includes a mechanism for grouping devices into separate categories in the configurator program, as well as separate tools for setting up work with the Tachograph. This section describes how the grouping works. The description of working with the Tachograph is given in a separate appendix.

Over time, when many devices are added to the account, it becomes necessary to group them according to a separate criterion – for example, by the company to which the devices belong.

When you select the "Tools" section in the configurator menu, you can assign the selected device to a specific category or create a new category ("folder") for it.

The figures below show how this procedure is performed:

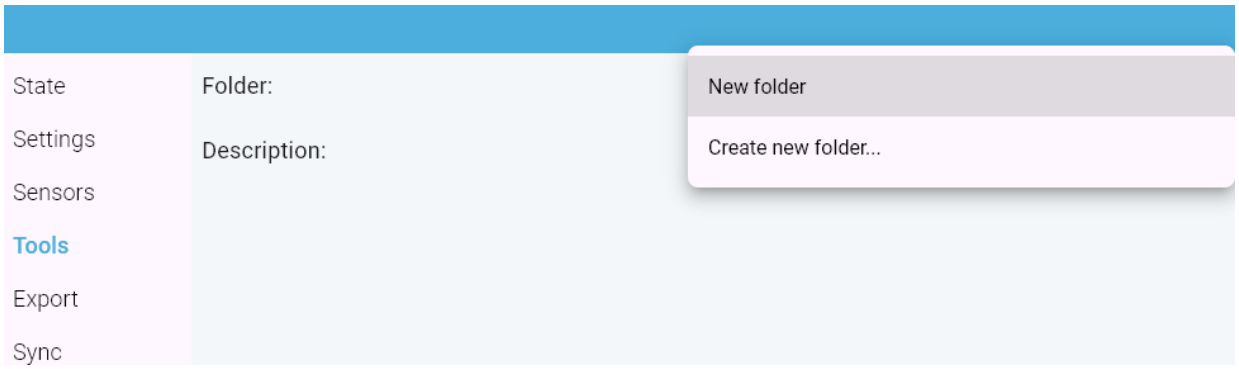

Figure 40. Creating a new folder

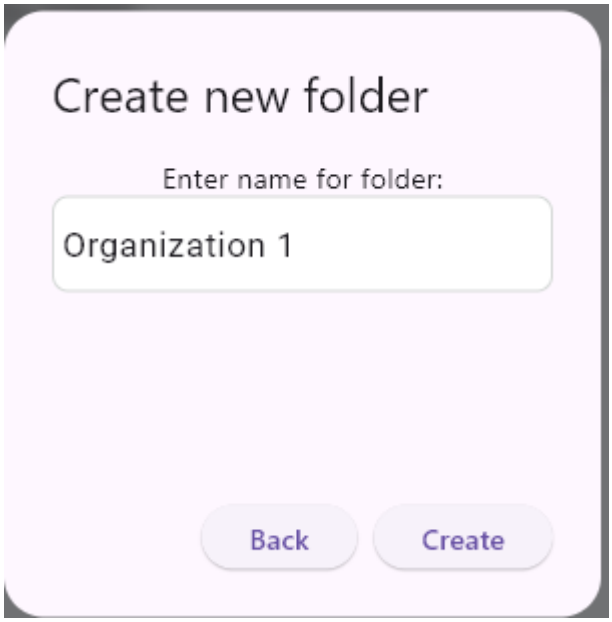

Figure 41. Enter the name of the directory

Note that one device can belong to only one category. It is also impossible to create a category that does not contain any devices – such a category will not be saved.

Additionally, you can add an arbitrary description of the object in the appropriate field (shown in the figure below). To save the entered data, click the "Save" button:

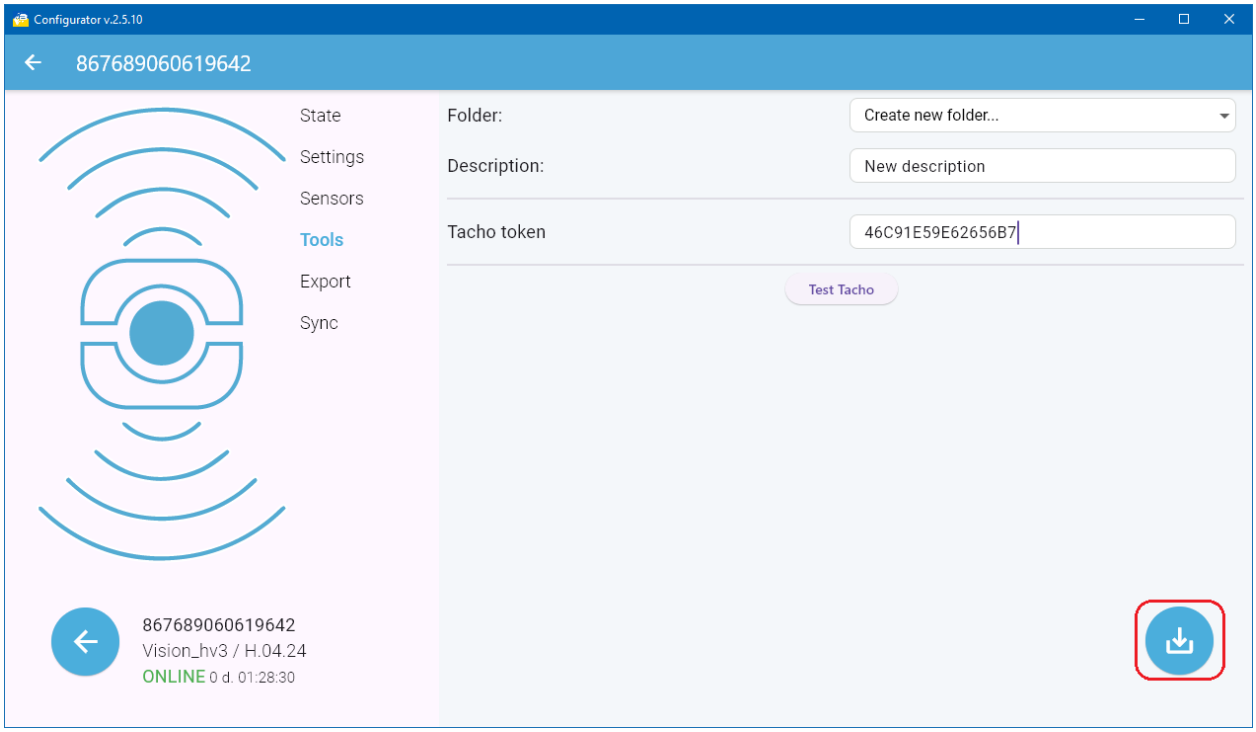

Figure 42. Saving category settings

After the categories are created, it is possible to view the list of devices in the configurator in the form of folders and the general list. To switch, use the button:

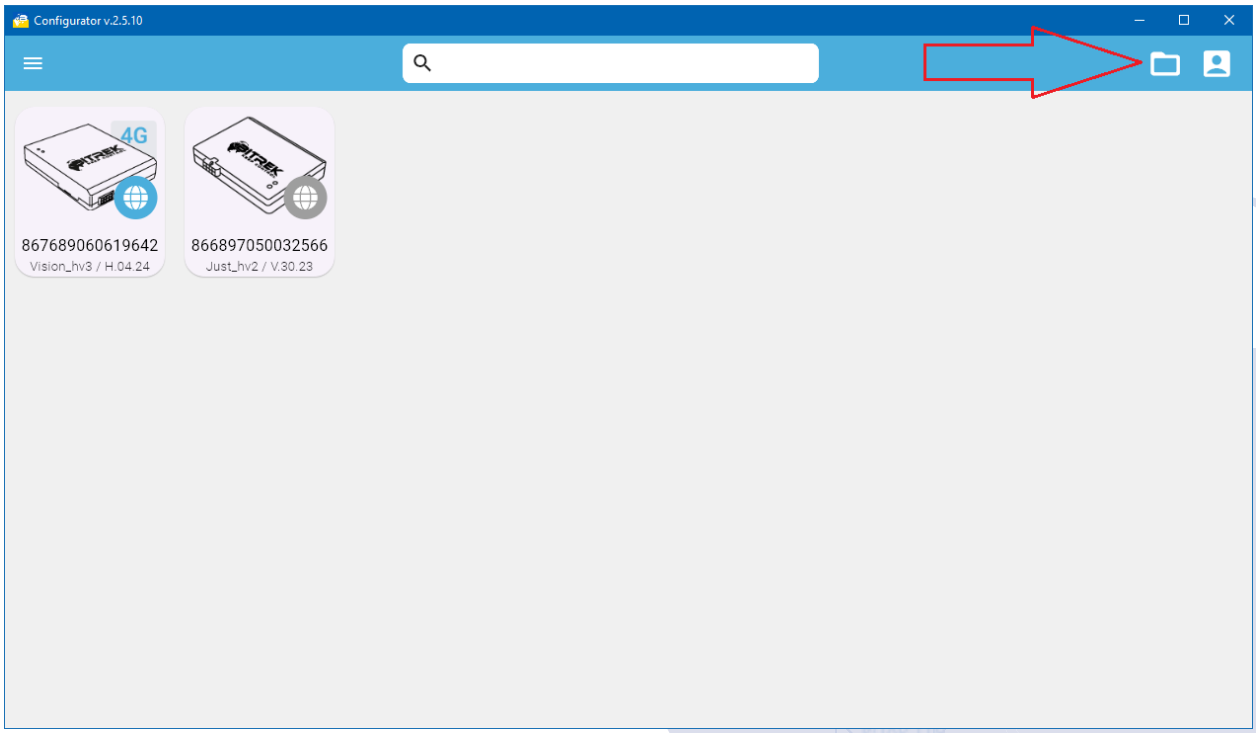

Figure 42. Switch the view

After switching to the Category mode, the devices will be grouped as shown in the figure below:

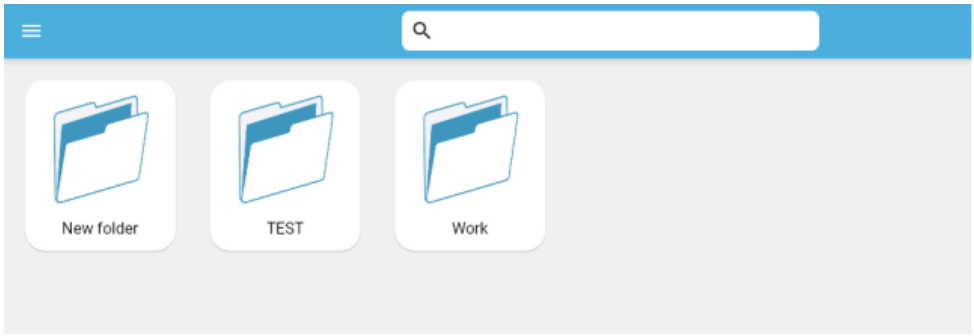

Figure 43. View in the "Category" mode

If a description has been added to the device, it will appear instead of the hardware and software versions of the device:

Figure 44. Displaying the device description

Export

To save the configuration to a file for the purpose of subsequently writing it to similar devices, go to the "Export" section and click the "Backup" button In the window that appears, select the folder where the configuration will be saved and click the "Select Folder" button. The configuration file will be loaded into the selected folder – it will have the name of the IMEI of the device whose parameters were saved.

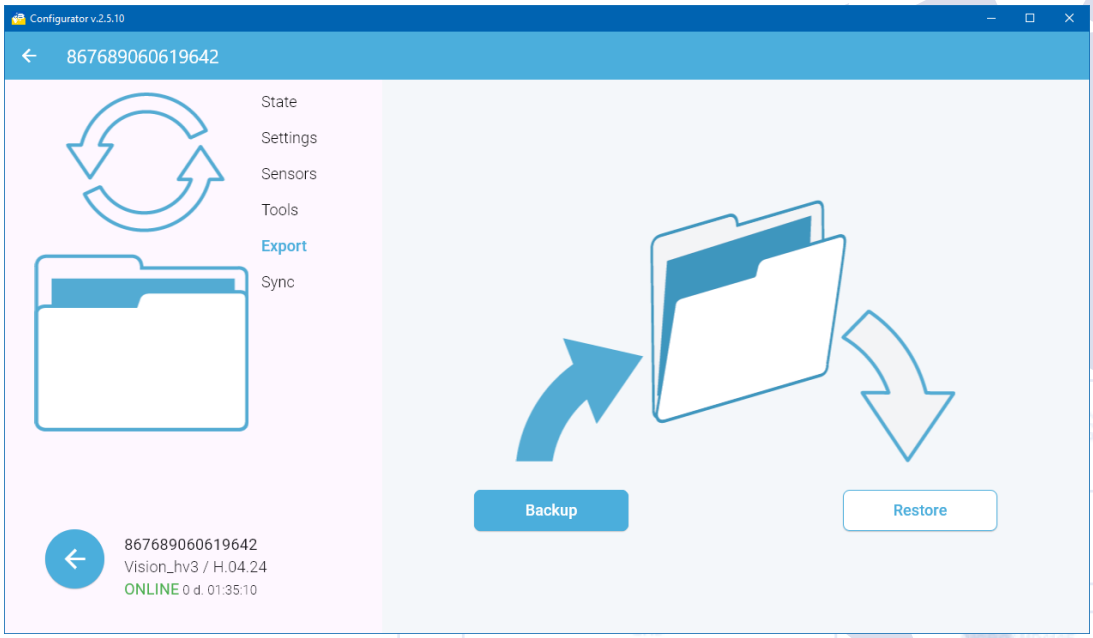

Figure 45. Backup/restore the configuration

Sync

After entering the settings and adding sensors, the created configuration is not automatically saved to the device – it remains created in the program and needs to be saved to the tracker. To write the current configuration, go to the "Sync" section and click the Upload button. All settings and sensors will be written to the device. All settings, except for the Static Navigation and A-GPS modes, are applied immediately after they are sent, you do not need to reboot the device.

The current configuration is read from the device every time the user selects this device from the list and accesses it. However, there may be a situation when the user needs to force the current configuration to be downloaded from the device (for example, if unnecessary parameters/sensors were accidentally changed, but the configuration has not yet been written to the device). To do this, click the Download button in the "Sync" section.

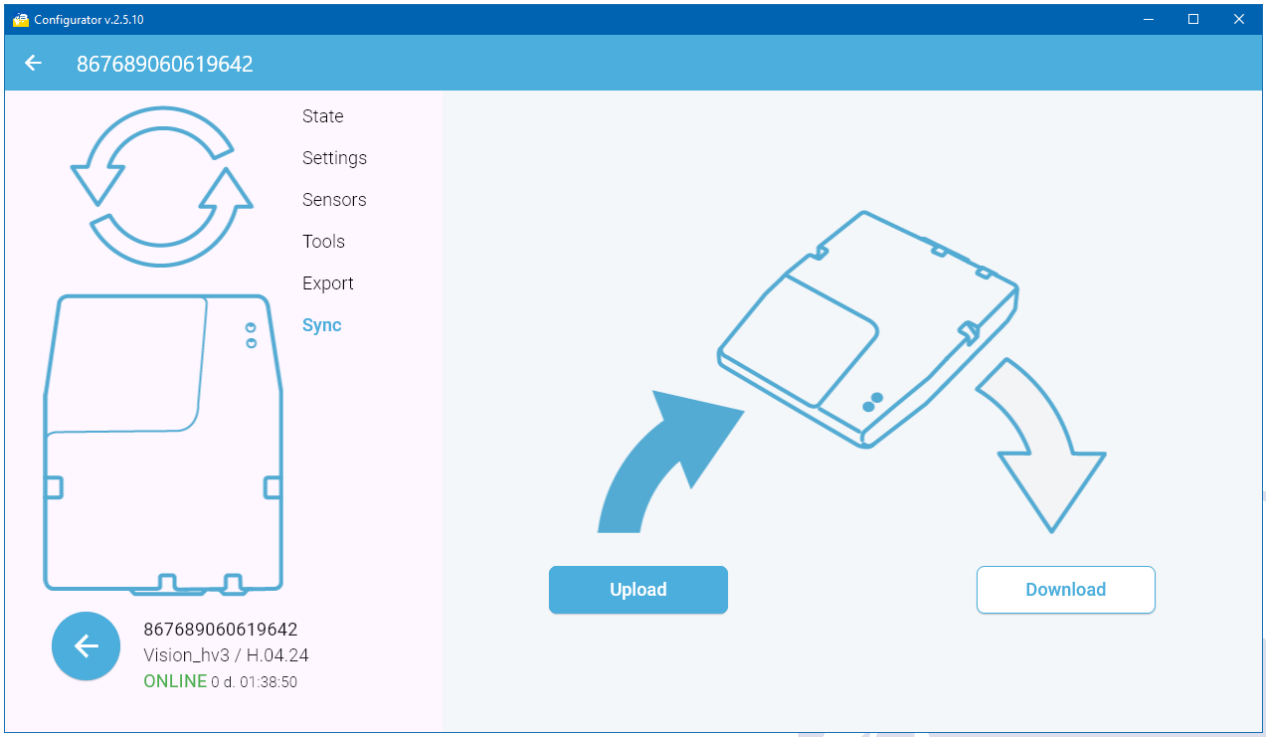

Figure 46. Writing/reading device parameters and sensors

Edit sensor settings

Sensors added to the device configuration can be flexibly configured. To enter the configuration mode of the selected sensor, click the Edit button:

#	IPS name	Sensor	Mode	Value
1	reboot	Reboot counter	Monitoring	22
2	A_odo	Absolute odometer	Monitoring	0
3	R_odo	Relative odometer	Monitoring	0
4	pointCs	Point creation source	Monitoring	2
5	VPWR	Power supply voltage	Monitoring	13.481
6	parking	Parking status	Monitoring	0
7	VBAT	Battery voltage	Monitoring	4.279
8	dinL1	State of digital input d_low	Monitoring	0

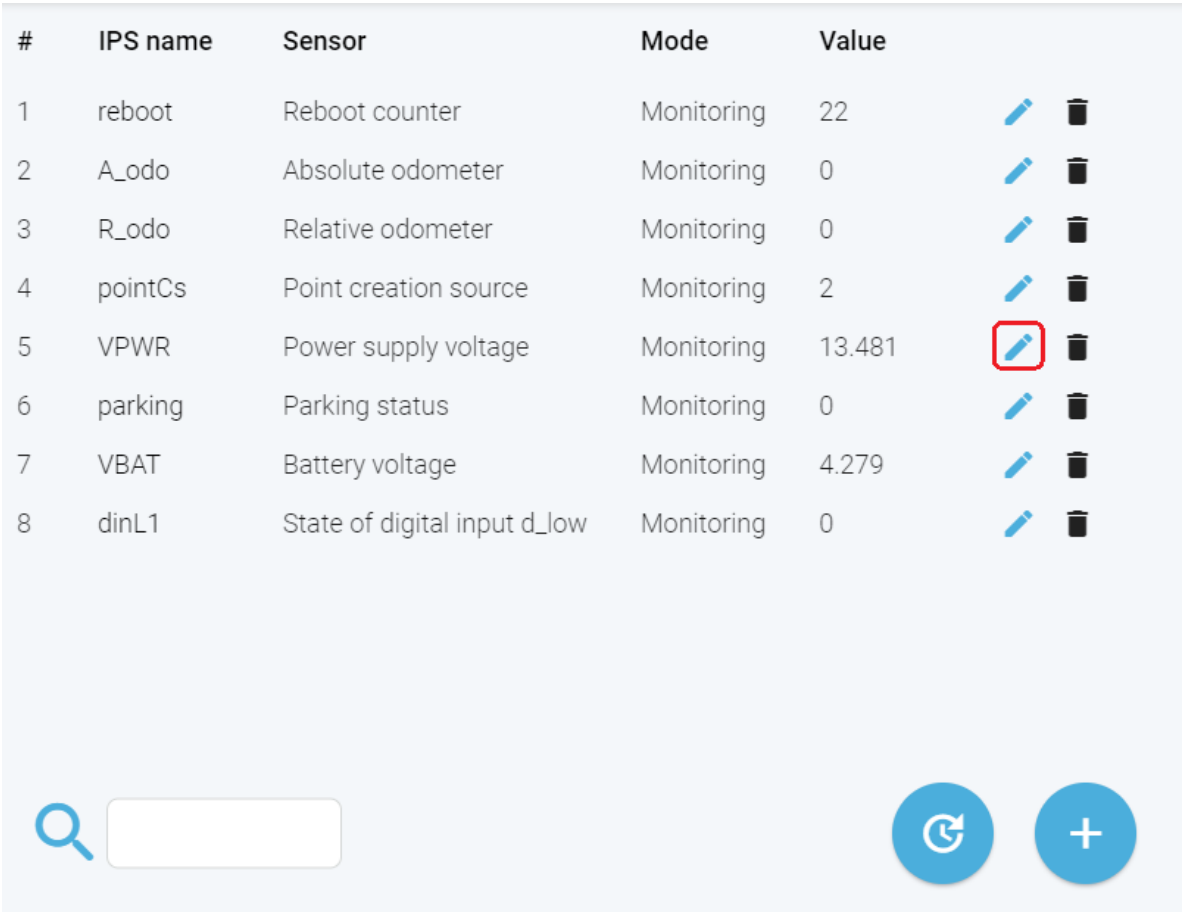

Figure 47. Sensor editing

Name	Value
PGN	0
StartPos	0
LEN	16
Mode function	Monitoring
View function	f16_div1000
IPS name	VPWR
Lower limit	0.0
Upper limit	0.0
Averaging	0
Hold time	0

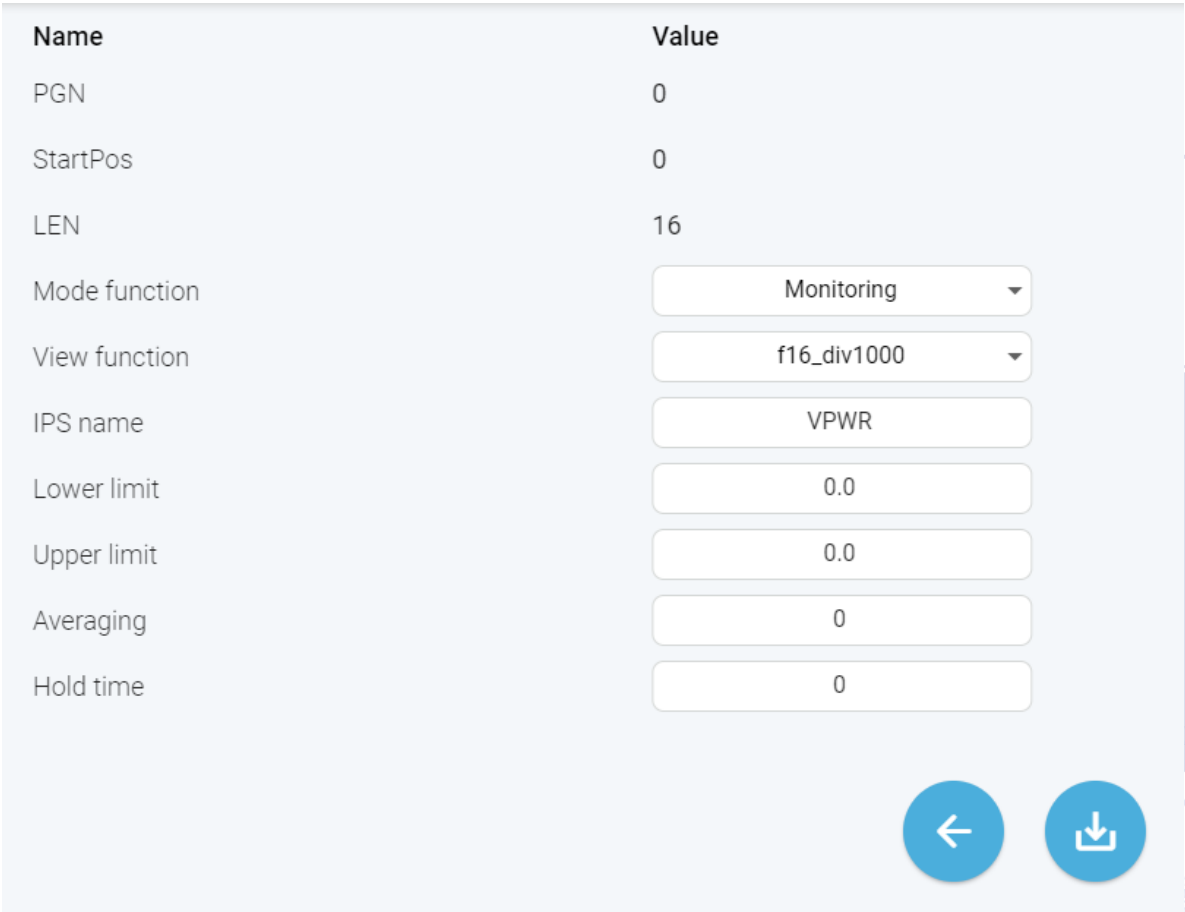

Figure 48. Sensor parameters

After entering the settings mode, the user is given the opportunity to edit a number of sensor parameters. Below is a list of the parameters that can be edited and their explanations.

Mode function. There are three variants of mode functions are available:

- *Monitoring*. In this mode, every time the tracker will create a new record to send to the server, this record will include all the current values of the sensors configured in the "Monitoring" mode. Thus, each record on the server will contain the value of all configured sensors in the "Monitoring" mode at the time of sensor creation.

- *In and Out of range*. In this mode, the "Lower limit" and "Upper limit" parameters specify the range of values for which the condition can be fulfilled. As long as the actual sensor value does not fall into the specified range, the sensor value transmitted to the server will be equal to 0. As soon as the actual sensor value falls into the specified range, the device will create a separate record to send to the server. In this record, the value of the sensor will be 1 – this means that the condition is met and the sensor has been activated. In addition to this record, the current values of all other sensors configured in the "Monitoring" mode will be included. The value of the sensor is equeal to -1 when there is no valid data.

  Example: we have two sensors configured for analog input ADC1. The first sensor is in the "Monitoring" mode, the second sensor is in the "In and out of range" mode, the specified range is from 8 to 20 volts. The actual value of the voltage at the input of ADC1 is 5 Volts. In this case, the sensor configured in the "Monitoring" mode will transmit the value of 5 Volts to the server and the sensor configured in the "In and out of range" mode will transmit 0.
  Then, the voltage on ADC1 rose to 10 Volts. In this case, a sensor configured in Monitoring mode will transmit 10 Volts to the server, and a sensor configured in "In and out of range" mode will transmit 1.
  Additionally, if there is no sensor value at all, then the value that will be transmitted to the server will be -1.

- *Output control*. This mode is similar to the "In and Out of range" mode, but in addition to the results of the specified conditions, the device will control the Lock output according to the following principle: if the condition is met and the sensor returns a value of 1, the output is activated. If the sensor returns 0, the Lock output is deactivated.
  Please note that if you configure several sensors in this mode, the output will be controlled by all of them. Therefore, **we do not recommend** configuring more than 1 sensor with this function.

- *Delta*. In this mode, the Upper limit parameter specifies the sensor value by which the actual sensor value should change to create an additional point.

Example 1: The tracker is installed on a stationary object. The device creates a timeout point once per hour. A sensor has been created for the analog input, configured in the "Delta" mode. The value 1 Volt is entered in the "Upper Threshold" parameter. In this mode, the device will create a record for transmission to the server once per hour. This record will contain all the current values of the sensors configured in the "Monitoring" mode as well as in the "Delta" mode. But, as soon as the current value of the voltage changes by 1 volt from the previous value, the device will create an out-of-order record to the server, which will also contain all the values of the configured sensors. The "Delta" mode can be used in cases where it is necessary to generate more records when the values of the selected sensor change.

Example 2: You need to configure an iButton or RFID reader so that when the ID key is inserted, the device instantly generates an event. In this case, for the Delta mode, you need to set the Lower Threshold field to 1, the Upper Threshold field to -1, and the Data Transfer Period to Server parameter to 0. Similar settings are also valid for the Output Control mode.
The Delta mode can be used in cases where you need to generate more records when the values of the selected sensor change.

View function. This parameter determines exactly how the value of the sensor will be displayed. Below there are the view functions available for configuration in the device.

No.	Name	Representation
1	u8	Unsigned 1 byte
2	s8	Signed 1 byte
3	u16	Unsigned 2 bytes
4	s16	Signed 2 bytes
5	uf16	Unsigned float 2 bytes
6	uf16_div100	Unsigned float 2 bytes divided by 100
7	uf16_div1000	Unsigned float 2 bytes divided by 1000
8	u32	Unsigned 4 bytes
9	s32	Signed 4 bytes
10	f32	Float 4 bytes
11	f32_div100	Float 4 bytes divided by 100
12	f32_div1000	Float 4 bytes divided by 1000
13	u64	Unsigned 8 bytes
14	s64	Signed 8 bytes
15	f64	Float 8 bytes
16	u16_div100	Unsigned 2 bytes divided by 100
17	s16_div100	Signed 2 bytes divided by 100
18	u16_div1000	Unsigned 2 bytes divided by 1000
19	s16_div1000	Signed 2 bytes divided by 1000
20	u32_div100	Unsigned 4 bytes divided by 100
21	s32_div100	Signed 4 bytes divided by 100
22	u32_div1000	Unsigned 4 bytes divided by 1000
23	s32_div1000	Signed 4 bytes divided by 1000
24	u8_invers	Unsigned 1 byte inversed
25	string	String
26	sf16	Signed float 2 bytes
27	sf16_div100	Signed float 2 bytes divided by 100
28	sf16_div1000	Signed float 2 bytes divided by 1000

IPS name. This parameter determines the name of the sensor transmitted to the server. The maximum name length is 7 characters. It is important that there are no sensors with the same names when configuring the device. If such a situation occurs, such sensors will be highlighted in red in the list of sensors and when you try to send the configuration to the device, the program will issue an error and offer to check the correctness of the sensor settings.

Averaging. This parameter affects the time during which the value of the sensor must meet the conditions of the event in order for this event to be recorded. Works with "In and Out of range" and "Delta" mode functions. The resolution of the parameter is 100 ms. For example, if the averaging value is set to 10 for a sensor with the function of "In and Out of range" mode, then the sensor will record a trip only when the actual value will be in the range for at least 1 second.

Hold time. This parameter affects the time during which the device will remember the last value received from the sensor. For example, if the selected parameter stops being transmitted over the CAN bus, the device will remember its last value for the time specified in this parameter. If the device does not receive a new value from this sensor by the end of the timeout, the device will reset the sensor value. Measurement resolution is 1 sec. In the event that the retention time is specified as 0, the device will not reset the sensor value until the device is restarted.

SMS commands

The device can work with SMS commands. Each SMS message sent to the device must have the following format (uppercase is a must):

PASS:[SMS_PASSWORD]:[SMS_CMD]:[SMS_CMD_DATA]

,where:

[SMS_PASSWORD] – SMS access password, by default – 2222. It can be changed in the "Settings" section of the device.
[SMS_CMD] – SMS command. The list of available commands is presented below.
[SMS_CMD_DATA] – parameter value. Filled in only for commands that require a parameter value.

A complete list of commands with examples is presented below.

MODE – information command. An example of an SMS message with the following command:

PASS:2222:MODE

The device will send an SMS with information about the status of the device. The answer has the following format:

[SW_VERSION]:[IMEI]:[GPRS_STATUS]:[APN]:[SOCK_STATUS]:[IP/SERVER_NAME]:[PORT]:[SAT_NUM]:[LAT]:[LONG]:[TIME_ALIVE_IN_SEC]

,where:

[SW_VERSION] – device software version;
[IMEI] – IMEI of the modem;
[GPRS_STATUS] – GPRS session activity status: '0' – not active or '1' – active;
[APN] – the current APN of the GPRS session;
[SOCK_STATUS] – socket status of the primary server. Possible values:
0..4 – no connection;
5..9 – connected to the main server.
[IP/SERVER_NAME] – the current address of the main server;
[PORT] – the current port of the main server;
[SAT_NUM] – the current number of visible satellites;
[LAT]:[LONG] – current GPS coordinates determined by the device;
[TIME_ALIVE_IN_SEC] – device operating time in seconds since the last reboot.

Example of the response:
F.19.22:862430055552968:1:internet:9:nl.gpsgsm.org:20332:15:50.464142:30.363543:12345678

KILL – control command. Causes the device to reboot. An example of an SMS message with the following command:

PASS:2222:KILL

After receiving the command, the device will send a response SMS with the following text, after which it will reboot:

DEVICE REBOOT NOW

LOCK – control command. This command involves filling the parameter value field (SMS_CMD_DATA) and is used to control the digital output of the device. It is possible to activate the output by sending '1' and to deactivate the output by sending '0'.

PASS:2222:LOCK:1

The device will change the output state to the specified one and send an SMS reply with the following text:

SETT LOCK

OUT2 – control command. This command involves filling in the parameter value field (SMS_CMD_DATA) and is used to control the digital output 2 of the device. It is possible to activate the output by sending '1' and deactivate the output by sending '0'.

Examples:

PASS:2222:OUT2:1

In response, the device will change the output state to the specified one and send an SMS with the following text:

SETT OUT2

APN – control command. This command involves filling in the parameter value field (SMS_CMD_DATA) and is used to set the current APN.

PASS:2222:APN:internet

In response, the device will send the following text:

SETT NEW CONFIGURATION AND RECONFIG

IPS – control command. This command involves filling in the parameter value field (SMS_CMD_DATA) and is used to set the current address and port of the main server.

PASS:2222:IPS:193.193.165.165:20332

In response, the device will send the following text:

SETT NEW CONFIGURATION AND RECONFIG

Explanation of the use and layout of SMS commands.

1. For SMS commands containing the field [SMS_CMD_DATA] – the value of the parameter, it is possible to combine several commands into one, by using the delimiter symbol ‘,’. An example of sending such commands:

   PASS:2222:APN:internet,IPS:nl.gpsgsm.org:20332

2. For SMS commands containing the field [SMS_CMD] – SMS command, the final action rule is applied. This means that such a command must either end the SMS message or be the only command in the SMS message. Examples are given below:

   Example 1 (correct):

   PASS:2222:APN:internet,IPS:nl.gpsgsm.org:20332,LOCK:1

   The device in this case will configure the APN, address and port of the main server and set the active value of the digital output.

   Example 2 (correct):

   PASS:2222:APN:internet,IPS:nl.gpsgsm.org:20332,KILL

In this case, the device will configure the APN, address and port of the main server, after which it will reboot.

Example 3 (not correct):

PASS:2222:KILL,APN:internet,IPS:nl.gpsgsm.org:20332

In this case, the device will reboot, but the APN and server settings will not be applied.

Example 4 (not correct):

PASS:2222:APN:internet,KILL,IPS:nl.gpsgsm.org:20332

In this case, the device will apply the APN settings and then reboot immediately. The primary server address setting will be ignored.

If the command does not correspond to any of the formats described in this section or if the SMS access password is entered incorrectly, the device will send the following response:

WRONG PASSWORD/INCORRECT COMMAND

The device supports GPRS commands to control the first digital output (Lock) sent from the main server. Such commands, as an example, can be used to remotely lock the vehicle's engine.

Command format:

CMDE:LOCK:1 – activate the output;

CMDE:LOCK:0 – deactivate the output;

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