VEGA
ABSOLUTE

MONITORING DEVICE

VEGA MT X

User Manual

www.vega-absolute.ru

Document Information	
Title	Monitoring Device Vega MT X
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This document complies to the next devices:

Series Name	Device Name
Vega MT X	Vega MT X Int
	Vega MT X Ext
	Vega MT X LTE

Revision History

Revision	Date	Name	Comments
01	22.07.2019	KEV	Document release date
02	10.12.2019	KEV	New functions in Configurator description, new CAN-script launch command, SIM-cards auto switching
03	07.04.2020	KEV	Part 11 File server is added, new settings for the CAN-sensors
04	14.05.2020	KEV	SMS-commands for SIM changing are added
05	04.06.2020	KEV	The functionality and settings description of BLE sensors is added
06	25.08.2020	KEV	Minor changes in Configurator's parts
07	02.10.2020	KEV	Description of connecting supported tachographs, other edits

08	09.11.2020	KEV	There is a new server type for SMS command: Wialon Combine, there are the new SIM-holders in the new board revisions
09	04.12.2020	KEV	There is an alarm about SIM-card installing in the unpowered device

CONTENTS

1 INTRODUCTION

This manual is designated for Vega MT X monitoring device (hereinafter – the device) manufactured by Vega-Absolute OOO and provides information on powering and activation procedure, control commands and functions of the device.

This manual is targeted at specialists which familiar with installation and repairing procedures rules for motor transport and had holding of professional knowledges in the field of electronic and electrical equipment of different vehicles.

The device shall be installed and adjusted by qualified specialists to ensure proper operation of the device

For successful using of the device you should learn monitoring system principle of operation in complex and understand the function of every its part.

Vega-Absolute OOO reserves the right to make changes to the manual related to the improvement of equipment and software, as well as to eliminate typos and inaccuracies, without prior notice.

2 DESCRIPTION AND OPERATION

Vega MT X CAN device is designed for monitoring of vehicles by the using of GLONASS/GPS positioning systems including the determination of vehicle placement, speed, and motion direction as well as for transmitting of collected data through GSM.

Vega MT X have the built-in processor with a CAN-processor functionality and supports up to three CAN-buses that allows to get a full information about vehicle.

Non-volatile memory allows to store information about events and statuses of the device in the absence of power supply.

Writing of statuses into non-volatile memory carried out at once per minute and that should be considered when operating with digital outputs statuses

Collected data transmits through GPRS technology on the dedicated server which from that data may be get through a special program for latest analysis and processing on the dispatcher console. Support of several servers allows to send information about vehicle status on the four servers simultaneously.

Setting of the device and firmware updating may be carried out through USB-port or by the air with Configurator application.

The vehicle route is recorded as individual points in time (track). Along with the track, information is recorded coming into the device from internal and external sensors, as well as from an additional equipment. The block has a flexible setting for the period of saving track points: by the time (set in seconds), by the distance (in meters), by the course change (in degrees). The readings of all sensors and the statuses of the device can also be transmitted with different events: by the time, by the parameter changing, or along with the track.

Configurator application also allows to realize the remote diagnostic of the device and save the result to a file.

3 SPECIFICATION

Parameter	Value
Housing dimensions, mm	110 x 67 x 20
Ingress protection rating	IP53
External power, V	9...36
Consumption current, mA - in sleep mode - in active mode	 1,5 40...300
Operating temperatures, °C	– 40...+85
Built-in battery	560 mAh
CUN-bus supported	3
RS-232	1
RS-485	1
UART	1
Lin/K-Line	1
Digital outputs	4
Multifunctional inputs	3
1-Wire	1
Ignition control input	1
Built-in accelerometer	Yes
GSM and GLONASS/GPS antenna	Internal or external[1]
SIM	2 SIM-cards or 1 SIM-chip and 1 SIM-card[1]
GSM-modem	4 diapason or LTE[1]
Micro-USB	Yes
Built-in black box	Up to 100 000 entries
Tamper sensor	2

Vega MT X CAN provide the next functionality:

- Wialon IPS, Wialon Combine, EGTS, NDTP, VEGA protocols supporting
- Simultaneous operation with four servers through any of supported protocol
- Device activity can be programming by the “Scenarios” function (up to 25 scripts)
- Configuration through GPRS, USB, SMS
- Firmware updating through GPRS, USB
- Remotely configuring and monitoring of status through free engineer server
- Driver identification by the I-Button keys
- Temperature control at the engine compartment and the car salon with an external 1-Wire sensors

[1] See device series table

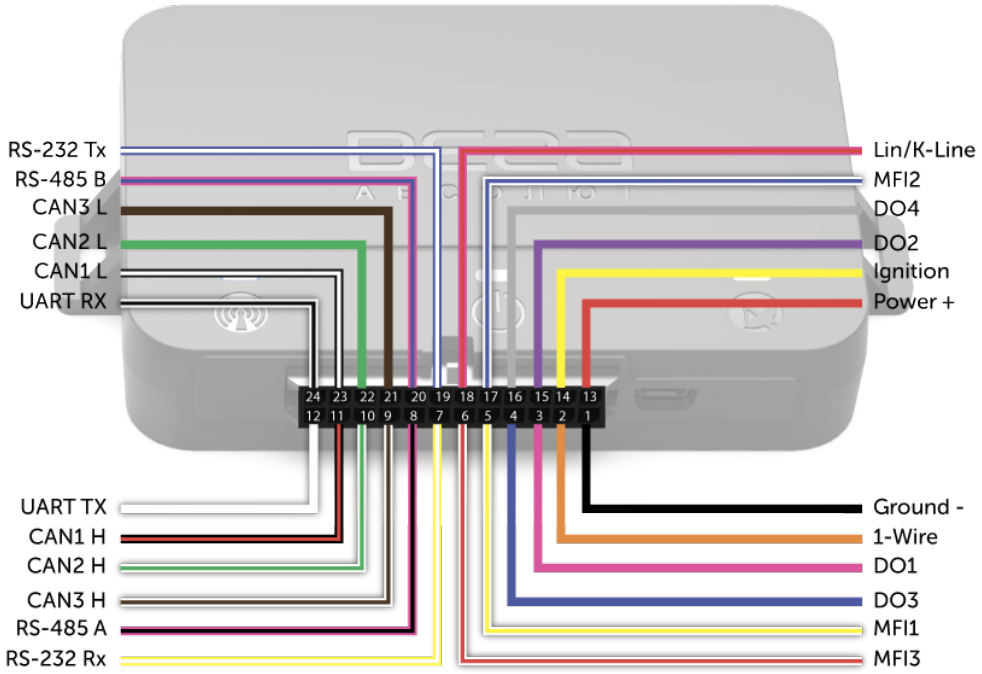
- Manage of actuators by the commands and by the events
- Built-in black box holding up to 100,000 entries
- SMS-notifications with a wide spectrum of set abilities
- GPS-odometer
- Geofences control with ability of SMS-notification and manage of actuators (up to 50 specified geofences)
- Trip counter
- Remotely diagnostic of the device status

Device series:

Parameter	MT X Int	MT X Ext	MT X LTE
GSM and GLONASS/GPS antennas	Internal	External	External
SIM	2 SIM-cards or 1 SIM-chip and 1 SIM-card		
GSM	Quectel MC60 4x band modem (850/900/1800/1900 MHz) GPRS class 12 85.6kbps Up/Down		Quectel EC21E LTE Cat 1 / 10Mbps down/5Mbps uplink
ГНСС	Quectel MC60 ГЛОНАСС/GPS/Galileo/QZSS Sensitivity: -167dBm (tracking) Hot start: 1s / Cold start: 35s Warm start: 4,5 s Channels: Acquisition: 99, Tracking: 33 Positioning accuracy: 2.5m		U-blox EVA-M8M ГЛОНАСС/GPS/Galileo/QZSS/BeiDou Sensitivity: -164dBm Hot start: 1s / Cold start: 26s Warm start 3 s Channels: Acquisition: 72 Positioning accuracy: 2.5m
Bluetooth	3.0 + BLE		no

4 OPERATION BEGINNING

CONTACTS DESCRIPTION



Contact	Wire color	Description
1	Black	Ground -
2	Orange	1-Wire
3	Pink	Digital output 1
4	Dark blue	Digital output 3
5	White + yellow	Multifunctional input 1
6	White + red	Multifunctional input 3
7	Yellow + white	RS-232 Rx
8	Pink + black	RS-485 A
9	White + brown	CAN3 High
10	White + green	CAN2 High
11	Black + red	CAN1 High
12	White	UART TX
13	Red	Power +

14	Yellow	Input of ignition control
15	Violet	Digital output 2
16	Grey	Digital output 4
17	White + dark blue	Multifunctional input 2
18	Pink + red	Lin/K-Line
19	Dark blue + white	RS-232 TX
20	Pink + dark blue	RS-485 B
21	Brown	CAN3 Low
22	Green	CAN2 Low
23	Black + white	CAN1 Low
24	White + black	UART RX

DEVICE INDICATION

The device has three LED indicators. Blue indicator shows the navigation receiver status. Red indicator shows the presence of an external power. Green indicator shows GSM-connection status.

LED signal		Meaning
	Blue glowing	Navigation receiver in the mode of sputnik tracking. Location determined.
	Blue flashing one per second	Location determination in progress.
	Red glowing	External power supplying on.
	Red flashing	External power supplying off.
	Green not glowing	GSM-signal absent.
	Green glowing	The device is in range of a GSM network.
	Green flashing	GSM data exchange in progress.

SIM INSTALLING

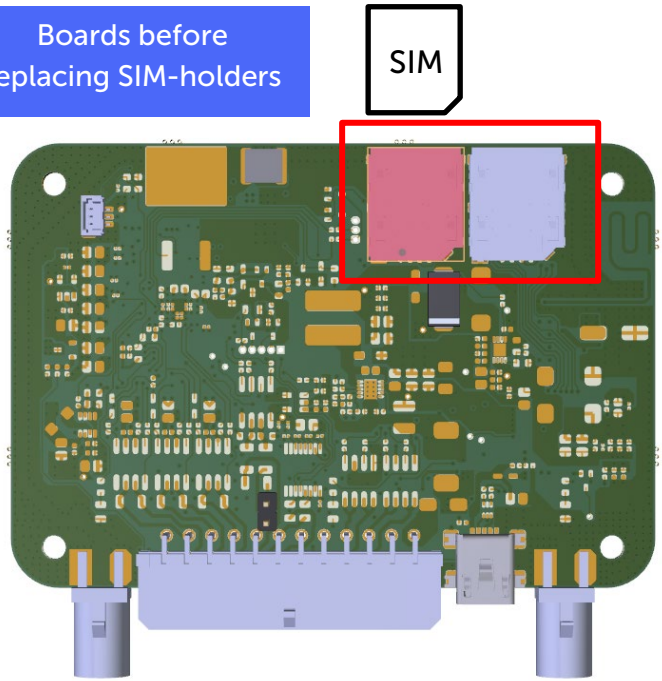
To use the Vega MT X CAN monitoring device, you need a micro-SIM with support of SMS and GPRS functions. There must be cash on the account. PIN protection must be disabled.

To avoid damage and malfunction, it is recommended to perform all manipulations with the board when it is de-energized

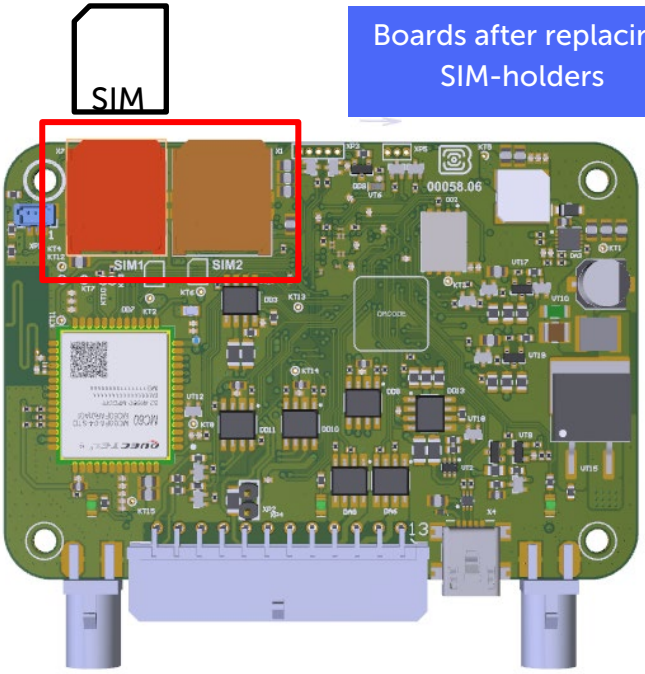
The device supports the ability to use two SIM cards. In this case, one of them will perform the reserve function, and will be used only if it is not possible to send data from the first main SIM (see details about SIM-cards switching in part 7, "GSM network"). The location of the primary and secondary SIM slots is shown in the figure below, the primary slot is highlighted in red.

Please note that the location of the SIM slots may differ depending on the board version, and the SIM card may be installed in different way.

Boards before replacing SIM-holders



Boards after replacing SIM-holders



Boards before replacing SIM-holders	Boards after replacing SIM-holders
MT X Ext – revision[2] 3 and lower	MT X Ext – revision 4 and higher
MT X Int – revision 1	MT X Int – revision 2 and higher
MT X LTE – revision 1	MT X LTE – revision 2 and higher

To install the SIM, you must remove the top cover of the device and de-energize the board by carefully disconnecting the battery. Then insert the SIM into the holder, connect the battery and assemble the device.

[2] The board revision can be found through the "Configurator" application in the menu State-> System-> Board revision

INITIAL CONFIGURATION

Initial configuration is carried out through USB-port with Configurator application. For this you should follow the next steps:

1. Connect the connector with wires to the device.
2. Connect an external power with voltage of 9...36 V (See "Contacts description" part). After power connection the red LED will must become glowing.
3. Connect the device to the PC through USB-port located on the front panel.
4. Run the Configurator application on the PC, press "Connect" button and choose the connection method like "Connect through USB".
5. On the left menu choose "Settings".

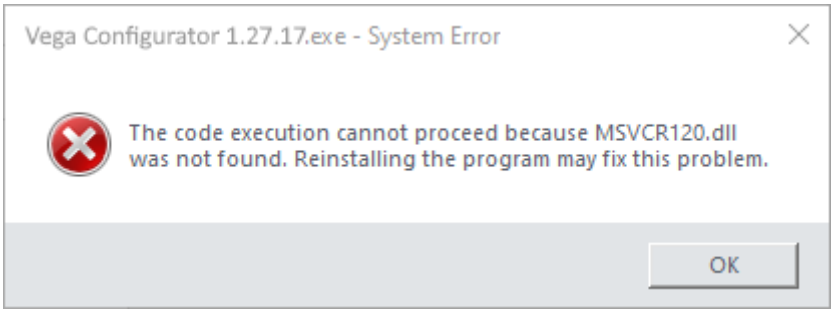
First, you need to make connection settings, after which you can configure and change other parameters at any time remotely as needed (See "Settings" part). Connection settings are:

- monitoring servers' settings (protocol, IP-address and port);
- network settings (SIM access point settings);
- settings for transmitting readings (information that will be transmitted to the server).

Pay attention to the settings for connecting to the engineering server using the VEGA protocol. These parameters will be used when connecting to the device remotely through the Configurator program

6. After setting connection parameters press the "Save" button.
7. Disconnect USB-cable. Now the device is ready for installing on a vehicle.

If an error like the following occurs when starting the “Configurator” program:



Install the vcredist_x86 library and the error will not appear

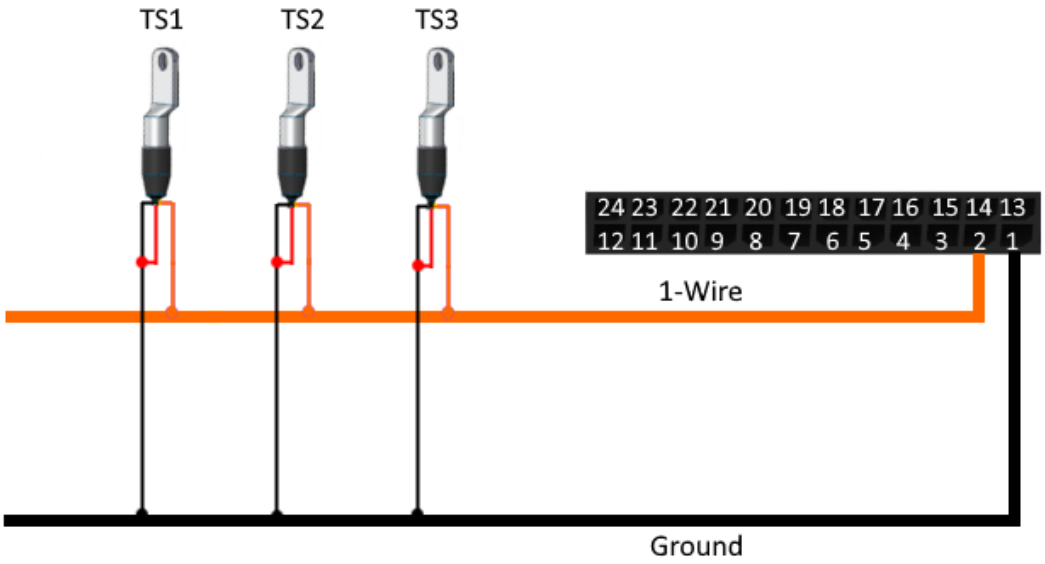
It is also important to install the driver for the COM port, otherwise each time you restart the unit, you will have to reconnect the unit via USB

All necessary programs can be downloaded on our website on the product page in the "Downloads" section or through the "Configurator" program in the "File Server" section in the Software/Drivers folder.

5 EXTERNAL EQUIPMENT CONNECTION

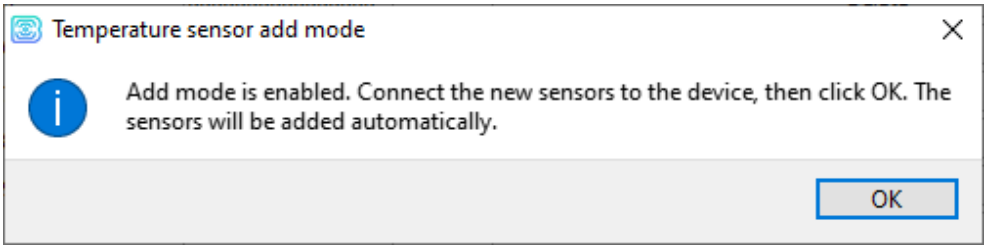
DALLAS TEMPERATURE SENSORS

Vega MT X CAN monitoring device allows to connect is up to ten Dallas temperature sensors through 1-Wire interface. Connection scheme is on the picture below. If connected temperature sensor has three contacts instead of two then you should close “Power” with “Ground”.



For the device to recognize the connection of a new sensor, it is necessary to connect to the device through the "Configurator" program (see "Settings" part), go to the "Inputs/outputs" tab and select the "Dallas temperature sensors" setting item.

To distinguish sensors after connection, it is recommended to connect them one at a time. Having connected the first sensor according to the diagram above, click the "Add sensors" button. An information window will appear.



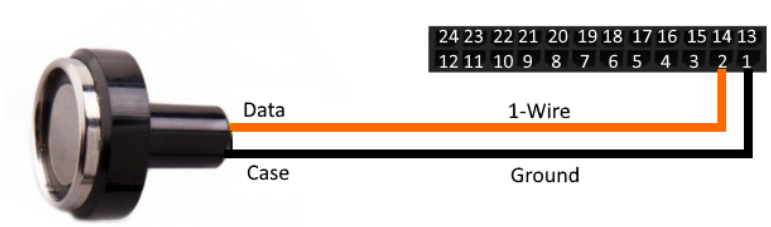
Click “OK” - the sensor number will be added to the free field. After that you can connect the next sensor in the same way.

You can also connect several sensors in turn, while the add window is open, in this case, after clicking the "OK" button, the sensors will be put into free fields in the order in which they were connected.

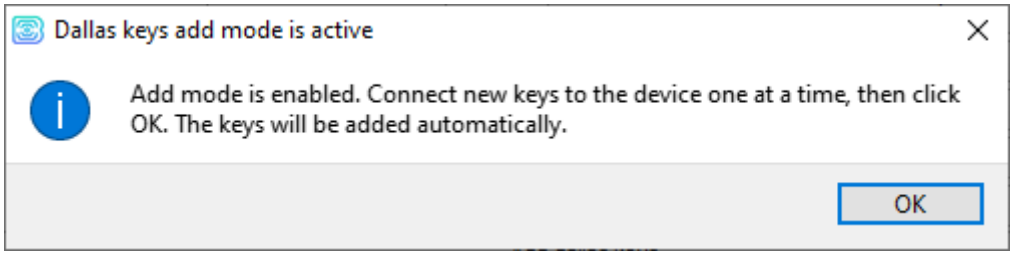
After connecting all temperature sensors, you can click the “Get settings” button and make the necessary settings related to temperature sensors, for example, configure sending data from the sensors to the server in the “Data transmission” tab or set the device behavior in the “Scenarios” tab.

AUTHORIZED DALLAS KEYS

Vega MT X CAN monitoring device allows you to connect an I-Button authorized key reader to a 1-Wire pin. The connection scheme is shown in the figure below. The number of authorized keys can reach ten. To add a key, you need to connect to the device through the "Configurator" program and go to the "Security" tab (see "Settings" part).



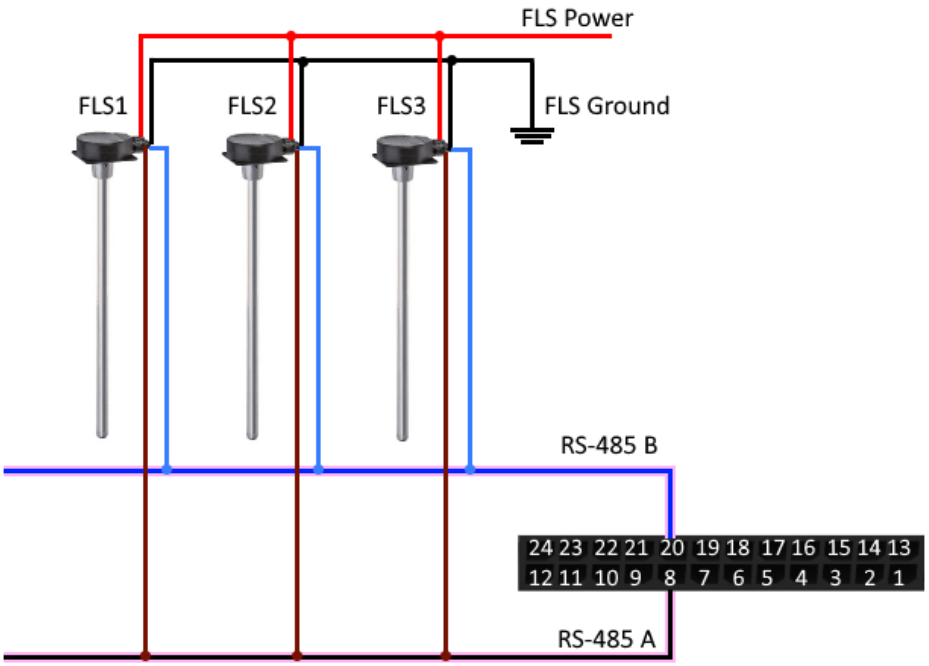
In the "Security" tab, expand the "Authorized Dallas keys" settings item and click the "Add Dallas keys" button. A dialog box will appear.



Attach the key to the reader as during authorization - the device will remember the key number - and click "OK". The key number appears in the free field. If several keys are added at the same time, it is allowed to attach them to the reader in turn, while the add window is open, and only then click “OK” - the numbers of all keys will be added to the free fields in the order in which they were applied to the reader.

FUEL LEVEL SENSORS

The monitoring device allows you to connect fuel level sensors via the RS-485 bus and operates with them using the LLS protocol. To do this, you need to connect to the device through the “Configurator” program and go to the “Settings” section to the “Inputs/Outputs” tab (see “Settings” part). For each connected fuel level sensor, it is necessary to select “Sensor Type” - RS-485 or RS-232 and specify the sensor address on the bus in the “Bus Address” field. The specified address must match the address specified when the sensor programming (see instructions for the used sensor). Up to four fuel level sensors can be connected simultaneously.



EXTENSION UNIT

The Vega MT X CAN monitoring device allows you to connect the Vega BR-1 expansion unit via the RS-485 or RS-232 interface. Vega BR-1 has 15 multifunction inputs and 15 digital outputs.

To configure the inputs, you must connect to the device through the “Configurator” program, go to the “Settings” section to the “Inputs/Outputs” tab and select the “Input/output extension unit” (see “Settings” part). Next, you need to select the connection interface - RS-485 or RS-232. After that, you can configure multifunctional inputs in accordance with the desired tasks (see the "Inputs" section of this part).

To configure the outputs, it is necessary to connect to the unit through the “Configurator” program, go to the “State” section to the “Input/output expansion unit” tab. At the very bottom of the I/O list of the expansion unit are the digital output controls - the “On” and “Off” buttons.

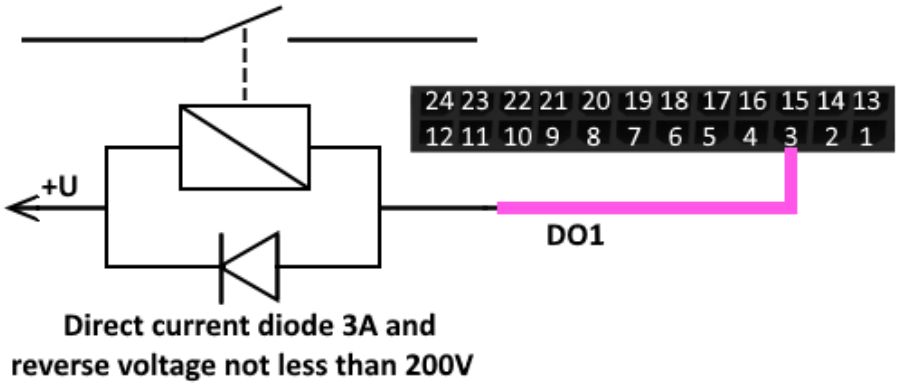
ACTUATORS

Actuators are connected to the device via digital outputs 1, 2, 3 and 4, which are of the type “Open collector”.

Using the “Configurator” program, you can switch the first digital output to a frequency mode by checking the corresponding field (see “Settings” part). The output frequency is set by a command from the server or through the "Configurator".

Permissible load on each digital output 0.5 A

To increase the load on the outputs of the device, you must use an external relay. The relay connection diagram is shown below.



INPUTS

Vega MT X CAN monitoring device has three multifunctional inputs that can operate in four modes:

- Analog;
- Digital;
- Frequency;
- Pulse.

In analog mode, the input voltage is measured. Such an input can be used for sensors whose readings vary in a certain range.

In digital mode, the input signal level (0 or 1) is measured. Such an input can be used for logic sensors, the readings of which are determined by two states (on/off).

In the frequency mode, the frequency of the pulse signal is measured. Such an input, for example, is convenient to use for a car tachometer.

In pulse mode, the number of pulses at the input is counted. Such an input can be used for flow rate sensors, for example, fuel consumption.

In the settings of multifunctional inputs in the "Configurator" program, in addition to selecting a mode for each input, there is a parameter called "Active Level". It can take the value "low" and "high" and characterizes the magnitude and direction of the input tightening.

Input type	Low active level	High active level
MT X Ext (board revision[3] is lower than 3-d)		
Analog	Pull-down to the ground 22 kOhm	Pull-down to the ground 22 kOhm
Digital	Pull-up to external power 44 kOhm	Pull-down to the ground 22 kOhm
Pulse	Pull-up to external power 44 kOhm	Pull-down to the ground 22 kOhm
Frequency	Pull-up to external power 44 kOhm	Pull-down to the ground 22 kOhm
MT X LTE, MT X Int, MT X Ext (board revision is higher than 4-th)		
Analog	Pull-down to the ground 240 kOhm	Pull-down to the ground 240 kOhm
Digital	Pull-up to external power 44 kOhm	Pull-down to the ground 240 kOhm
Pulse	Pull-up to external power 44 kOhm	Pull-down to the ground 240 kOhm
Frequency	Pull-up to external power 44 kOhm	Pull-down to the ground 240 kOhm

[3] The board revision can be found through the "Configurator" application in the menu State-> System-> Board revision

Pull-up to external power cannot be carried out while battery powered device

When the device of the MT X Ext model (board revision is 3 and lower) is restarted, the multifunction input is pulled to external power, and in the MT X Int, MT X LTE models and MT X Ext model (board revision is 4 and higher), when the device is restarted, the input is pulled to the ground

TACHOGRAPHS

Vega MT X monitoring devices support the following tachograph models:

- Mercury TA-001,
- Shtrih - Taxo RUS,
- Atol Drive 5,
- Continental VDO DTCO 3283/1381.

DDD files are uploaded from tachographs only to the 1st server via WIPS and WCOMBINE protocols

All models support the WIPS/WCOMBINE commands listed in the protocol (see the protocols description www.fmsvega.ru).

Useful applications for working with the tachograph are Tacho Manager - an application for storing and loading DDD files manually from a computer and Tacho View - an application for visual analysis of driver activity.

The data transmitted by each tachograph is listed in the table.

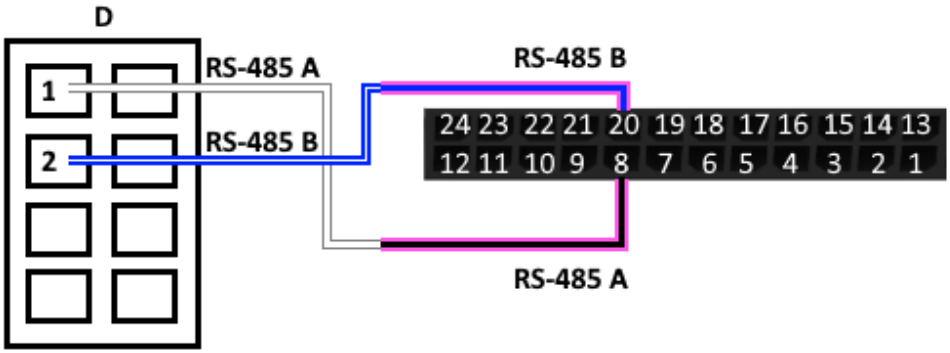
Data	Mercury TA-001, Atol Drive 5	Shtrih - Taxo RUS	Continental VDO DTCO 3283/1381
Tachograph commands (download data from card 1, download data from card 2)	+	+	+ download is available only from slot 1
Status and type of tachograph	+	+	+ updated only when trying to get DDD file
Tachograph date and time	+	+	-
Vehicle registration number	+	+	-

Vehicle VIN number	+	+	-
Odometer readings, 0.1 km	+	+	-
Tachograph Status Flags (Ignition, Backlight, Ground Off, Ferry/Train)	+	+	-
Card X state	+	-	- available via CAN sensors functionality, TCO01, PGN FE6C
Card type in slot X	+	+	-
Activity, card X	+	+	- available via CAN sensors functionality, TCO01, PGN FE6C
Card number in slot X	+	+	-
Driver X, identification line 1	+	+	-
Driver X, identification line 2	+	+	-
Driver X, time in the current mode	-	+	-
Driver X, total driving time per day	-	+	-
Driver X, continuous driving time	-	+	-
DDD file upload status to device	+	+	+

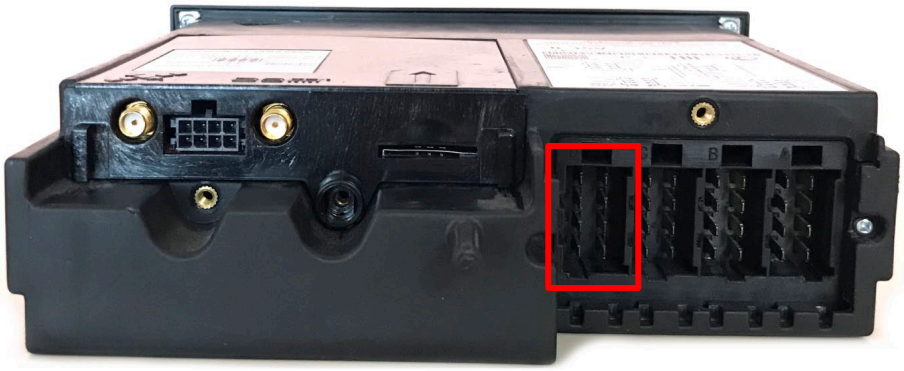
X = 1, 2.

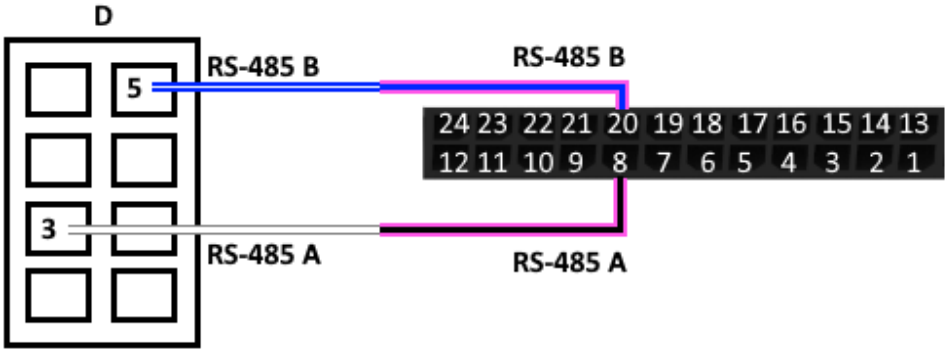
The connection of each type of tachograph has its own features, we will consider their connection separately.

Mercury TA-001 connects through RS-485 interface. You should be sure that the firmware version is not lower than V104_0210_norm. Current firmware versions and update instructions are by the link. In the tachograph settings for the RS-485 interface, the **ScoutNet** protocol must be selected.

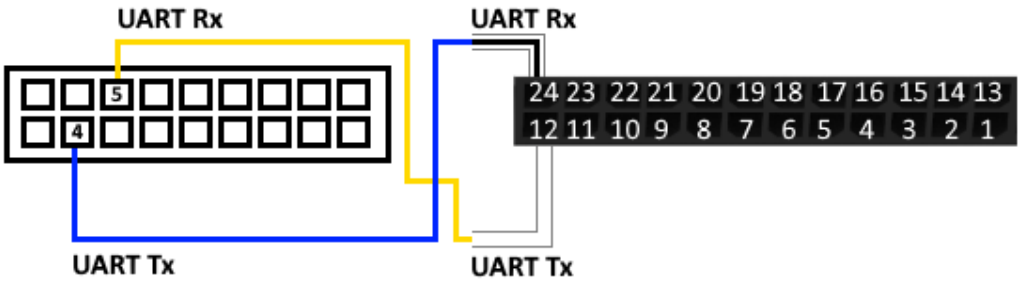


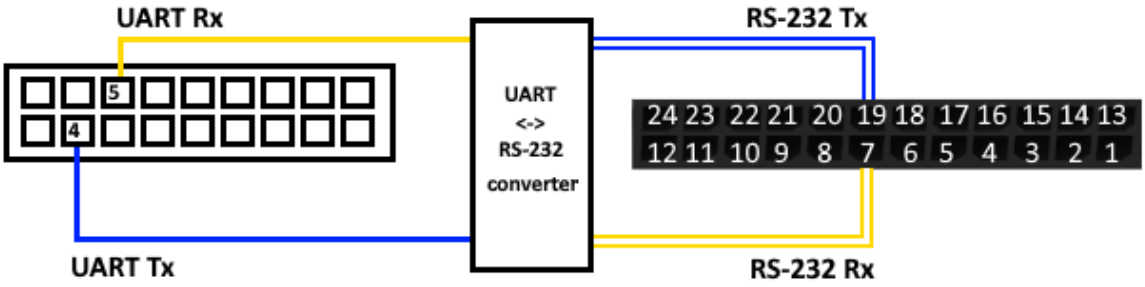
Shtrih - Taxo RUS connects through RS-485 interface. In the tachograph settings for the RS-485 interface, the **Shtrih-Taxo** protocol must be selected.



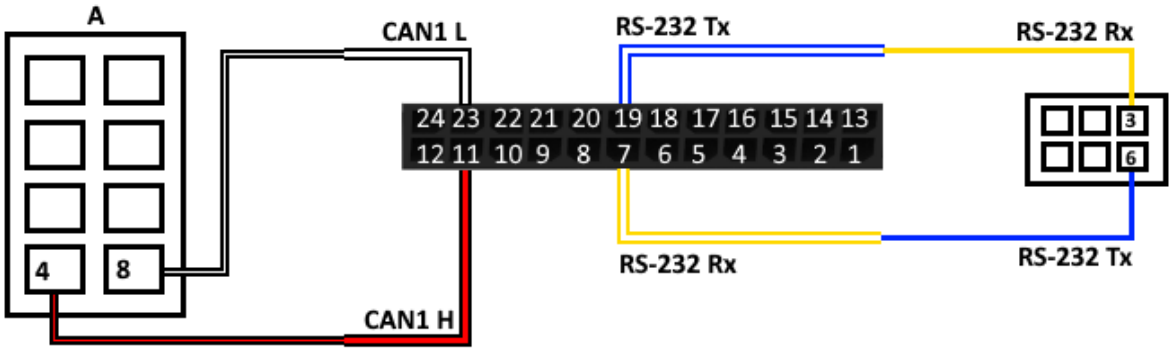


Atol Drive 5 connects through UART interface or through UART <-> RS-232 converter. In the tachograph settings in the part «Penal – Penal protocol», the **ScoutNet** protocol must be selected. Please note that this tachograph model goes into sleep mode if not used for 25 seconds, and after 7 minutes falls asleep even deeper.





Continental VDO DTCO 3283/1381 connects through RS-232 interface located on the front of tachograph. For reading the data about cards and tachograph, it is necessary to connect the vehicle CAN-bus to the tachograph and monitoring device. CAN-bus connecting is option.



From the side of the monitoring device, you should also configure the interface for working with the tachograph through the "Configurator" application. More details in the "Settings" part - "Tachograph".

6 CONFIGURATOR

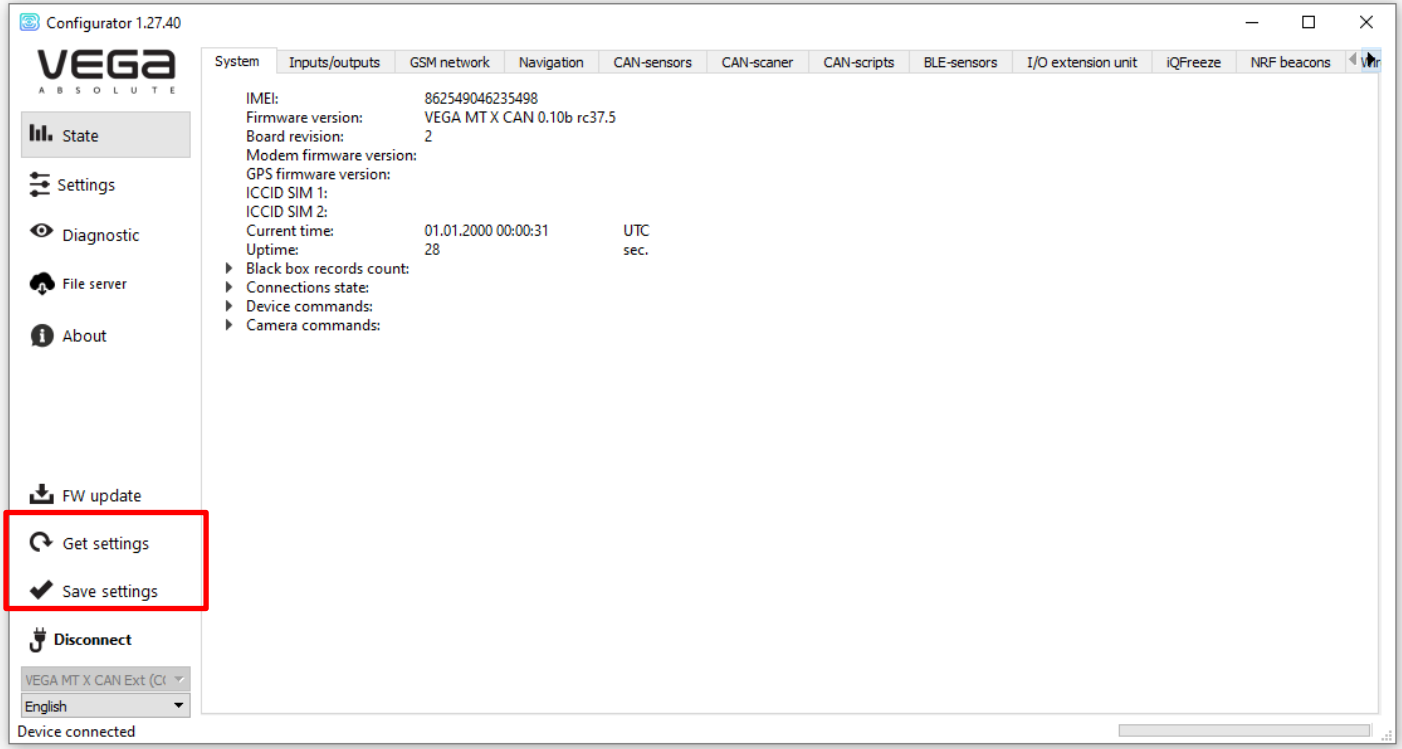
The Vega MT X CAN monitoring device allows you to fine-tune many parameters. The device can be configured either remotely via GPRS, or directly via USB connection. This part describes the interface of the "Configurator" program, with which the settings are made. The “Configurator” program does not require installation and allows you to:

- Fine-tune the device;
- Diagnose the device and save result to the file;
- Update the device firmware;
- View the current state of the block in real time.

When running the “Configurator” application, you need to connect to the device, for this, click the “Connect” button in the lower left corner of the window. Further, depending on the connection method, select “Connect through USB” or “Connect through TCP”. A remote connection is always made through an engineering server using the VEGA protocol. Indicate the address and port that were specified during the initial configuration of the connection parameters for this device with the engineering server.

From the proposed list, select the desired device and click "OK." Go to the “Settings” in the menu on the left and click the “Get settings” button in the lower left corner of the window to see the current device settings.

After changing the settings, click the “Save settings” button to apply the selected settings.



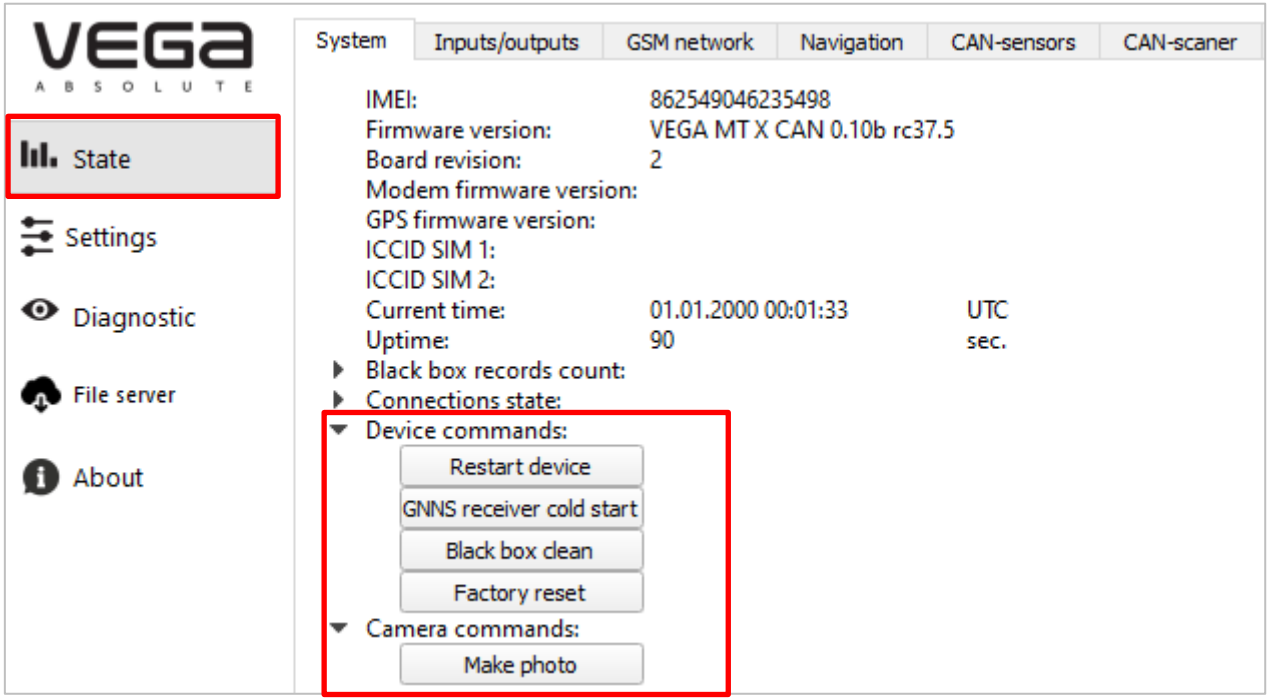
The “Configurator” program has the functions of saving settings to a file and loading settings from a file with the *.vsf extension. The corresponding buttons are in the lower right corner of the program window. This function can be used both to speed up the process of setting up several devices of the same type, and when contacting technical support for a more informative description of occurs.

7 STATE

The “State” menu in some tabs allows you to not only view the status of the device and its parameters, but also configure or manage some options.

SYSTEM

1. In the first tab "System" there are the device and camera commands buttons.



Restart device – forced device reload. In this case, the connection with the device will be lost and it will need to be reconnected to the “Configurator”.

GNSS receiver cold start – run the cold start procedure.

Black box clean – deletes all entries from all black boxes.

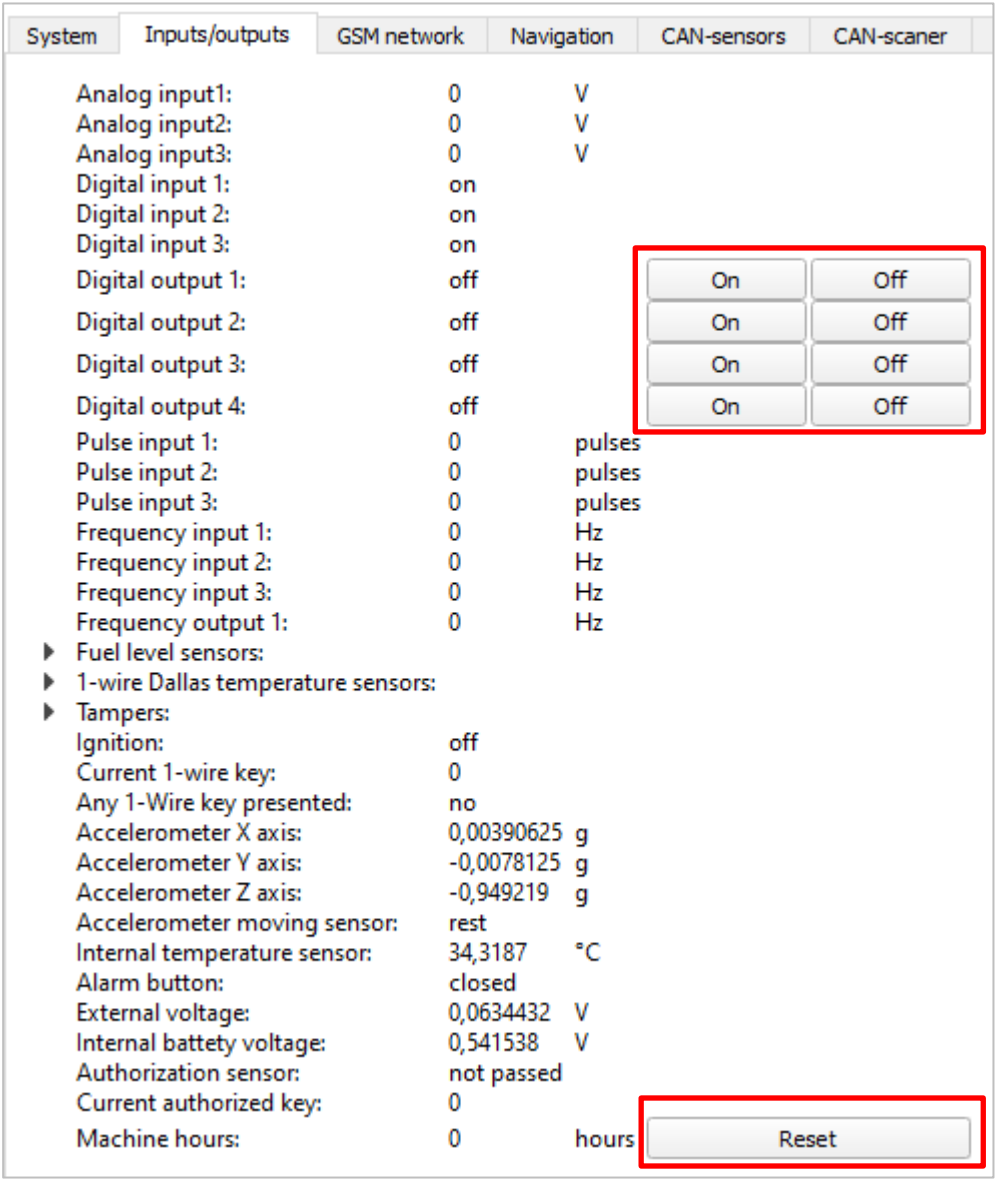
Factory reset – returns all parameters to factory.

When you press any of these buttons, the program will ask for confirmation to send the command.

Make photo – by the pressing takes a photo. Confirmation for that command does not asked.

INPUTS/OUTPUTS

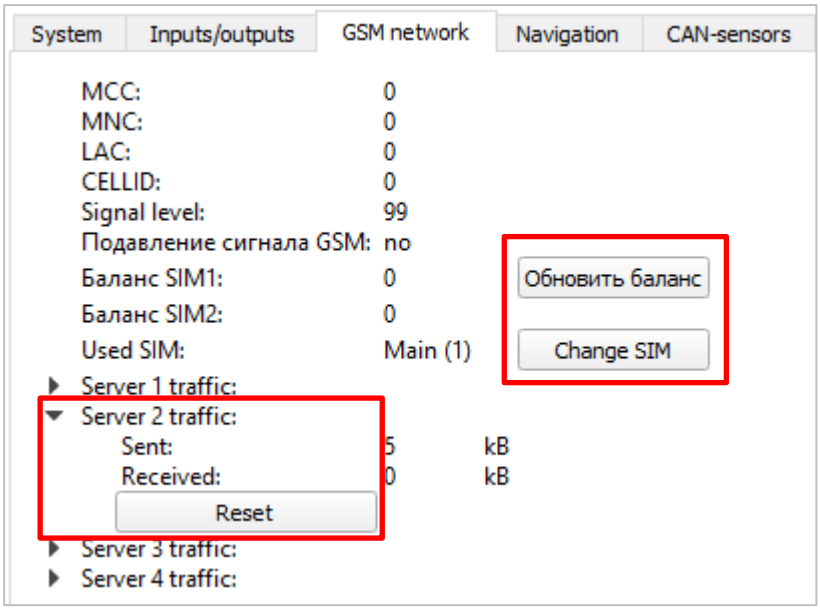
Several settings buttons are also in the “Inputs/Outputs” tab, which displays the status of the device I/O. These buttons enable you to turn on/off the digital outputs and reset the machine hours.



GSM NETWORK

In the “GSM network” tab, it is possible to reset the statistics of sent/received packets from each of the servers or force change the used SIM-card. The devices have their own algorithm for SIM-card switching from main to reserve and back:

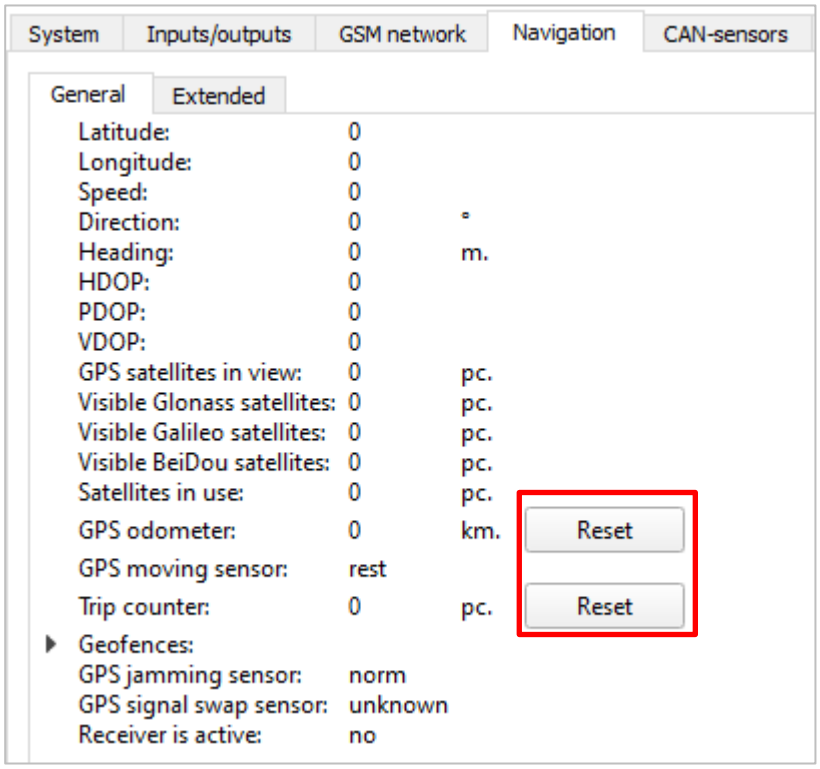
1) The device cannot join to the network for the 5 minutes while it operates with main or reserve SIM-card;
2) If 16 unsuccessful attempts were made to establish a TCP connection to each server (not disabled in the settings);
3) If a TCP connection is established, but there is no data at the application level from the servers for the 5 minutes.



If you press the “Update balance” button, then the device updates the balance of active SIM according to the settings in the “Server connection” part.

NAVIGATION

In the "Navigation" tab there are two buttons that allow you to reset the GPS odometer and reset the trip counter.



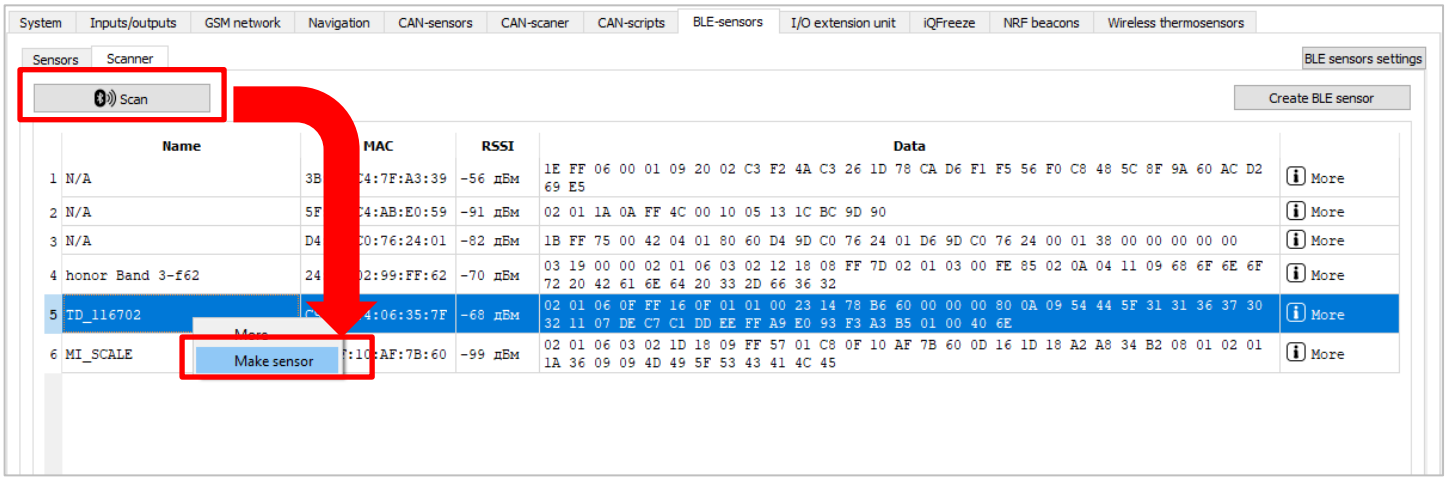
CAN-BUS

A detailed description of working with the CAN-bus is given in part 8.

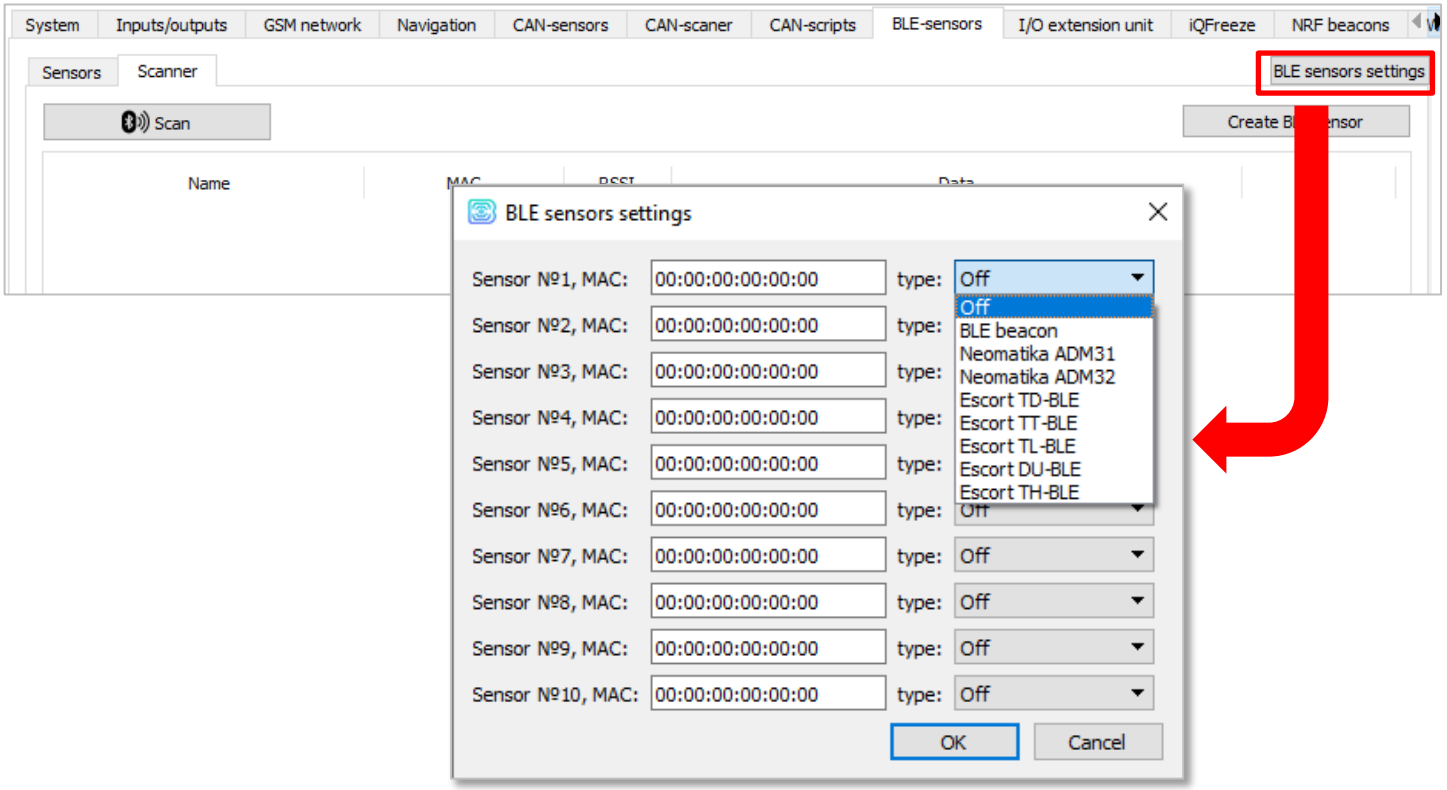
BLE-SENSORS

Only devices of the MT X Int and MT X Ext model with firmware version 0.10b rc41.1 and over and GSM firmware version MC60E... (there is must be E after 60) support BLE-sensors. Also consider the Bluetooth does not work without SIM and in all situations when the GSM modem is off

You can connect to device up to 10 sensors. To do this, you can scan all the nearest BLE sensors and create a sensor from those detected by calling the context menu or just by clicking the "Create BLE Sensor" button.



Second way is to manually specify the MAC addresses of the connecting sensors in the settings.



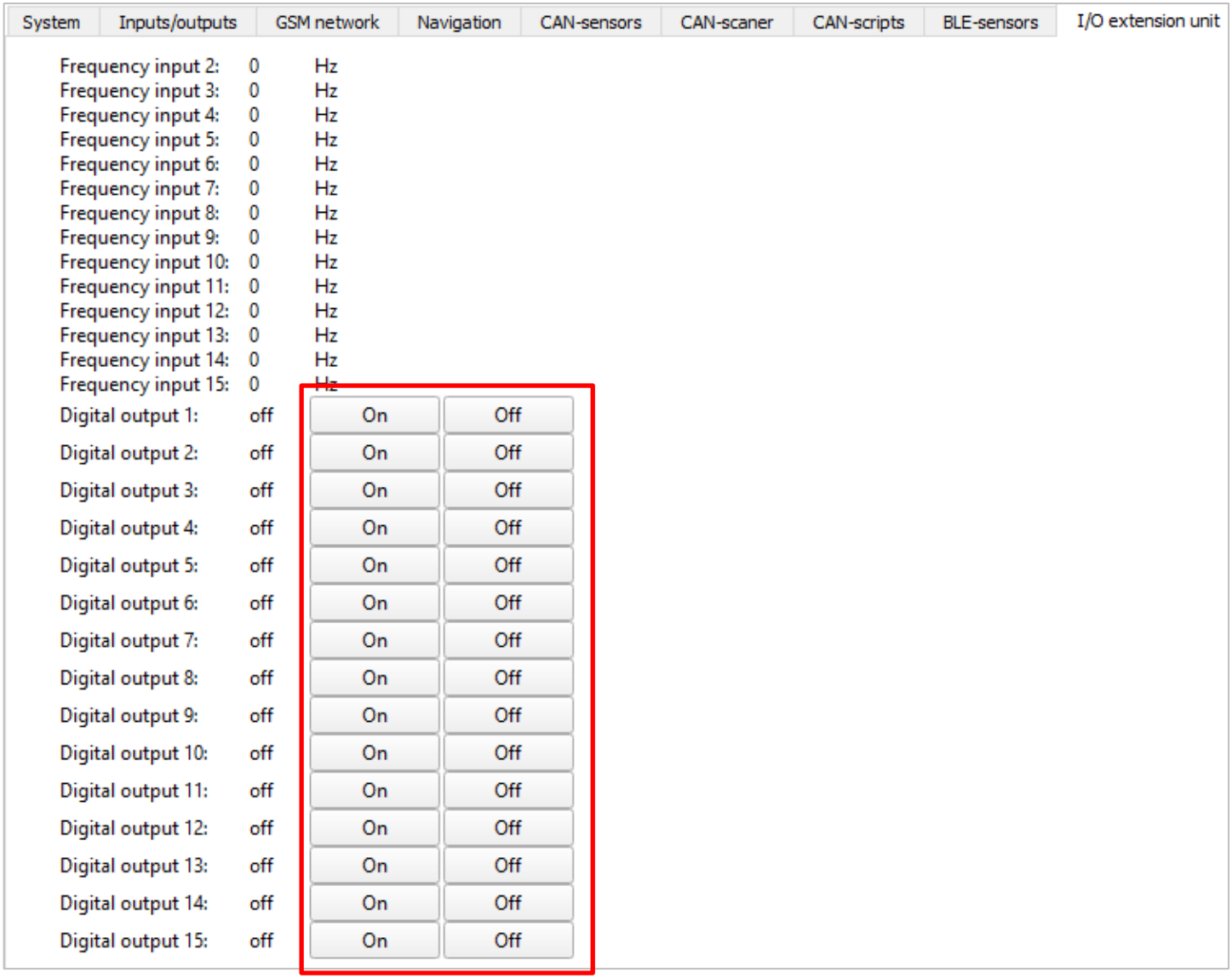
Supported BLE-sensors types are listed in the drop-down list.

- BLE beacon – beacon linked to MAC;
- Neomatika ADM31 – temperature, humidity, ambient light sensor;
- Neomatika ADM32 – angle sensor;
- Escort TD-BLE – fuel level sensor;
- Escort TT-BLE – temperature sensor;
- Escort TL-BLE – temperature, ambient light sensor;
- Escort DU-BLE – angle sensor;
- Escort TH-BLE – temperature, humidity, ambient light, pressure sensor.

After connecting the sensors, you can go to the data transmission settings in the "Data transmission" tab, as well as configure Bluetooth in the "BT/BLE" tab.

INPUT/OUTPUT EXTENSION UNIT

In the “I/O extension unit” tab, there are buttons for turning on/off the digital outputs of the expansion unit.

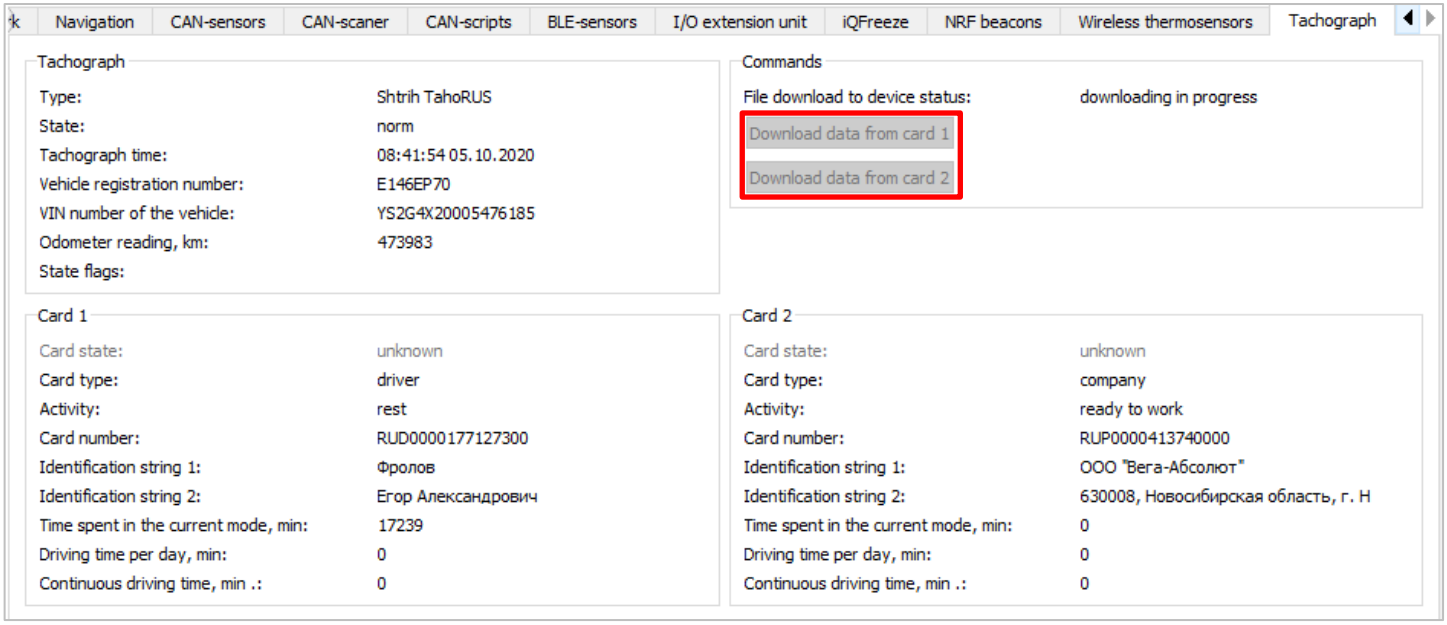


WIRELESS THERMOSENSORS

In the tab "Wireless thermosensors" you can reset the alarms of all sensors by clicking on the corresponding button at the very bottom of the tab.

TACHOGRAPH

In the “Tachograph” tab you can download the data from card 1 and 2 by pressing the corresponding button.



8 OPERATING WITH CUN-BUS

To operate with the CAN bus, the program has three tabs in the “Status” section: CAN-sensors, CAN-scanner, and CAN-scripts. Below, each of them is considered in detail.

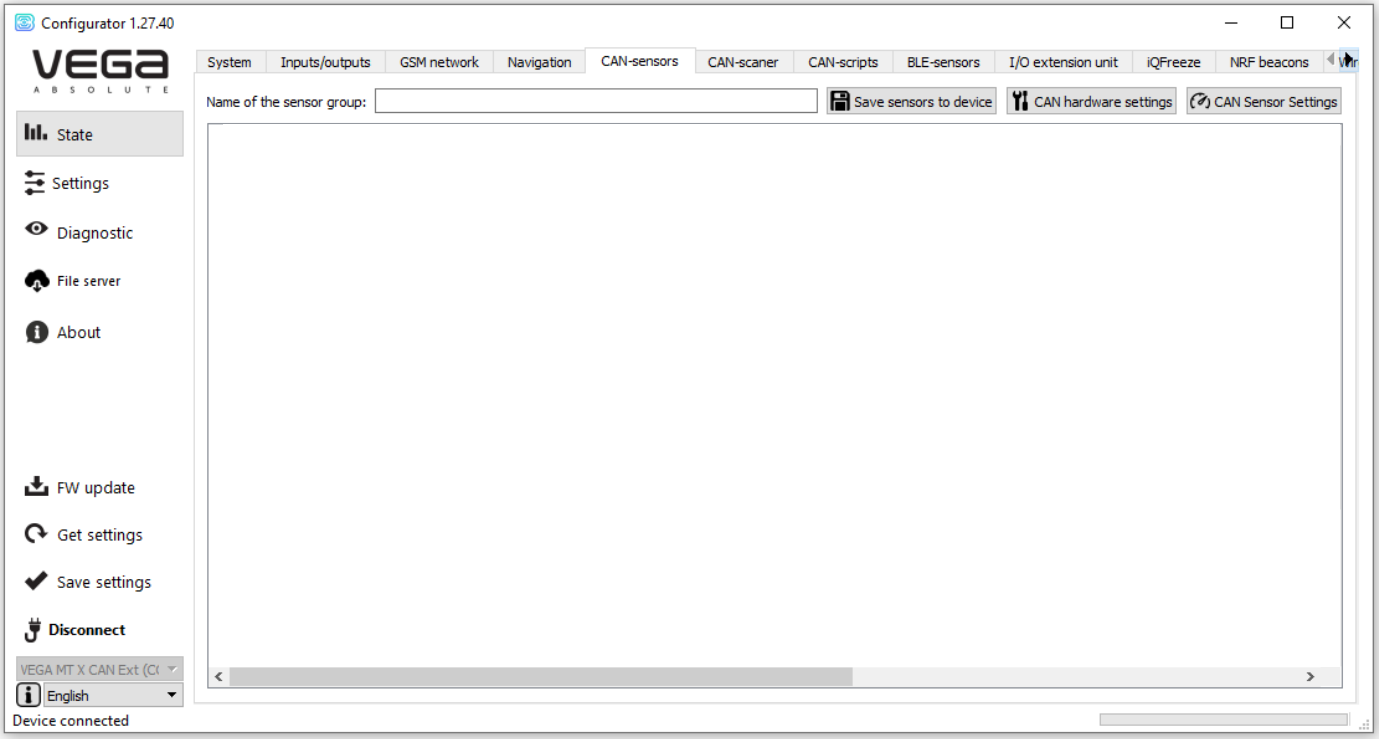
When sending random commands to the vehicle’s CAN bus, the result may be unpredictable. Vega-Absolute company is not responsible for the consequences of experiments with the CAN bus.

CAN-SENSORS

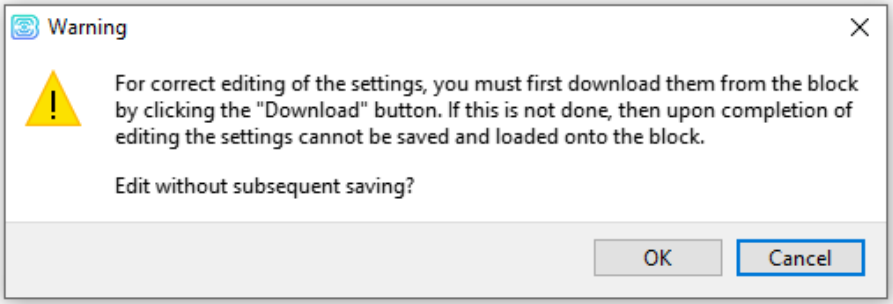
In the “CAN-sensors” tab, the CAN-bus sensors are configured.

CAN-sensors transmitted to the server only if one of the protocols VEGA, Wialon IPS or Wialon Combine used

In the "Name of the sensor group" field, you can enter any comment that will later help determine the belonging of the sensors and their settings to a specific vehicle model.

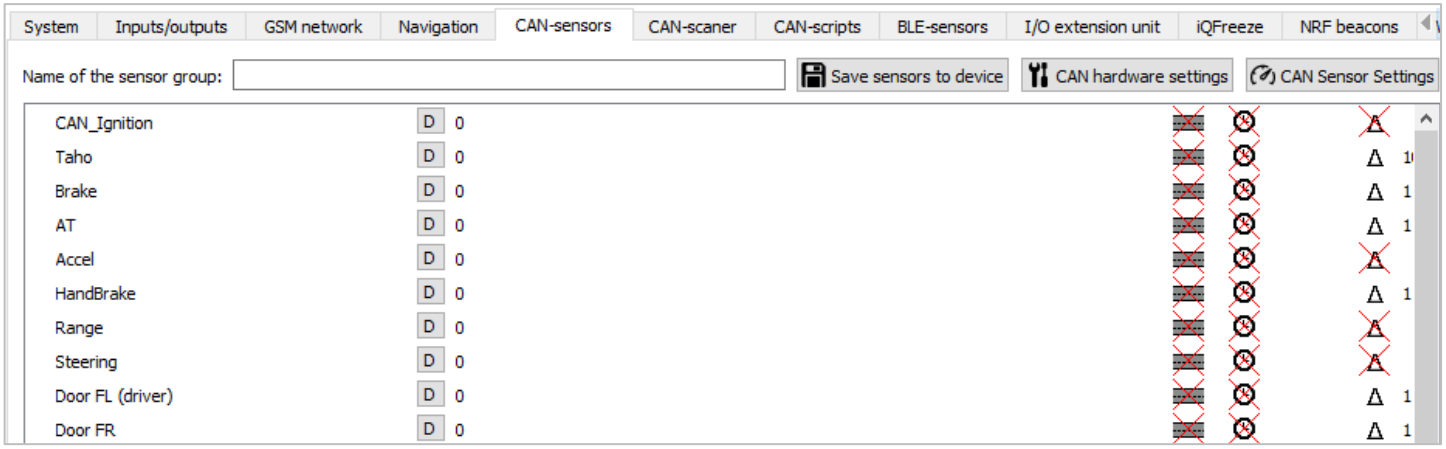


If you do not load the settings from the device and try to change the CAN settings, a warning will appear:



It also appears if the device was not connected at all. Therefore, before configuring CAN sensors, you need to load the settings from the device by clicking the "Download" button in the left part of the window.

After that, a list of already connected sensors, their current values and transmission settings will appear in the table.



- transmit with the track;

5 c - transmit with the period (in this case with 5 second period);

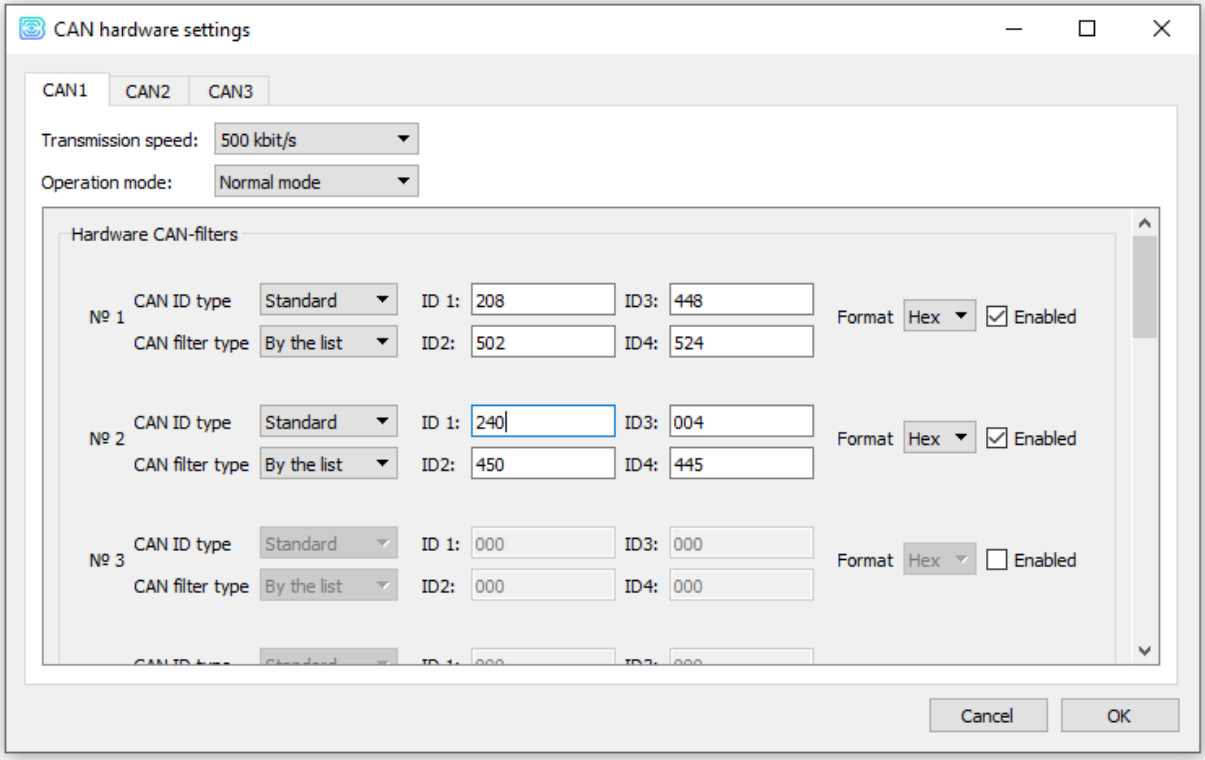
3 - transmit by the changing (in this case when the value will become equal 3);

- button for calling the window with transmitting settings for that sensor;

 - button for calling the individual window with settings for that one sensor (like the "CAN-sensors settings" button, only when you click on it, **all** sensors will be listed).

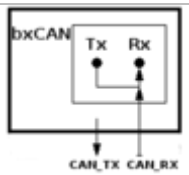
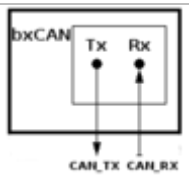
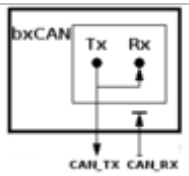
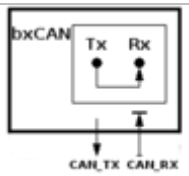
"Save sensors to device" button – all added sensors are saved in the device memory.

"CAN hardware settings" button – when clicking the window with settings appears. Window contains the settings of hardware CAN-filters for specific CAN-sensors or diapasons of them for every CAN bus.



Transmission speed – it is important to indicate the correct speed for the CAN bus.

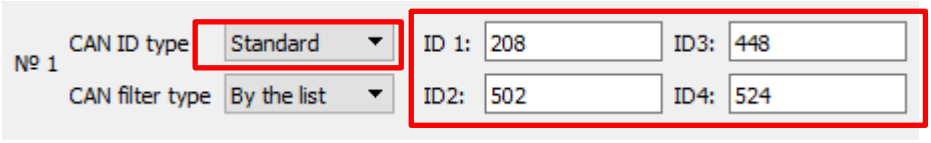
Operation mode – allows to choose the operation mode with CUN bus:

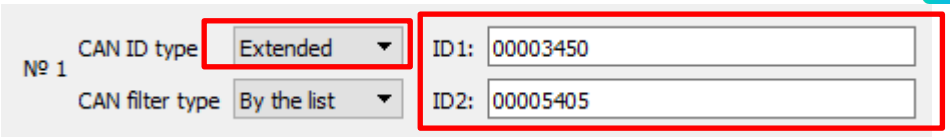
Mode	Visualization	Comments
Off	-	Exchange with the CAN bus is not conducted in any form. CAN bus disabled.
Silent mode		Packets from the device will not get into the CAN bus of the car, from the point of view of the CAN bus it is not connected. This mode is recommended in cases when it is only necessary to receive parameters from the CAN bus, and control is not required.
Normal mode		Data is transmitted and read from the CAN bus in normal mode on both sides.
Loopback mode		The device will transmit data to the CAN bus and listen to itself at the same time. Packets from the CAN bus will not reach the device. Packets from the device go to the CAN bus.
Silent loopback mode		In this mode, all packets will be returned to the device without going to the CAN bus. From the CAN bus, accordingly, no data packet will reach the device. Suitable for debugging device without physically connecting to the CAN bus.

Now let us move on to the settings of **CAN filters**. Filters are needed to filter out the unnecessary data from the huge flow of information coming from the vehicle's CAN bus, thereby reducing the load on the processor.

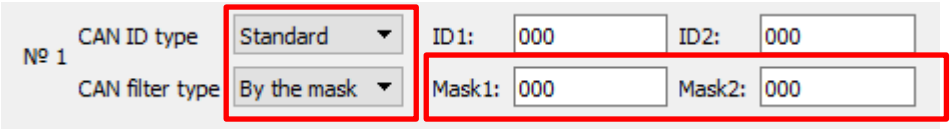
If no filter is enabled, this is equivalent to the fact that this CAN bus is disabled.

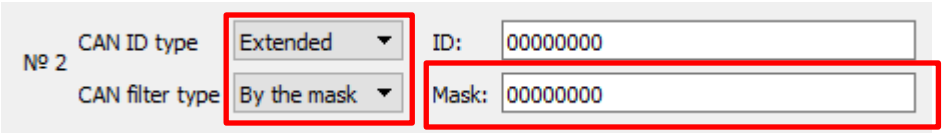
CAN ID type – 11 bits standard or 29 bits extended. In standard mode you may specify up to four sensors ID in the one filter, but in extended mode - no more than two.





CAN filter type – «By the list» or «By the mask». «By the list» means that in fields ID1, etc. specific frame IDs will simply be indicated. If you choose the type «By the mask», then the lower ID fields will turn into "mask" fields, where you can set a mask for a whole group of frames. With the selected "extended" CAN ID type, there will be only one mask.





When all the parameters are configured, you need to make sure that the "Enabled" checkbox is checked, then you must click the "OK" button in the settings window and "Save settings" button in the general window - otherwise the settings will not be saved on the device.

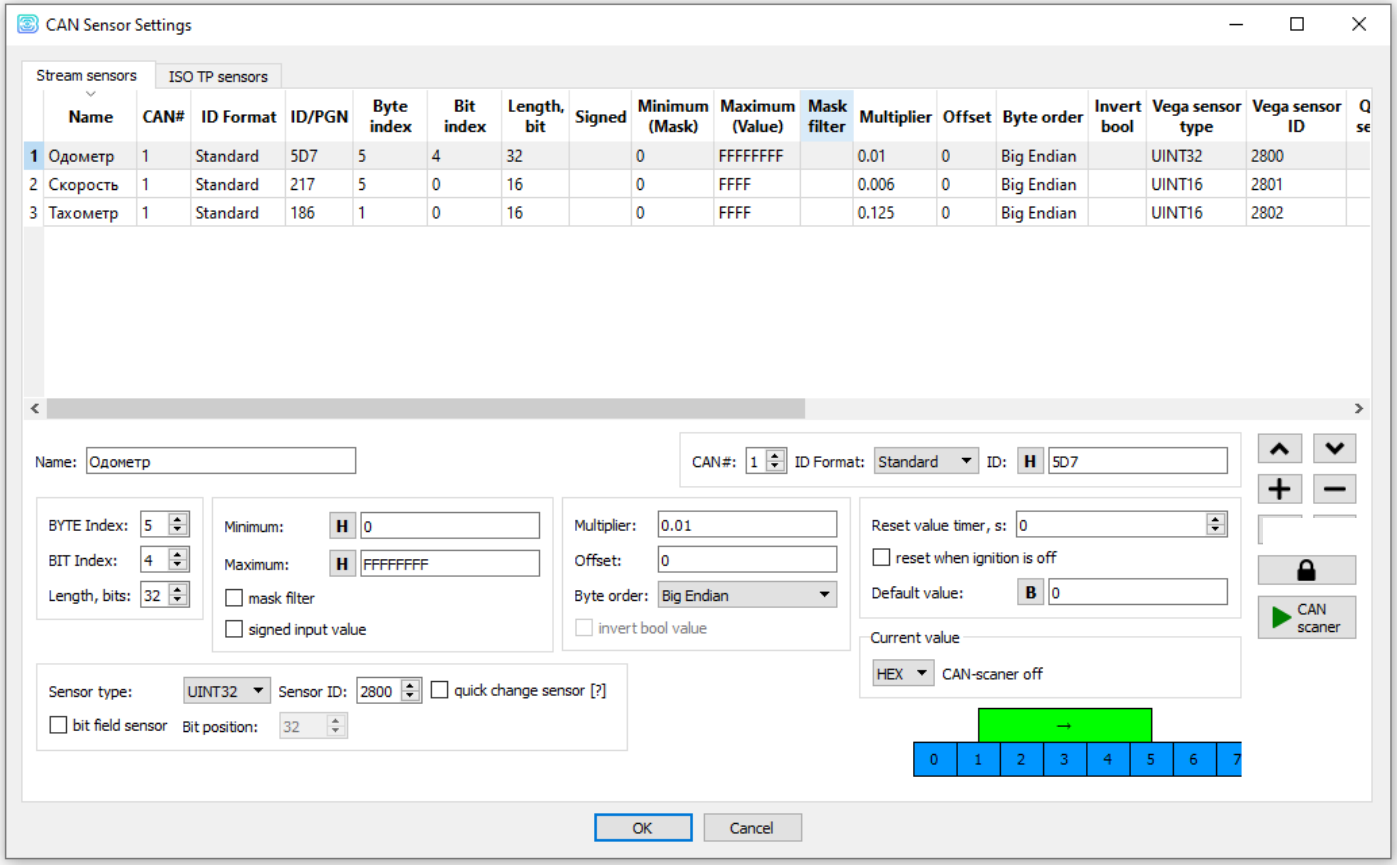
After that, you can proceed to the settings of specific CAN sensors.

"CAN sensors settings" button - when clicked, a window for editing the sensors appears.

Sensors can be of two types: "Stream sensors" and "ISO TP sensors" - they are configured in separate tabs.

STREAM SENSORS

Stream sensors are those parameters whose values enter the vehicle's CAN-bus continuously, i.e., by the *stream*, and are constantly changing. They can be seen when scanning the CAN bus.



Stream sensors can be either open or hidden (i.e. have encrypted configuration parameters, these are all sensors received from the file storage - see section 11).

On the right side of the window are the control buttons.

 - add sensor – a new row will appear below the selected.

 - delete sensor – the selected row will delete.

 - up/down buttons – the selected row moves relative to the rest.

 - save to the file - when pressed, the program will prompt you to choose a location to save the settings file in *.vsf format.

 - load from the file - when pressed, the program will prompt you to select a settings file in *.vsf format.

Let us consider the custom parameters in order.

Name – CAN-sensor name, set arbitrarily.

CAN# – number of the CAN-bus from which the information about this sensor will getting.

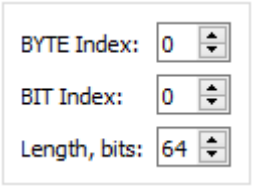
ID Format – frame type is standard (11 bit), extended (29 bit) or PGN (the number of a group of parameters J1939 type).

ID/ PGN – frame's ID when the type is standard or extended and a frame's PGN if the chosen type is PGN.

Byte Index – serial number of the byte in the frame from which the sensor value begins.

Bit Index – the serial number of the bit in the byte from which the sensor value begins.

Length, bits – sensor length in bits.



Signed – if checked then CAN data is processed as signed (**two's complement**).

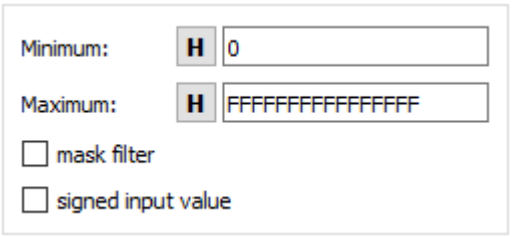
Minimum (Mask) – minimum sensor value to be processed or mask.

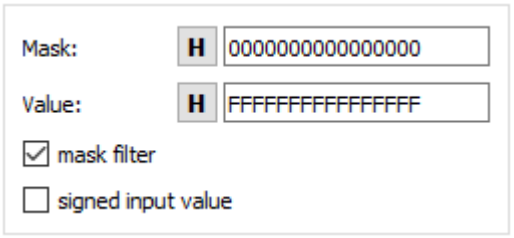
Maximum (Value) – maximum sensor value to be processed or values that the mask should skip.

Sensor values that will not fit within these limits will be ignored. Limitations apply to values received from the CAN bus, without processing by Multiplier, Offset etc.

Mask filter – if checked then you may enter the mask in the “Mask” field and the sensor value to be skipped in the “Value” field.

The mask is applied bit by bit (00 - filters nothing, FF - filters), so if you want to cut off bytes, then put the FF mask in the desired byte, and enter the number to be skipped in the "Value" field (see the usage example).





Multiplier – sensor multiplier.

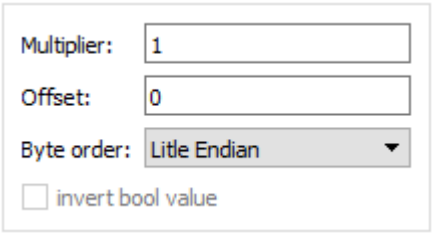
Offset – sensor offset.

The total value that will be written to the sensor =

= value from the CAN-bus **×** Multiplier **+** Offset

Byte Order – frame byte order: little endian or big endian.

Invert bool value – inverts a value of BOOL type.



Sensor Type – sensor value type, integer, floating point, etc.

Sensor ID – sensor ID, can take values from 2800 to 2927, a total of 128 sensors can be added. When transmitting via Wialon IPS protocol, the sensor format will be pYYYY, where YYYY is the sensor ID specified in this field. When transmitting via Wialon Combine protocol, just the sensor ID specified in this field will be displayed.

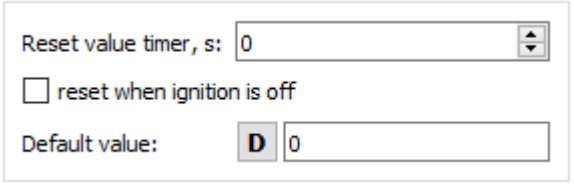
Quick change sensor – if the input value has changed for a short time upwards, then this value will be fixed for 1.5 s - applicable only to sensors of the UINT and BOOL types.

Bit Field Sensor – if checked, then this sensor is a bit and it takes no more than one bit. From a several such bit sensors you can make one ordinary. To do this, you need to create several bit sensors and specify the same "Sensor ID", and in the "Bit position" field specify where every sensor will be recorded. At the same time, it is mandatory to specify the same "Sensor Type" for all those bit sensors.

Bit position – the field is active only with a checked "Bit Field Sensor" parameter. In this case, this parameter sets the sensor bit where this value will be written.

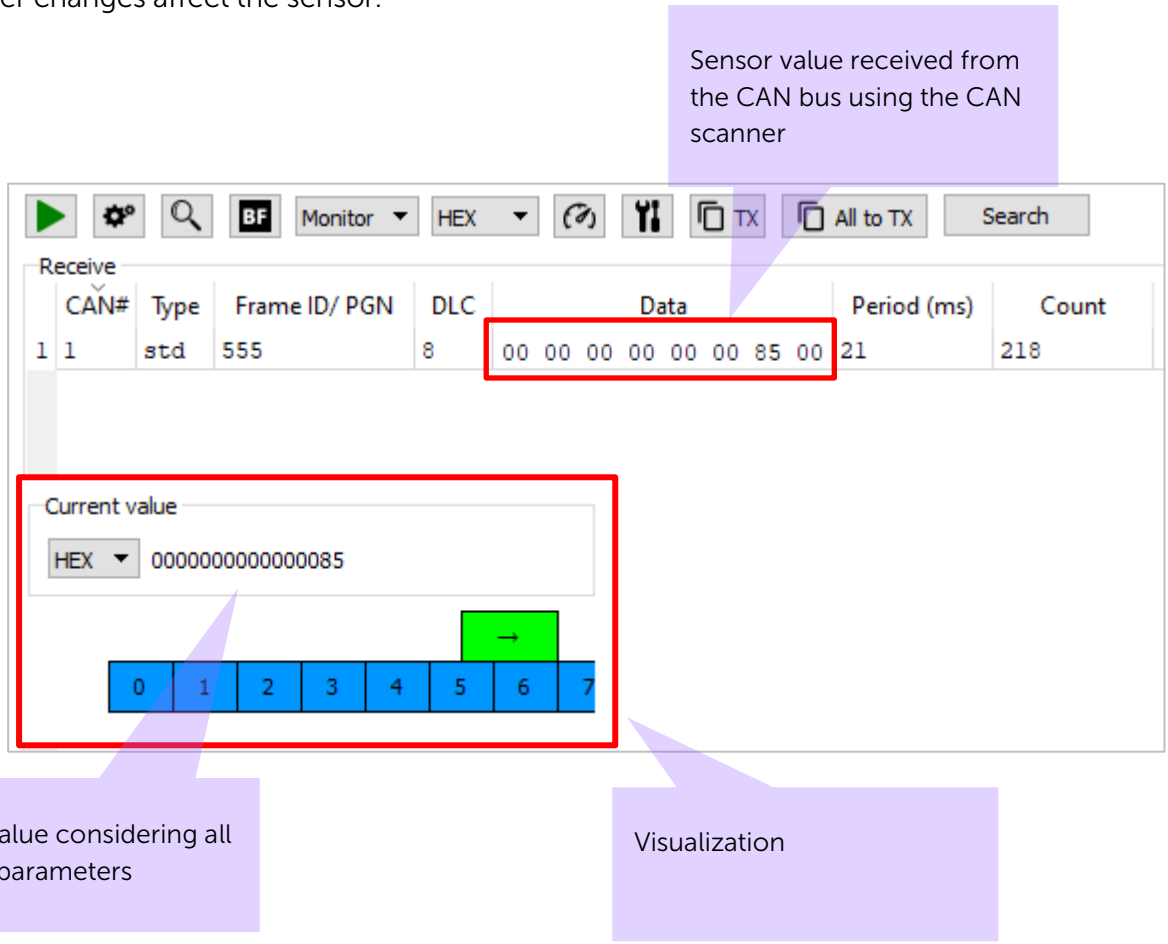
Reset value timer, s – if during the specified period this Frame ID is absent on the CAN bus, then write the default value to the sensor. It can take values from 0 to 15 seconds. At 0 the function disabled.

Reset when ignition is off – if checked, then when the ignition is turned off, the "Default value" will be written to the sensor.



Current value – here displayed the sensor current value calculation based on data from CAN bus and with applying all of set parameters.

Below you can see visualization of tuned parameters in real time. On the diagram you may see and check whether those bits in the frame are exactly selected. Also, you can change sensor parameters and see how parameter changes affect the sensor.



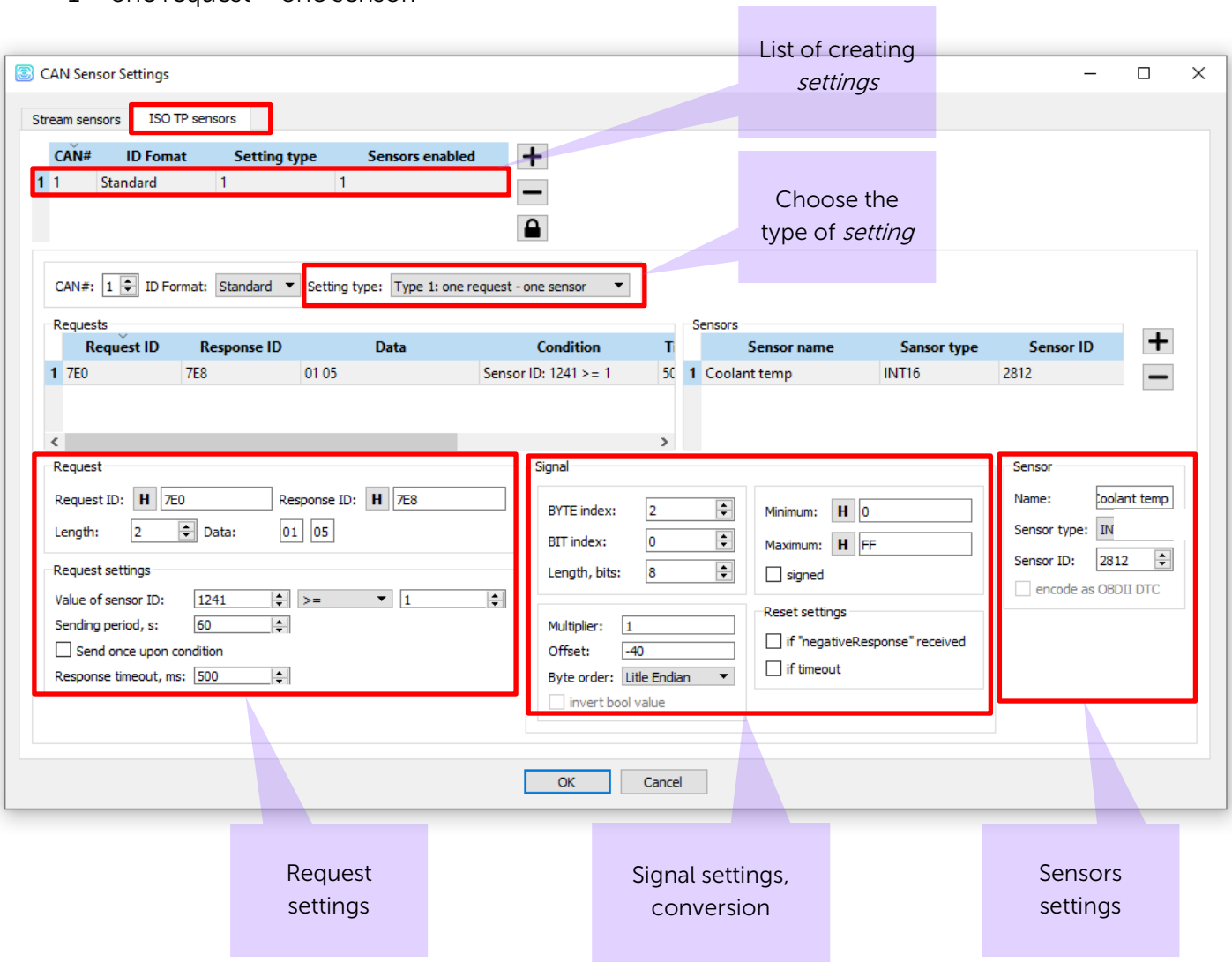
ISO TP SENSORS

ISO TP sensors are those parameters whose values do not enter the vehicle's CAN-bus continuously. They can be received by the sending into CAN bus the certain request.

"Configurator" allows create two types of *setting*:

0 – one request – some sensors,

1 – one request – one sensor.



When chosen **Type 0**, the one request may be set and sent for some sensors (may be added from 1 to 4 sensors).

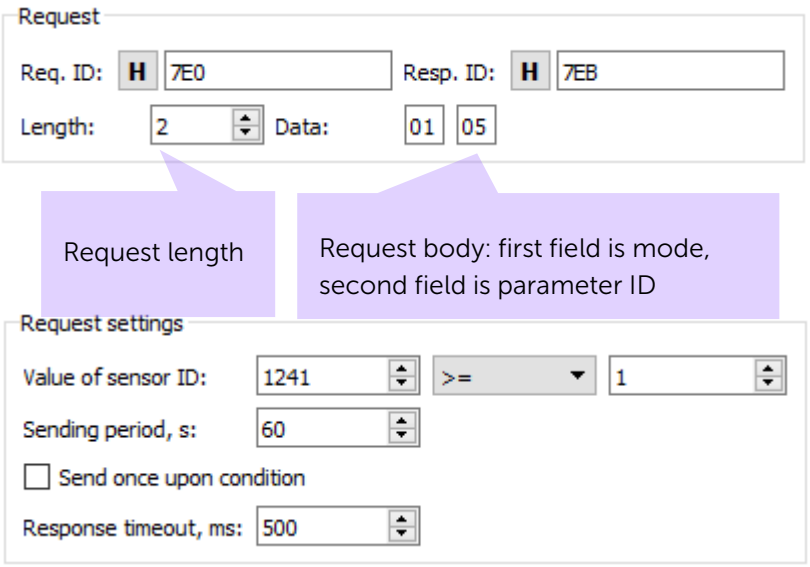
When chosen **Type 1**, the request is set and sent for every sensor so you have a pair "request-sensor" (may be created up to 3 pairs "request-sensor" in one *setting*).

To operate with ISO TP sensors, the CAN bus should be set to Normal mode. Some settings in this tab are like those in the Stream sensors tab, but there are significant differences. Sensor and signal settings are made in similar way.

Working with ISO TP sensors requires certain knowledge and skills. Vega Absolute is not responsible for any consequences that may occur when sending data to the vehicle's CAN bus

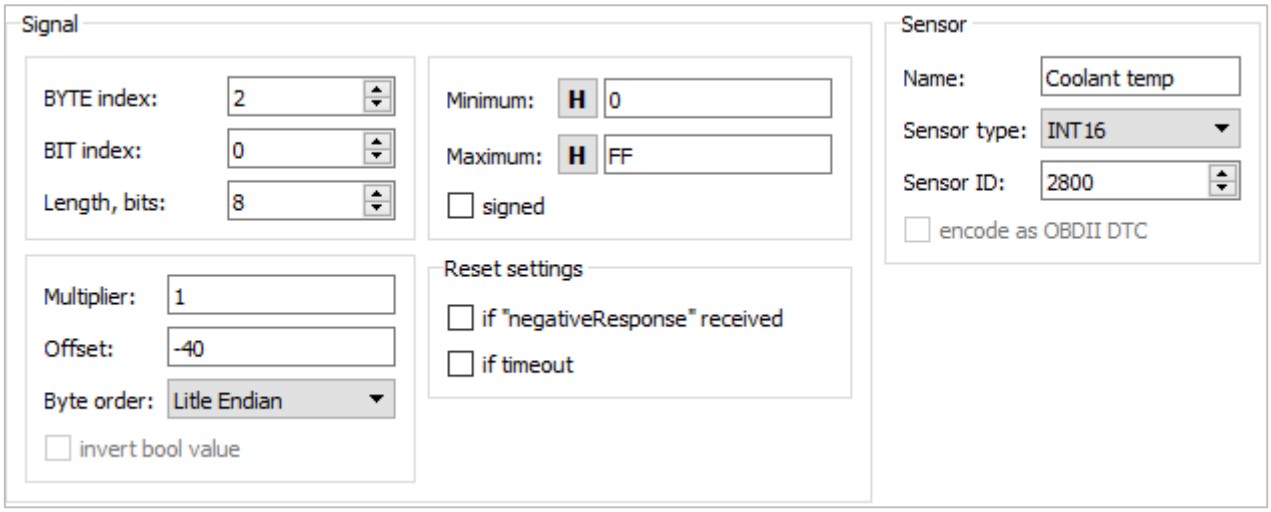
To get the correct answer, you need to know where the parameter value is located and how to formulate the request. To do this, use either the standard[4] protocol or the protocol from the car manufacturer, if you have one.

The following settings should be taken from the protocol: request and response ID, Length, Data, but the send settings make yourself.



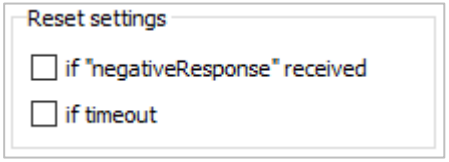
[4] ISO 15765-4 (standard OBD-2 request and response IDs)
ISO 15765-2 (message exchange format for OBD-2)
SAE J1979 (available modes and parameters of OBD-2)

You can send a request with a specified period, or one-time when the condition is met. The sending condition is set in the first line: the readings of some sensor with the specified ID takes on some value - the request is sent. This is the recommended way to send requests. The ID sensor number is taken either from user CAN sensors (Sensor ID) or from the Wialon Combine protocol.



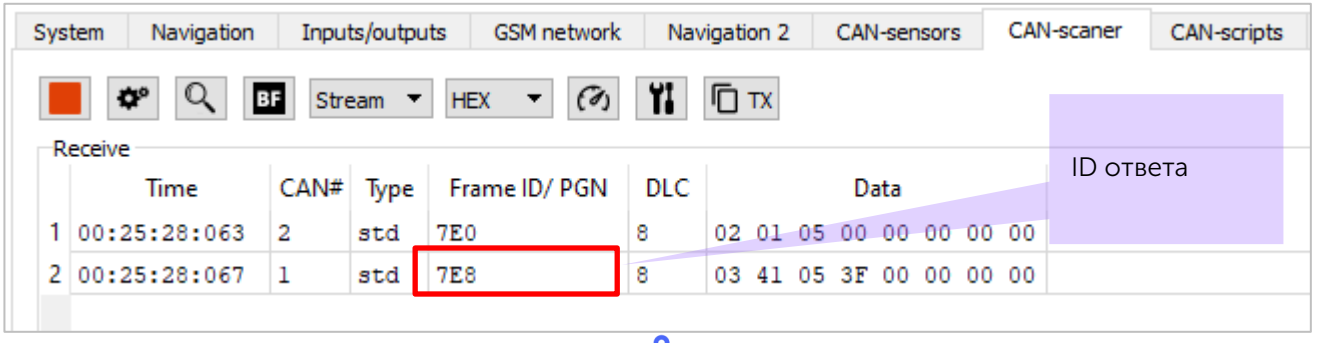
Signal settings are like those of “Stream sensors”, where their detailed description is given.

Let us dwell on the reset settings.



The sensor value is reset to zero when the conditions are met and if the corresponding checkboxes are checked: **if "negativeResponse" is received** - i.e. the response came with an error, or **if the timeout for waiting for a response has expired** - the timeout is set in the request sending settings.

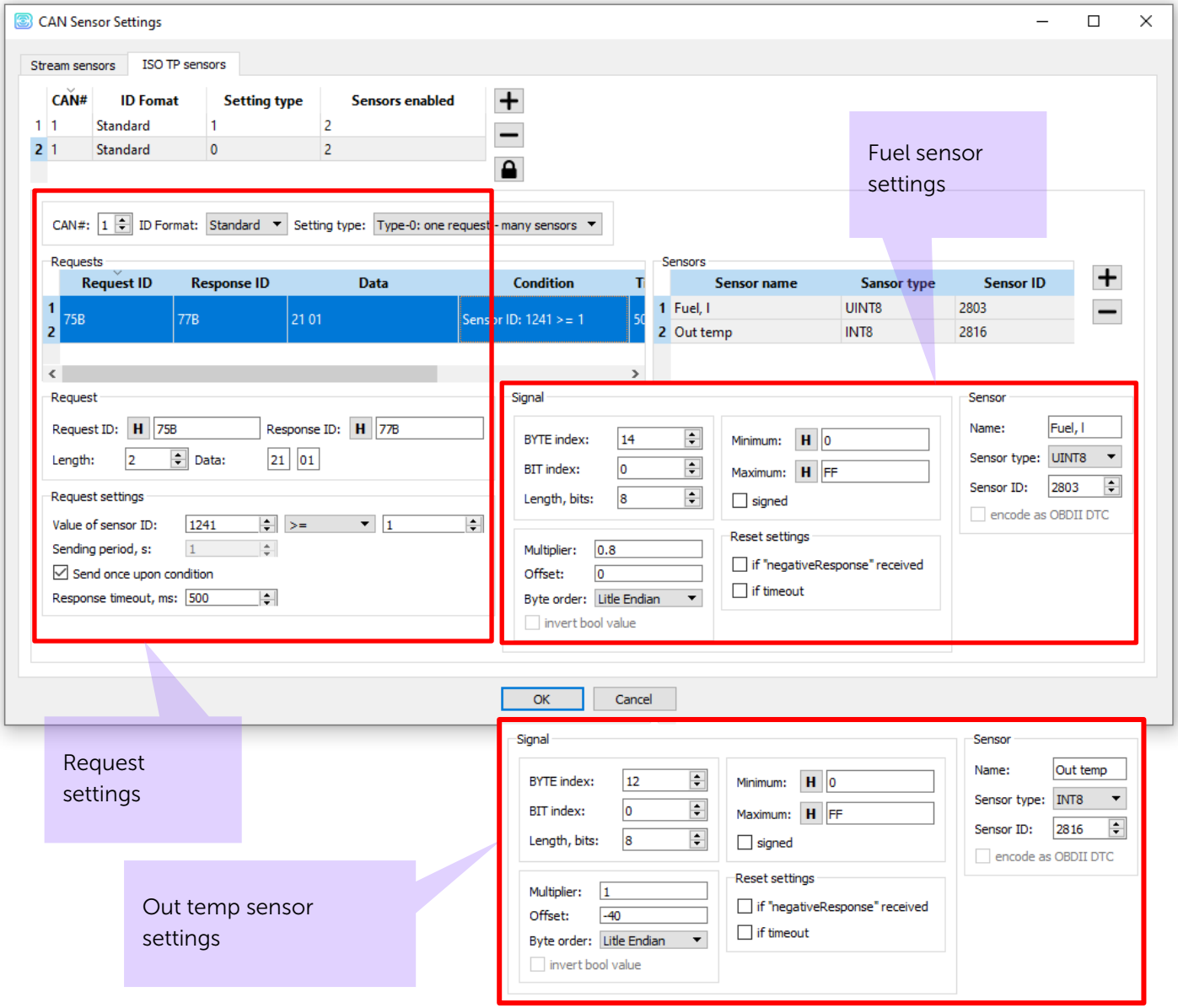
After sending the request, in the CAN scanner tab you can find the answer with the response ID



SENSOR EXAMPLES

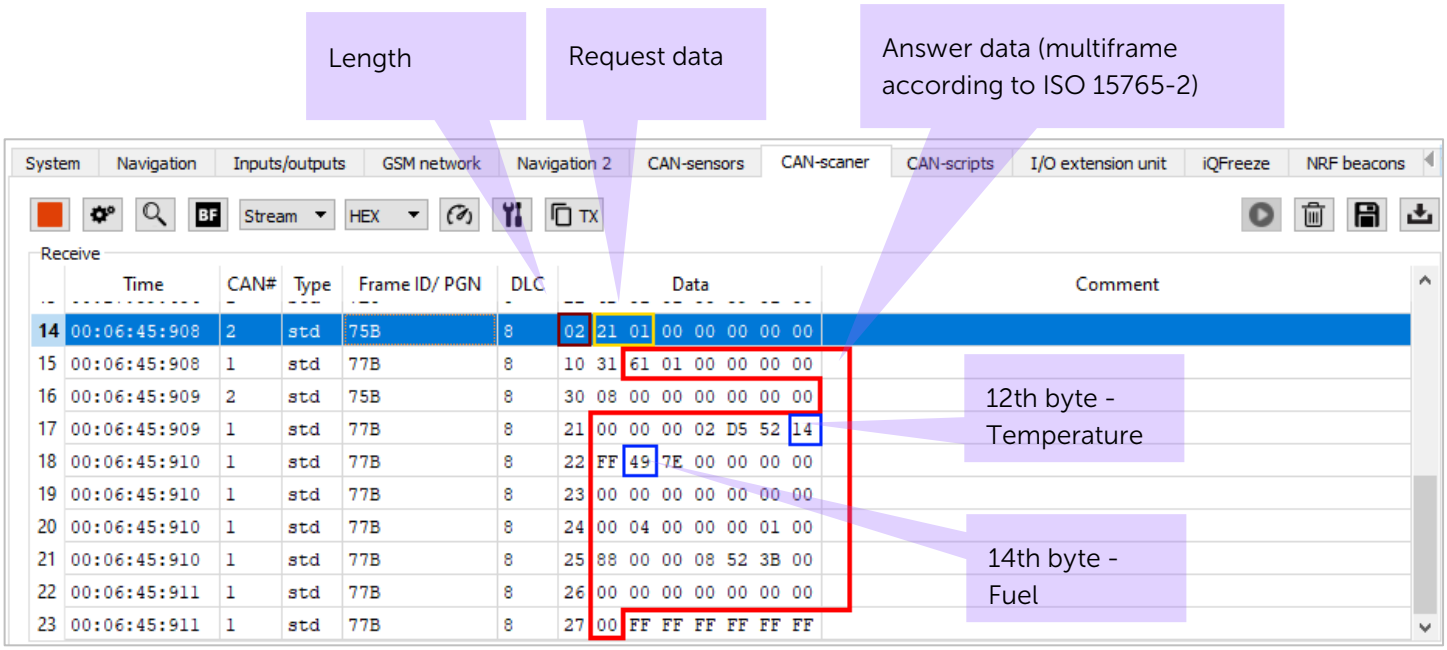
1) Example[5] for ISO TP sensor **Type 0** (one request – some sensors).

In this example, we form a request with ID = 75B, configure it, and add two sensors to it: Fuel (Fuel, l) and Outside temperature (Out temp).

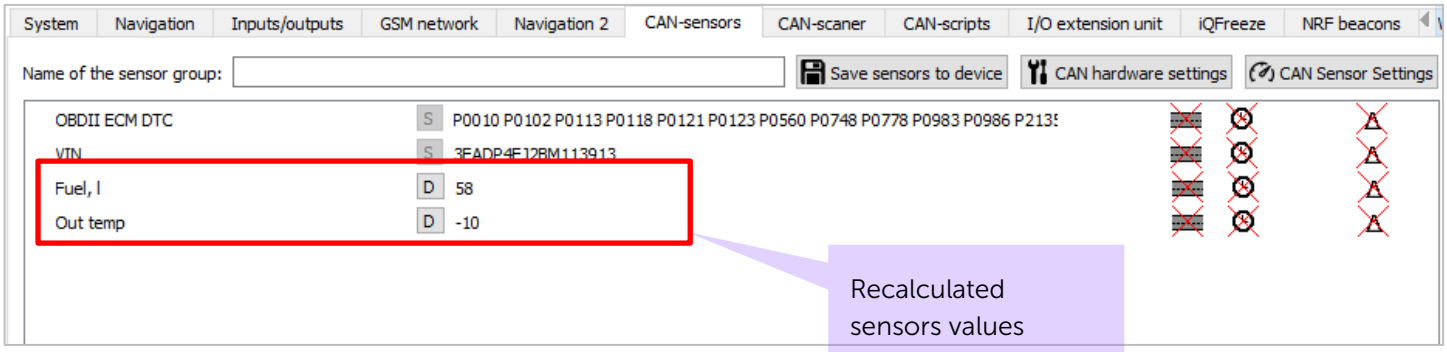


[5] request example for dashboard of Infiniti EX35, G35 2007+

As a result of this request, we will receive the following data in the scanner:

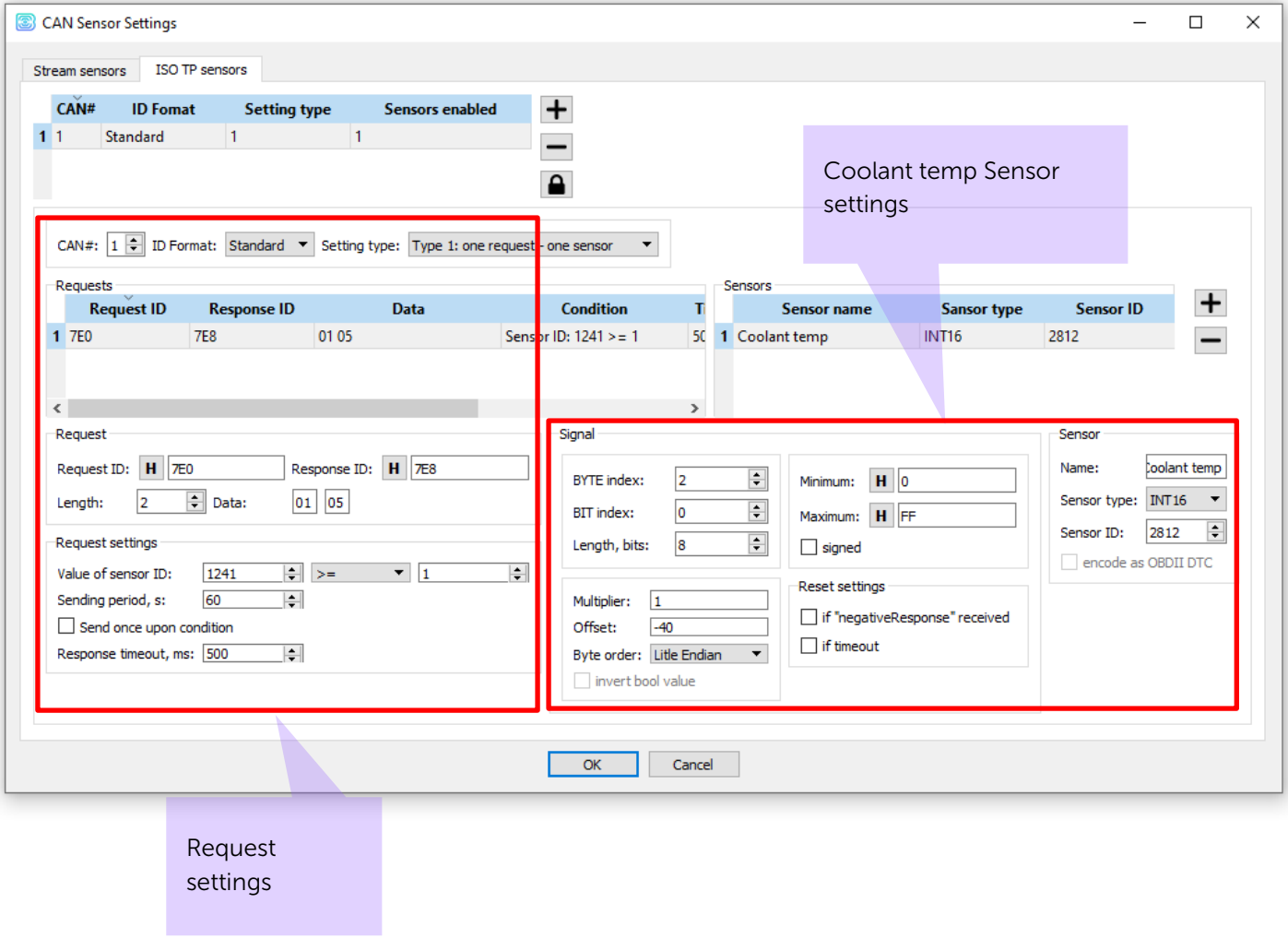


And in the CAN-sensors tab, the converted (according to the signal settings) sensor values will be displayed:

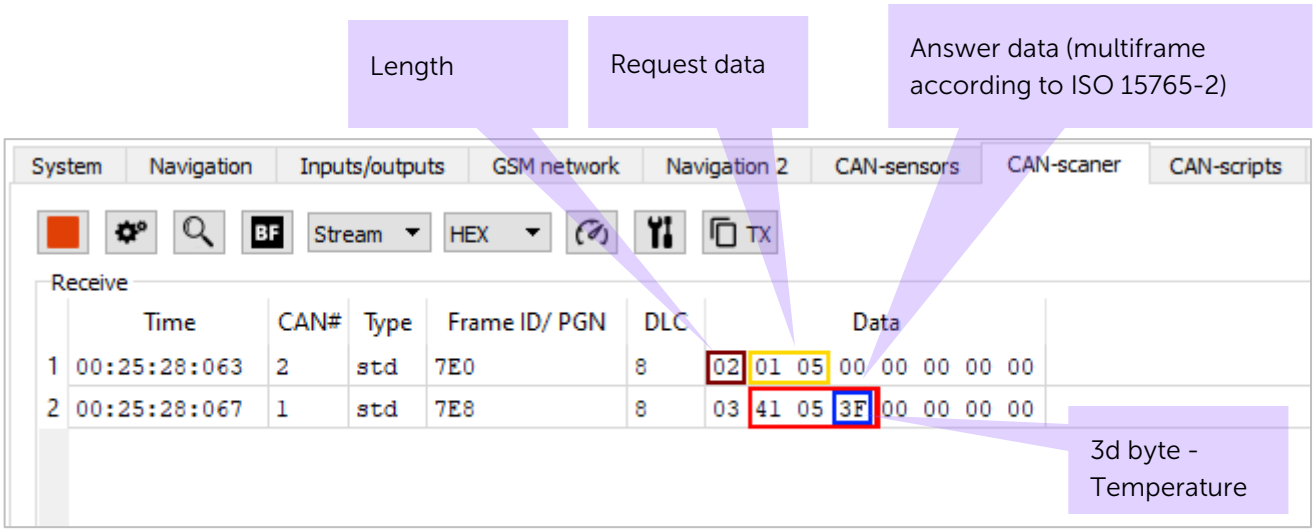


2) Example for ISO TP sensor **Type 1** (one request – one sensor).

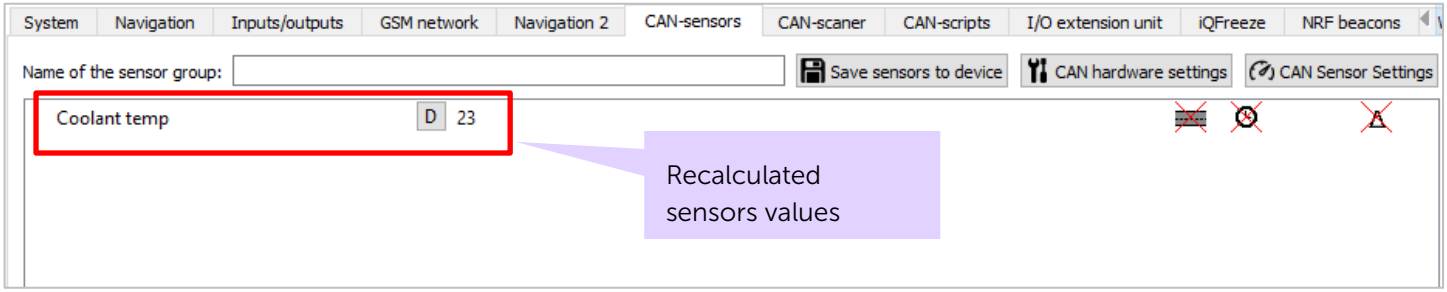
In this example, we form a request with ID = 7E0, configure it, and add one sensor to it - Coolant temperature (Coolant temp). If you wish, you can create another request and create another sensor for it, this is a feature of Type 1 requests - requests and sensors form a pair. In total, you can create up to three such pairs.



As a result of this request, we will receive the following data in the scanner:

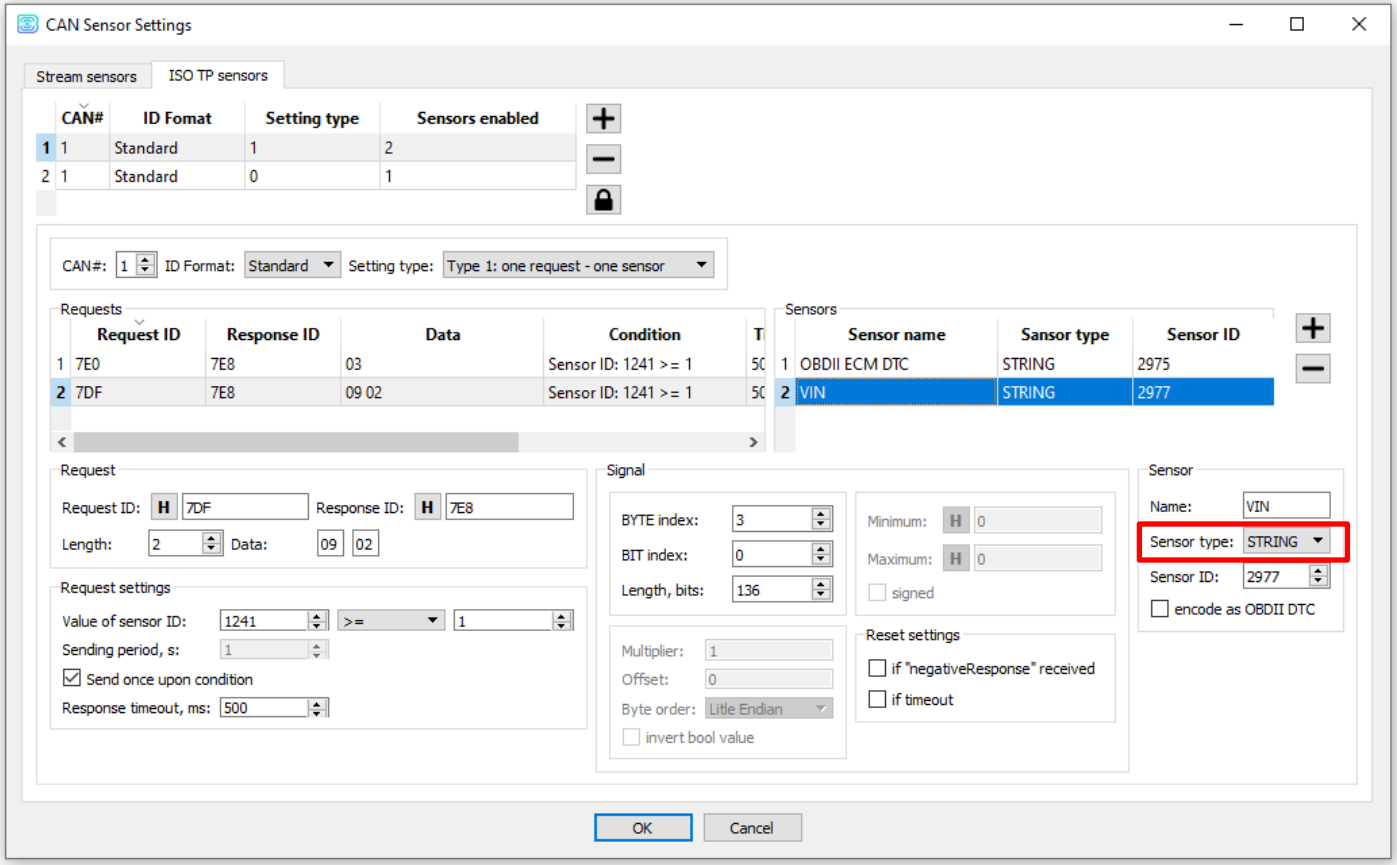


And in the CAN-sensors tab, the converted (according to the signal settings) sensor values will be displayed:

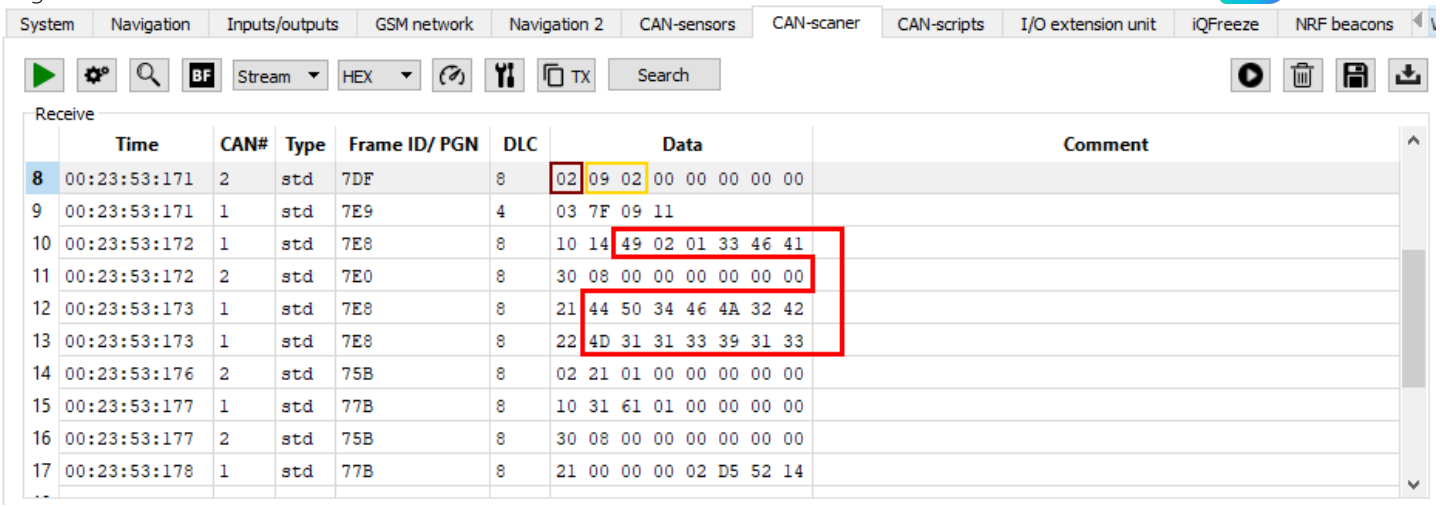


3) Example for reading the **VIN**. There is a **STRING** type for string sensors so that a value can be output to the server as a string. The most common case of the need to output string data to the server is to request a VIN (and DTC - example 4).

To do this, create a query with a sensor and set it to type **STRING**.

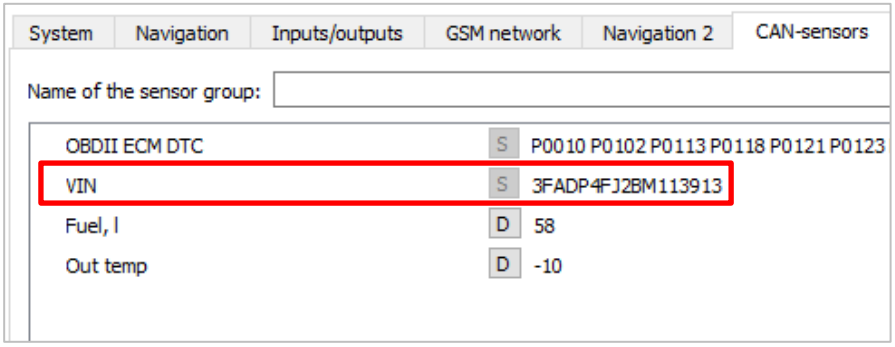


On the scanner we will see the following data:



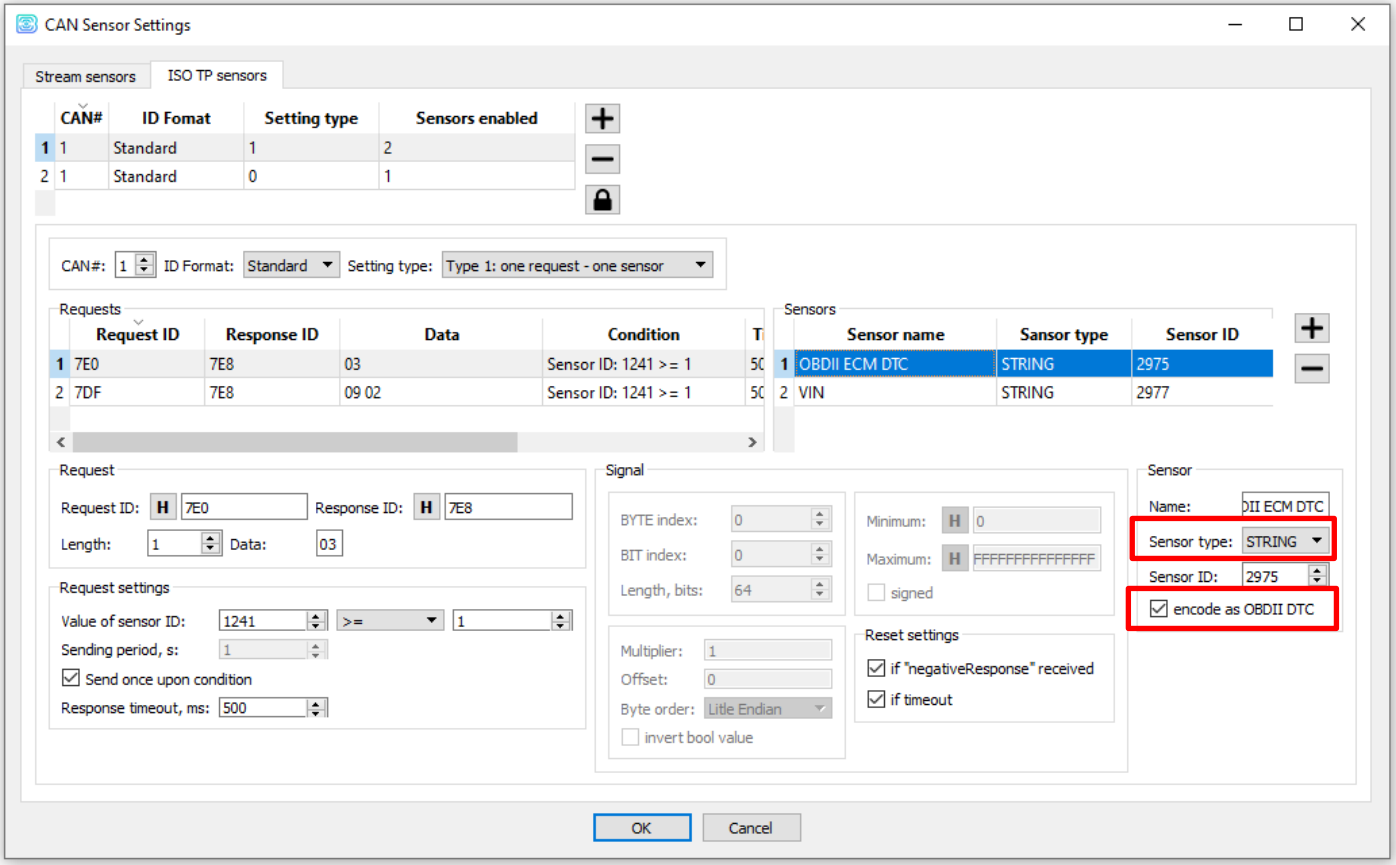
	Time	CAN#	Type	Frame ID/ PGN	DLC	Data	Comment
8	00:23:53:171	2	std	7DF	8	02 09 02 00 00 00 00 00	
9	00:23:53:171	1	std	7E9	4	03 7F 09 11	
10	00:23:53:172	1	std	7E8	8	10 14 49 02 01 33 46 41	
11	00:23:53:172	2	std	7E0	8	30 08 00 00 00 00 00 00	
12	00:23:53:173	1	std	7E8	8	21 44 50 34 46 4A 32 42	
13	00:23:53:173	1	std	7E8	8	22 4D 31 31 33 39 31 33	
14	00:23:53:176	2	std	75B	8	02 21 01 00 00 00 00 00	
15	00:23:53:177	1	std	77B	8	10 31 61 01 00 00 00 00	
16	00:23:53:177	2	std	75B	8	30 08 00 00 00 00 00 00	
17	00:23:53:178	1	std	77B	8	21 00 00 00 02 D5 52 14	

And after conversion they will be displayed as a string - VIN.

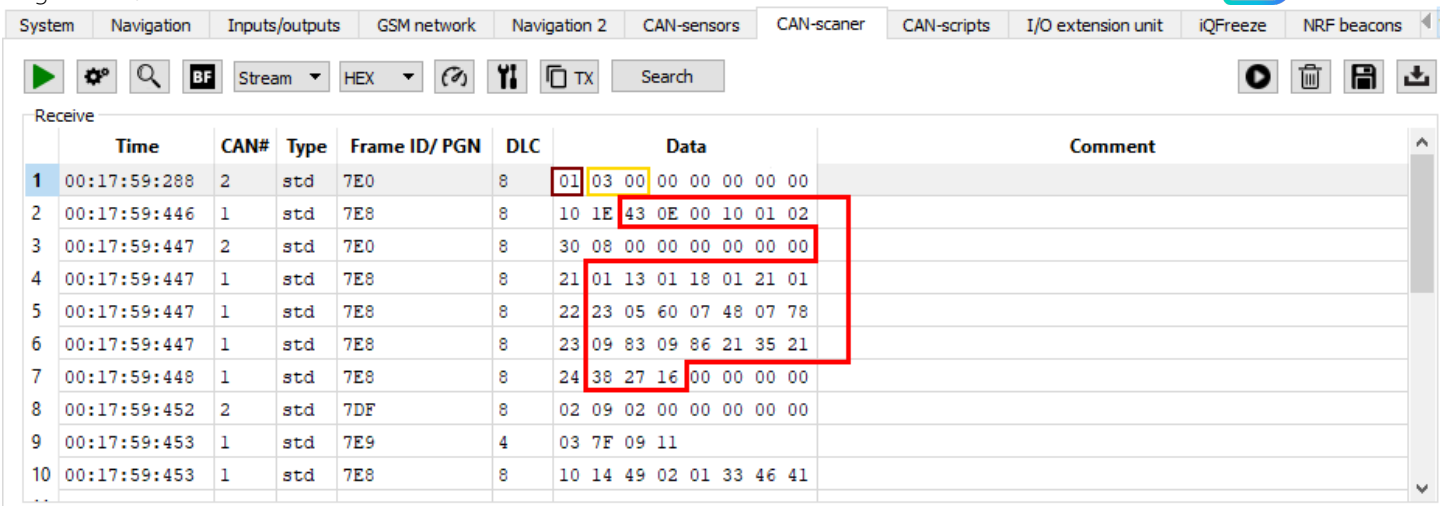


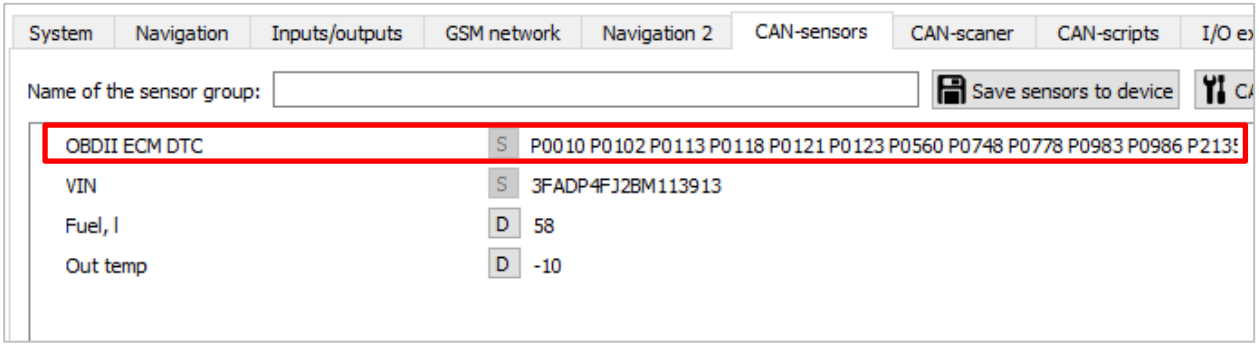
4) Example for reading the **DTC** (diagnostic trouble codes) according to the OBD-2 protocol.

In the sensor settings, select the type **STRING** and check the box "**Encode as OBDII DTC**" - the device will convert the data received from the CAN bus into DTC codes, separated by spaces.



The method of encoding messages with DTC is described in the documents regulating the OBD-2 protocol.


System
Navigation
Inputs/outputs
GSM network
Navigation 2
CAN-sensors
CAN-scaner
CAN-scripts
I/O extension unit
iQFreeze
NRF beacons
Stream
HEX
TX
Search
Receive
Time CAN# Type Frame ID/ PGN DLC Data Comment
1 00:17:59:288 2 std 7E0 8 01 03 00 00 00 00 00 00
2 00:17:59:446 1 std 7E8 8 10 1E 43 0E 00 10 01 02
3 00:17:59:447 2 std 7E0 8 30 08 00 00 00 00 00 00
4 00:17:59:447 1 std 7E8 8 21 01 13 01 18 01 21 01
5 00:17:59:447 1 std 7E8 8 22 23 05 60 07 48 07 78
6 00:17:59:447 1 std 7E8 8 23 09 83 09 86 21 35 21
7 00:17:59:448 1 std 7E8 8 24 38 27 16 00 00 00 00
8 00:17:59:452 2 std 7DF 8 02 09 02 00 00 00 00 00
9 00:17:59:453 1 std 7E9 4 03 7F 09 11
10 00:17:59:453 1 std 7E8 8 10 14 49 02 01 33 46 41

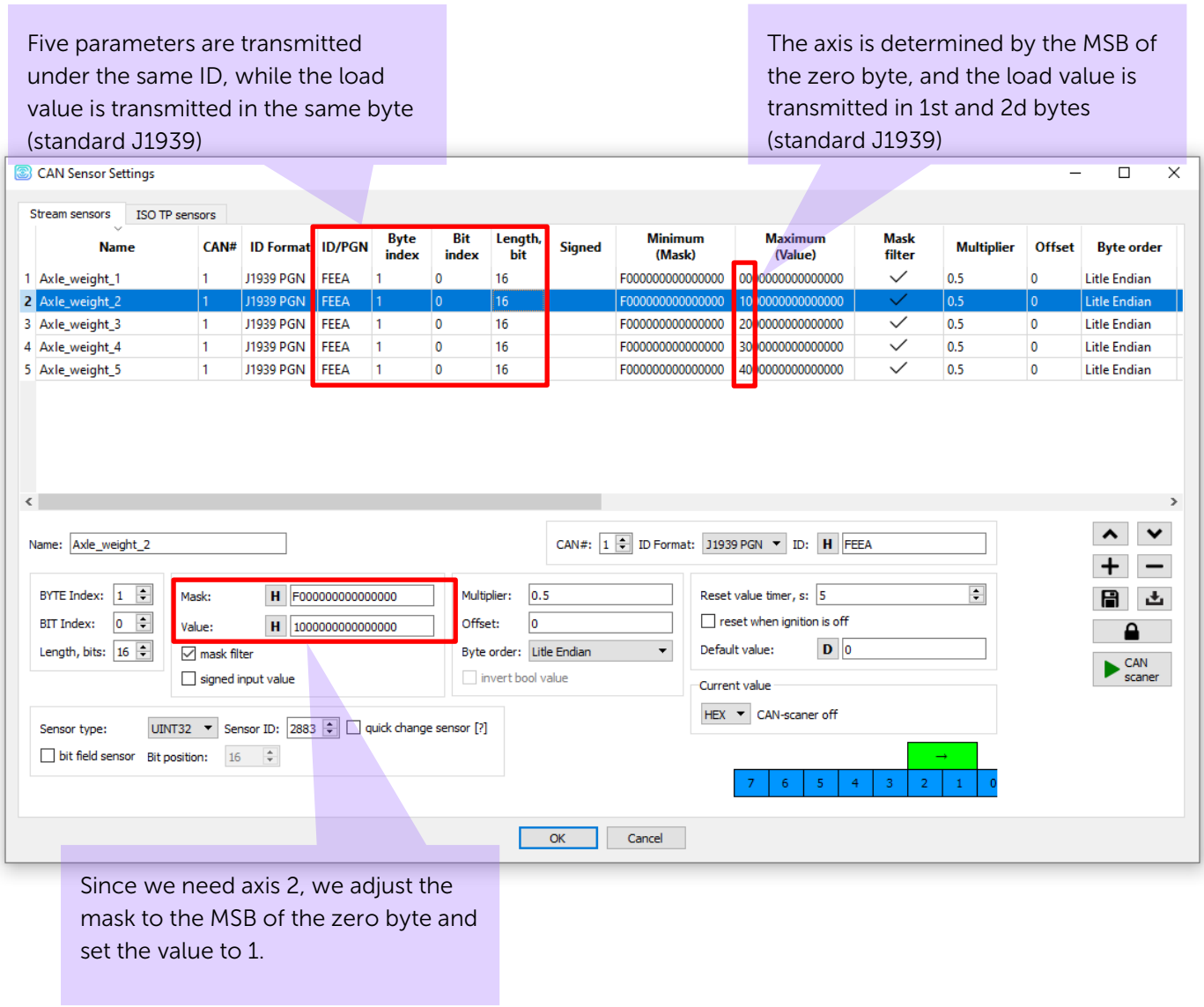

System
Navigation
Inputs/outputs
GSM network
Navigation 2
CAN-sensors
CAN-scaner
CAN-scripts
Name of the sensor group:
Save sensors to device
OBDII ECM DTC S P0010 P0102 P0113 P0118 P0121 P0123 P0560 P0748 P0778 P0983 P0986 P213
VIN S 3FADP4FJ2BM113913
Fuel, l D 58
Out temp D -10

5) Example of using a mask for the “Axle Load” parameter in accordance with J1939.

In this example, we want to filter the data from the CAN bus so that we get the load on axis 2. According to the J1939 standard, axis 2 is determined by the most significant bit of the zero byte is equal 1.

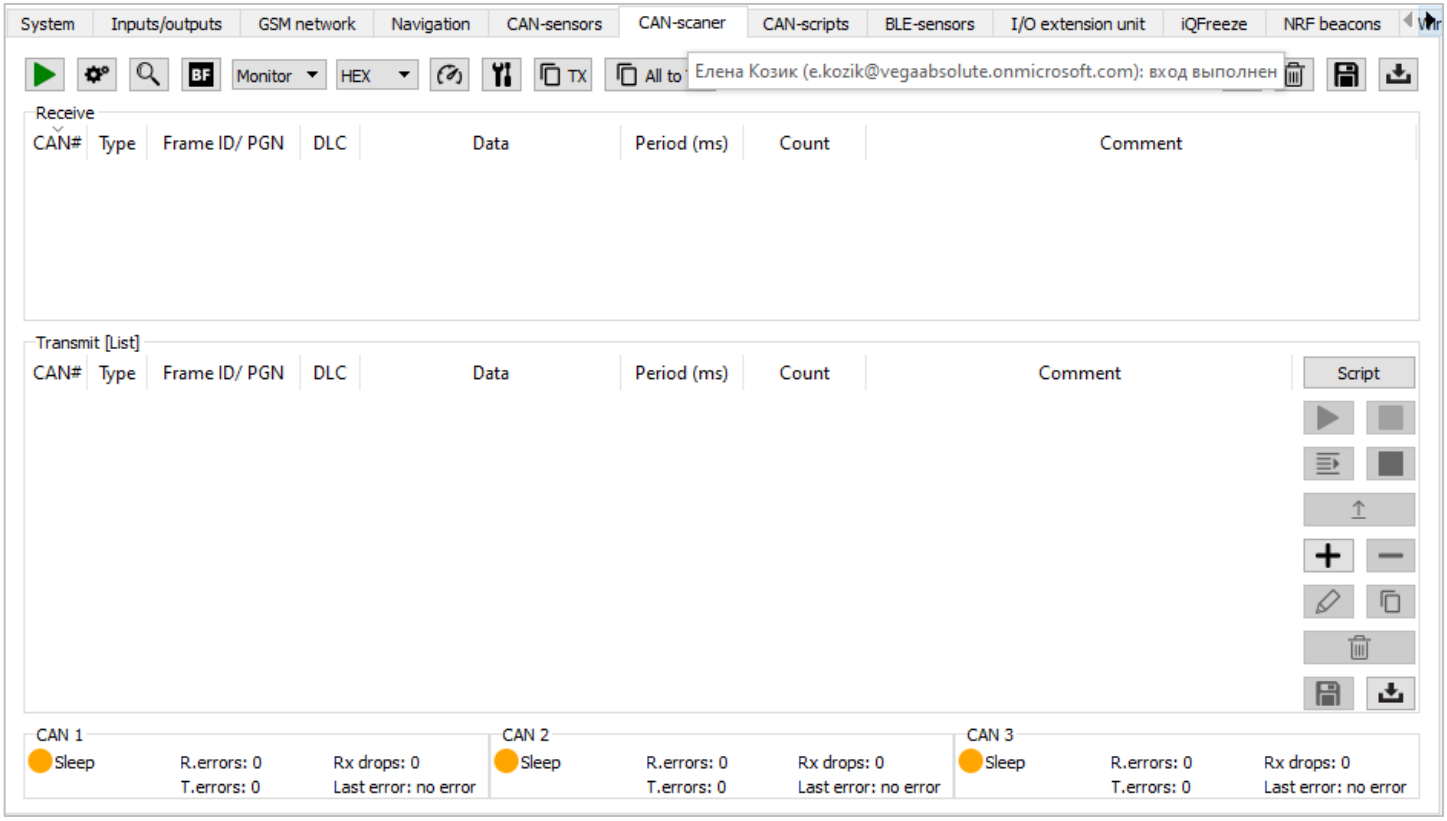
Go to the Stream sensors and configure the mask as follows:

Mask F000000000000000 – to make filter by the MSB of the zero byte (zero byte highlighted with red), **value** 1000000000000000, to make the MSB of the zero byte equal to 1.

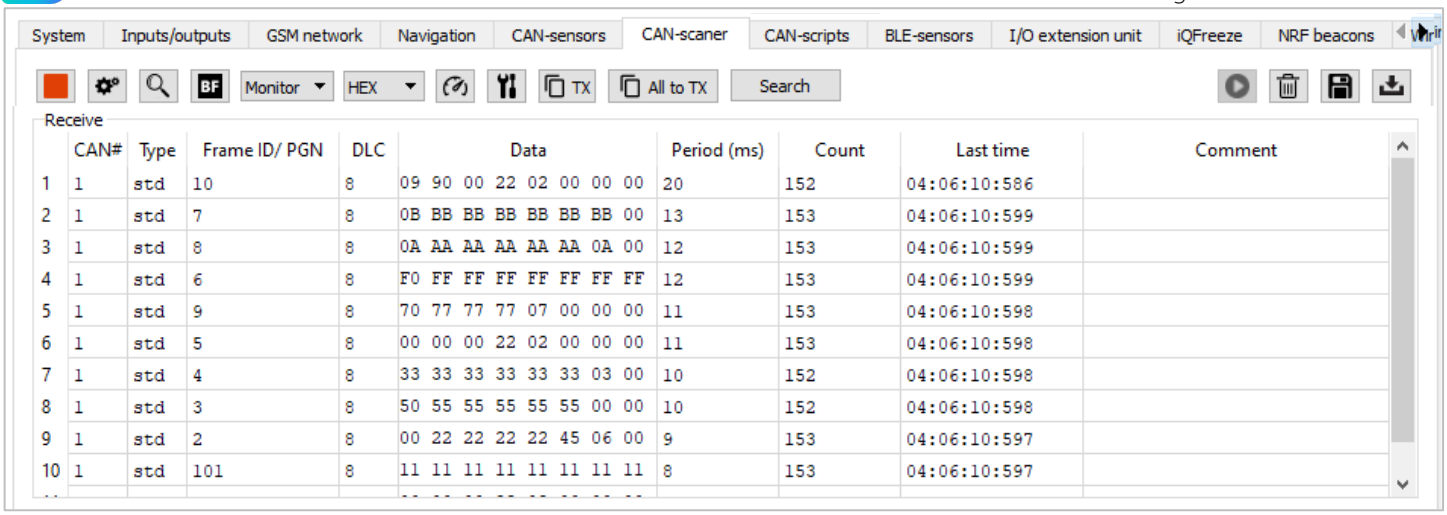


CAN-SCANNER

The “CAN-scanner” tab displays information coming from a data scanner physically connected to the CAN-bus. It is needed to determine all the information that is necessary for entering sensors in the “CAN sensors” tab.

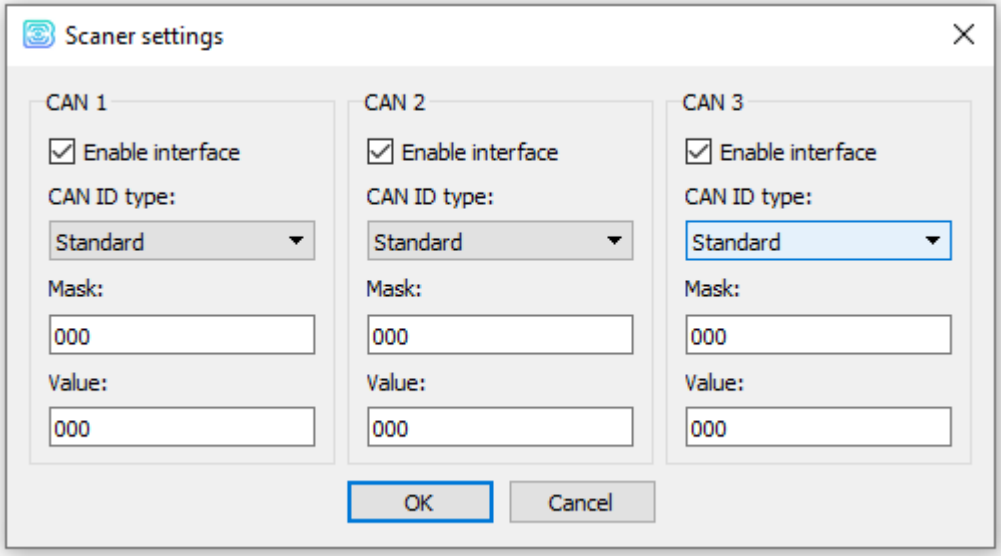


If the scanner is connected, you can press the start button “ ” and then all information from the CAN-bus will be displayed in the “Receive” field, and instead of the start button the stop button “ ” will appear. Consider the upper part of the window where the settings for displaying information from the CAN-bus are located and the information is displayed.



	CAN#	Type	Frame ID/ PGN	DLC	Data	Period (ms)	Count	Last time	Comment
1	1	std	10	8	09 90 00 22 02 00 00 00	20	152	04:06:10:586	
2	1	std	7	8	0B BB BB BB BB BB BB 00	13	153	04:06:10:599	
3	1	std	8	8	0A AA AA AA AA AA 0A 00	12	153	04:06:10:599	
4	1	std	6	8	F0 FF FF FF FF FF FF FF	12	153	04:06:10:599	
5	1	std	9	8	70 77 77 77 07 00 00 00	11	153	04:06:10:598	
6	1	std	5	8	00 00 00 22 02 00 00 00	11	153	04:06:10:598	
7	1	std	4	8	33 33 33 33 33 33 03 00	10	152	04:06:10:598	
8	1	std	3	8	50 55 55 55 55 55 00 00	10	152	04:06:10:598	
9	1	std	2	8	00 22 22 22 22 45 06 00	9	153	04:06:10:597	
10	1	std	101	8	11 11 11 11 11 11 11 11	8	153	04:06:10:597	

To reduce the amount of incoming information, you can configure filters by clicking the settings button "  " next to the start button.



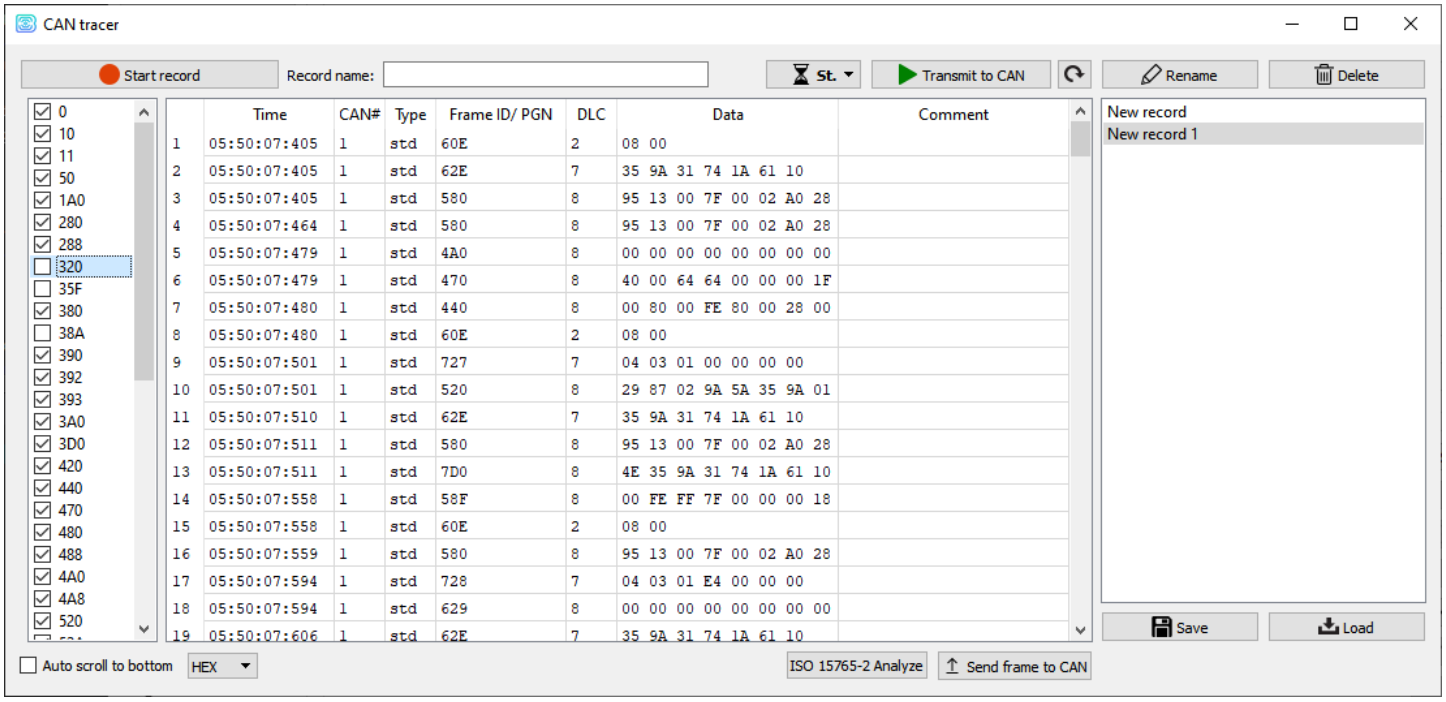
Here you can set one mask for each of the three CAN buses. If masks are not set, then all data from all buses will be displayed, regardless of the filters previously configured in the “CAN hardware settings” of the “CAN-sensors” tab.

Next is a drop-down menu for setting the bus read mode. If the “Monitor” mode is selected, the information will be displayed in the form of frames that are constant but change their values. If the “Stream” mode is selected, the information will be presented as a continuous log of values, a new line appears as soon as the frame value has changed.

If the desired sensor is found, then by clicking the button for creating a CAN-sensor " ", you can fill in part of the information automatically: frame ID, CAN-bus number, data type. And then fill in the rest and immediately save this sensor in the device

In the hardware settings " " you need to select only the speed and the appropriate operating mode of the CAN-bus. Filters configured in this window relate to the operation of the device and will not affect the operation of the scanner.

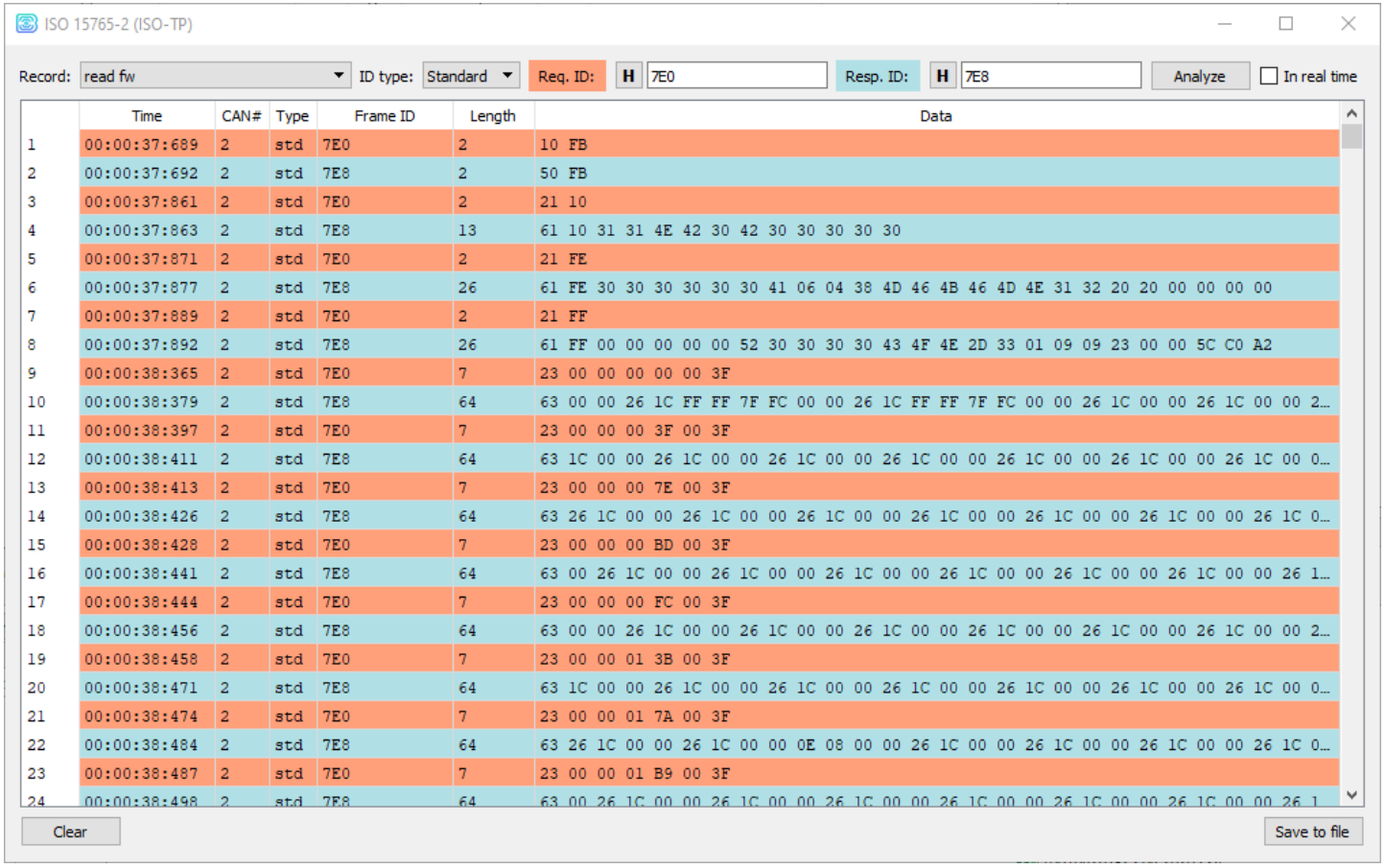
The magnifying glass icon “ ” brings up a window for recording frames from the CAN-bus. This feature is called CAN-tracer.



When you click on the “Start Record” button, all information coming from the CAN-bus in real time will be recorded in the stream mode and displayed in the window. In this case, the “New Entry” will appear in the field on the right - the name can be changed. After the recording is completed, you can write the

resulting values to a file, or immediately send the entire sequence to the CAN-bus. If you press the "Cycle" button, the sequence will be sent to the CAN-bus in a cycle mode. You can also set a delay between messages by pressing the hourglass button. Standard delay - with what interval messages arrived, with this they will be sent.

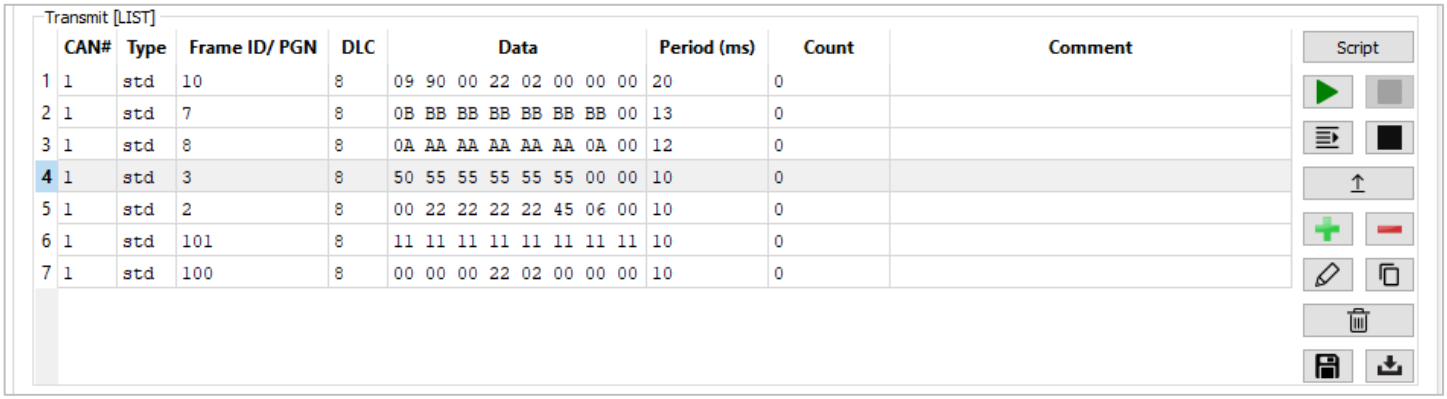
At the bottom of the CAN tracer there is a button "ISO 15765-2 Analyze", which allows you to open a window for convenient presentation of data according to the ISO-TP protocol: when specifying the ID of the request and response, the "clean" data of these requests and responses is displayed (without headers ISO-TP).



	Time	CAN#	Type	Frame ID	Length	Data
1	00:00:37:689	2	std	7E0	2	10 FB
2	00:00:37:692	2	std	7E8	2	50 FB
3	00:00:37:861	2	std	7E0	2	21 10
4	00:00:37:863	2	std	7E8	13	61 10 31 31 4E 42 30 42 30 30 30 30 30
5	00:00:37:871	2	std	7E0	2	21 FE
6	00:00:37:877	2	std	7E8	26	61 FE 30 30 30 30 30 30 41 06 04 38 4D 46 4B 46 4D 4E 31 32 20 20 00 00 00 00
7	00:00:37:889	2	std	7E0	2	21 FF
8	00:00:37:892	2	std	7E8	26	61 FF 00 00 00 00 00 52 30 30 30 30 43 4F 4E 2D 33 01 09 09 23 00 00 5C C0 A2
9	00:00:38:365	2	std	7E0	7	23 00 00 00 00 00 3F
10	00:00:38:379	2	std	7E8	64	63 00 00 26 1C FF FF 7F FC 00 00 26 1C FF FF 7F FC 00 00 26 1C 00 00 26 1C 00 00 2…
11	00:00:38:397	2	std	7E0	7	23 00 00 00 3F 00 3F
12	00:00:38:411	2	std	7E8	64	63 1C 00 00 26 1C 00 00 26 1C 00 00 26 1C 00 00 26 1C 00 00 26 1C 00 00 26 1C 00 0…
13	00:00:38:413	2	std	7E0	7	23 00 00 00 7E 00 3F
14	00:00:38:426	2	std	7E8	64	63 26 1C 00 00 26 1C 00 00 26 1C 00 00 26 1C 00 00 26 1C 00 00 26 1C 00 00 26 1C 0…
15	00:00:38:428	2	std	7E0	7	23 00 00 00 BD 00 3F
16	00:00:38:441	2	std	7E8	64	63 00 26 1C 00 00 26 1C 00 00 26 1C 00 00 26 1C 00 00 26 1C 00 00 26 1C 00 00 26 1…
17	00:00:38:444	2	std	7E0	7	23 00 00 00 FC 00 3F
18	00:00:38:456	2	std	7E8	64	63 00 00 26 1C 00 00 26 1C 00 00 26 1C 00 00 26 1C 00 00 26 1C 00 00 26 1C 00 00 2…
19	00:00:38:458	2	std	7E0	7	23 00 00 01 3B 00 3F
20	00:00:38:471	2	std	7E8	64	63 1C 00 00 26 1C 00 00 26 1C 00 00 26 1C 00 00 26 1C 00 00 26 1C 00 00 26 1C 00 0…
21	00:00:38:474	2	std	7E0	7	23 00 00 01 7A 00 3F
22	00:00:38:484	2	std	7E8	64	63 26 1C 00 00 26 1C 00 00 0E 08 00 00 26 1C 00 00 26 1C 00 00 26 1C 00 00 26 1C 0…
23	00:00:38:487	2	std	7E0	7	23 00 00 01 B9 00 3F
24	00:00:38:498	2	std	7E8	64	63 00 26 1C 00 00 26 1C 00 00 26 1C 00 00 26 1C 00 00 26 1C 00 00 26 1C 00 00 26 1

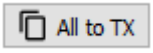
When the work with the scanner is finished, it is stopped, the necessary comments are added, you can save them by clicking the "  " button in the main window of the "CAN-scanner" tab. You can also download information from a file with *.frames or *.trc format.

At the bottom of the window is the workspace for working with frames. Work can be in the format of [List] or in the format of [Script]. Switching is carried out by pressing the button on the right, the current mode is displayed in square brackets on the left.



Work with [List] is constructed as follows:

- Add frames from the top field to the list using the " 

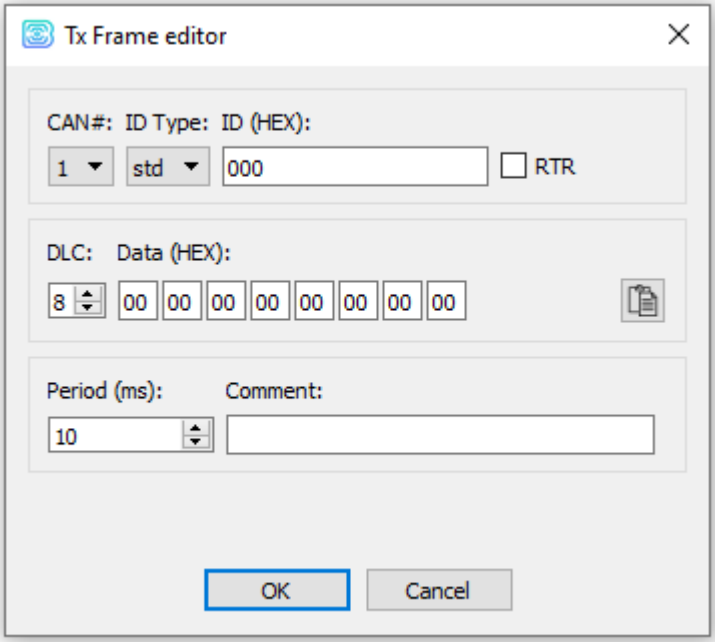
" or " 

" button
- Select the desired frame in the list.
- Press the "  " button or the space bar for one-time sending, the packet counter will increase by one
- Press the "  " button for sending with the specified period, while the packet counter will increase with each sending until the "Stop" or "Stop all" button is pressed

Working with [Script] is a little different. If there are several frames in the list, then you can start their sequential execution by pressing the "  " button, this will be the execution of [Script]. At the same time, the "Count" column takes on a slightly different meaning, here you need to set the number of repetitions in advance, after which [Script] will proceed to the next frame. Other control buttons on the right panel also differ - it becomes possible to repeat the execution of frames cyclically, move frames relative to each other (raise and lower the list), pause execution at any time.

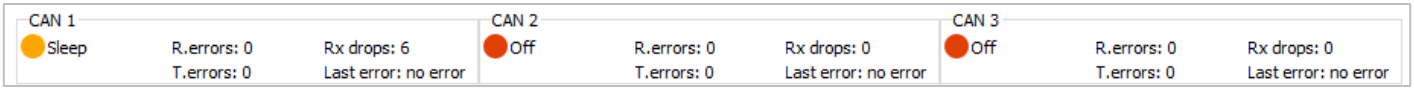
The CAN-tracer and [Script] functions are similar in meaning, but in the CAN-tracer, the entire range of values is recorded, there you cannot select individual frames and edit them as in [Scripts].

In addition, in [Scripts] (as in [List]], it is possible to create frames by manually filling in all the information. To do this, you need to click the edit button for the existing "  " or add a new frame "  ".



Herewith when creating a frame in the [Script] mode, it is possible to change the number of repetitions, but in the [List] mode there is no.

At the very bottom of the window is a status bar of all three CAN-buses:



In addition to the active/inactive status, parameters are displayed here:

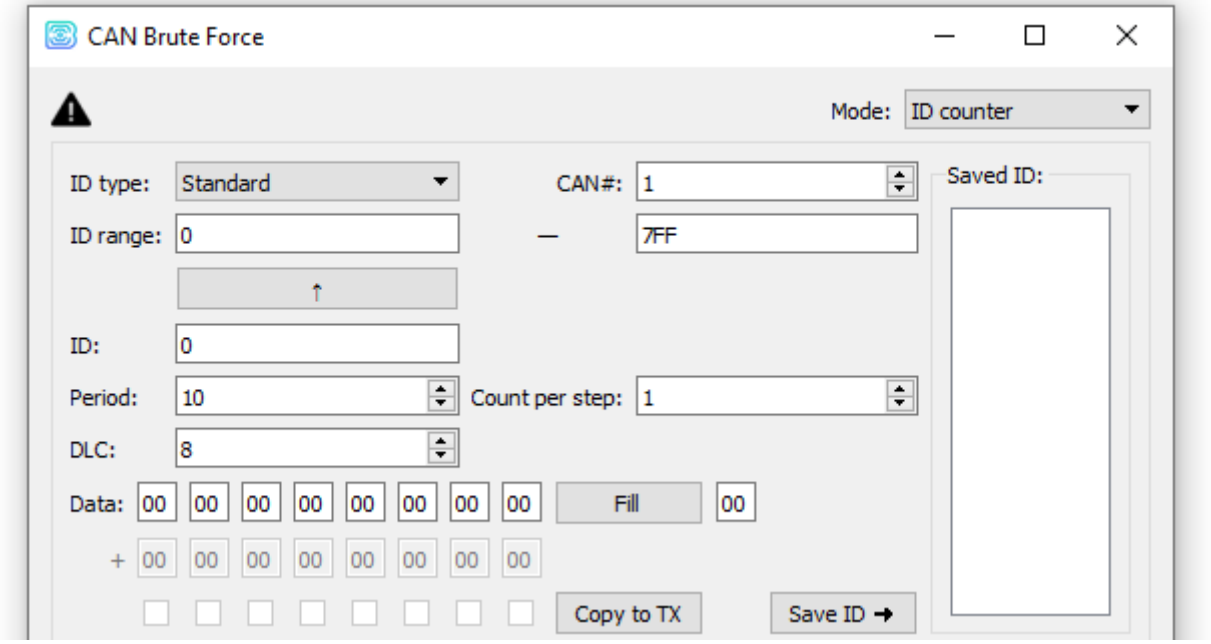
R.errors – number of wrong Rx frames;

T.errors – number of wrong Tx frames;

Rx drops – number of lost Rx frames;

Last error – a last occurs in the interface.

There is also a CAN Brute Force function to create and send messages to the CAN bus. By clicking on the "BF" button, a new window appears with the ability to select a mode and configure sending parameters.



This function works in four modes:

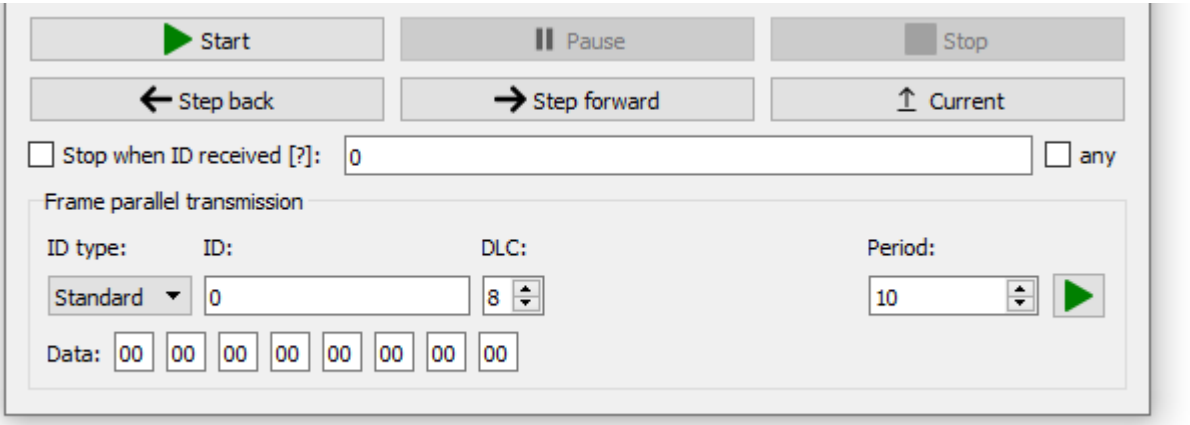
- **ID counter**: sends frames one by one from the specified ID range (you can adjust the number for each ID and sending period) with the specified data (the data does not change);

- **data counter**: sends frames with the specified constant ID, but with each step the data changes (configurable to which byte and how much to add);

- **data and ID counter**: both the first and second modes at the same time;

- **ID list**: IDs can be entered into the list on the right (by clicking the right mouse button, or by clicking the "Save ID" button), only frames with IDs from this list will be sent in turn.

Sending starts either automatically by pressing the "Start" button, or each step is sent manually (step forward, step back or current).



Stop sending either by pressing the "Pause"/"Stop" buttons (when paused, you can continue sending from the current step, if you stop only from the beginning), or when you receive a frame with the specified or any ID.

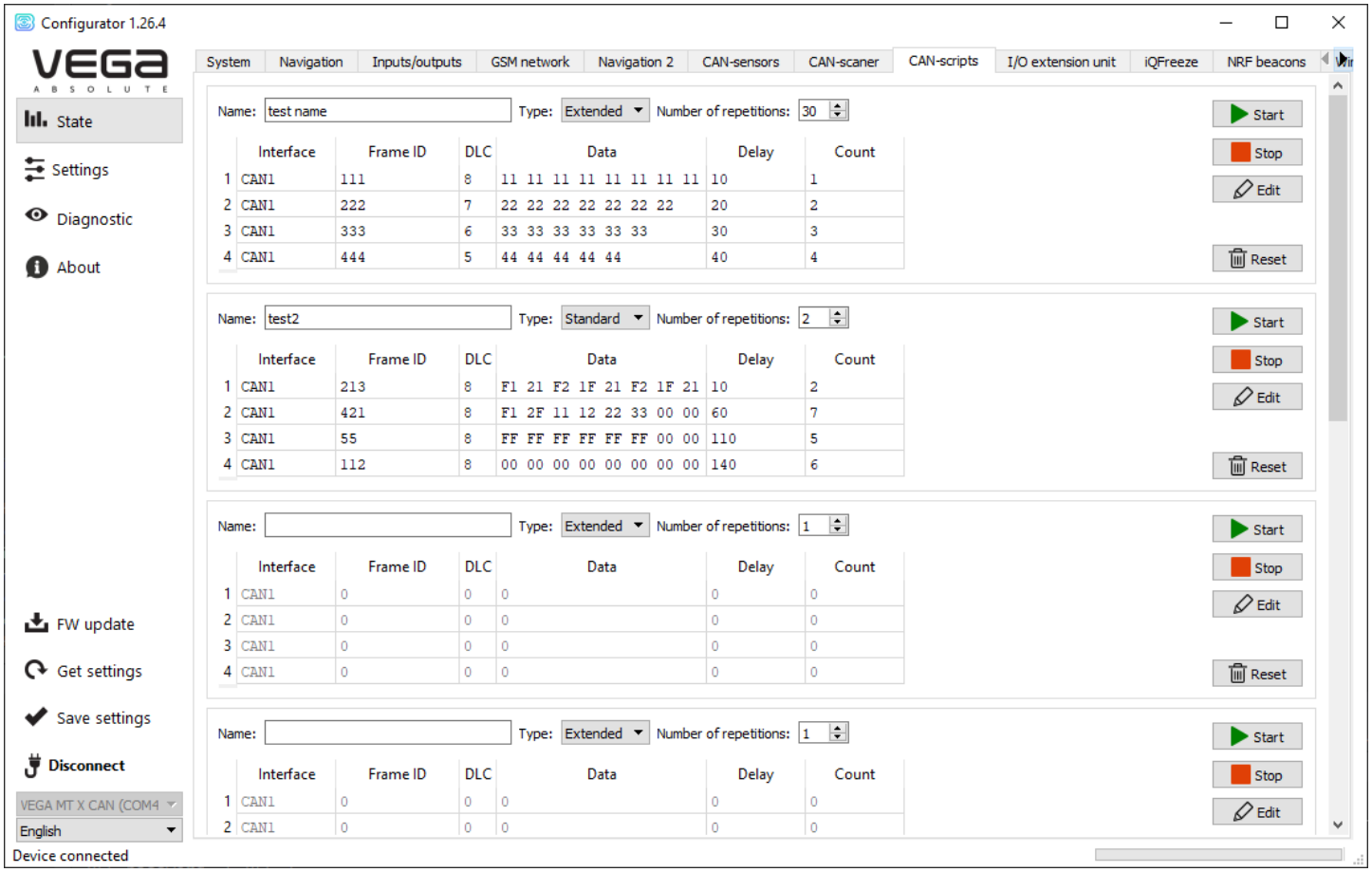
You can also enable parallel sending of a frame with the specified parameters, which will always be sent (can be used, for example, to emulate ignition).

When connecting via TCP, there may be loss of frames and mismatch in send periods. When sending random commands to the vehicle's CAN bus, the result may be unpredictable. Vega-Absolute company is not responsible for the consequences of experiments with the CAN bus.

CAN-SCRIPTS

In the “CAN-scripts” tab, scripts are configured similarly to the scripts in the “CAN-scanner” tab, but at the hardware level. These scripts are saved to the device and read from there.

In total, you can specify up to 8 different scripts. They are entered completely manually.



In the future, these scripts can be run using the SMS command (see section 14) or the Wialon IPS and Wialon Combine protocols (see the protocols description).

9 SETTINGS

SERVER CONNECTION

The “Server connection” tab has two types of settings.

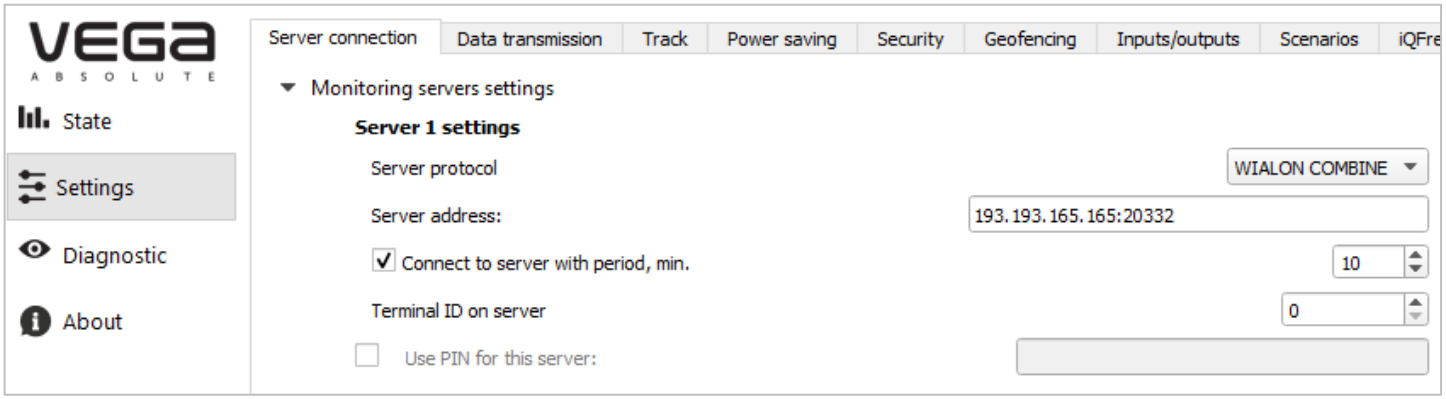
1. Monitoring servers’ settings

The monitoring device can operate by four protocols, exchanging data with four servers. In this settings item, it is proposed to select a data exchange protocol (EGTS, Wialon IPS, Wialon Combine, VEGA, NDTP), or disable data transfer. Next, specify the server address in the format XXX.XXX.XXX.XXX:YYYYY, where XXX.XXX.XXX.XXX is the IP address of the server, and YYYYY is the port.

Connect to server with period, min - if the check box is unchecked, the device is constantly in communication with the server, if it is checked - the device communicates with the server with the specified period.

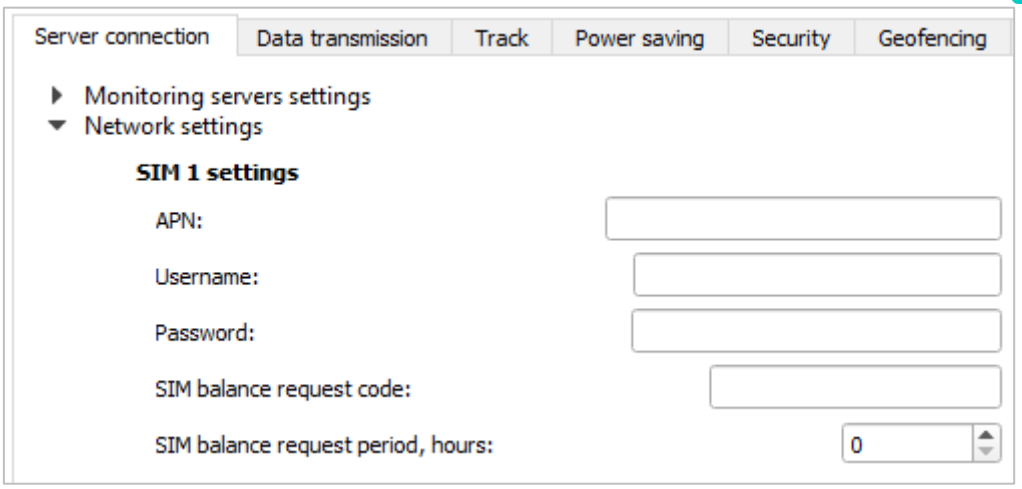
Terminal ID on server – no need to enter for the WIALON and VEGA protocols - they use the IMEI of the device as an identifier when connecting to the server.

Use PIN for this server – if the check box is unchecked, communication with the server is carried out without using a PIN code, if the check box is checked and a PIN code is set, it is used for VEGA, WIALON IPS and WIALON Combine protocols.



2. Network settings

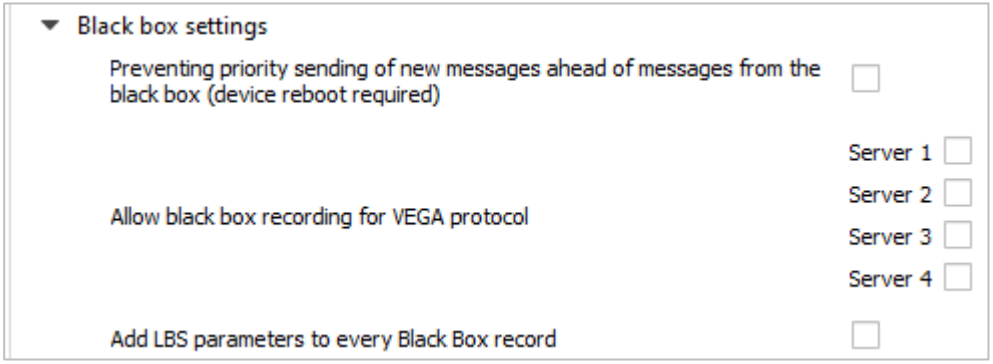
There are the settings of the SIM card access point for accessing the GSM network. Most modern SIM cards do these settings on their own. If this does not happen, in this setting item you can do it manually by specifying the APN of the access point, username and password.



SIM balance request code and SIM balance request period - settings for automatically requesting the balance of the SIM card with a certain period or by clicking the "Update Balance" button (see the "State" section, "GSM network" tab). For each SIM card, the settings are set separately, but the balance is requested only for the currently active SIM card.

DATA TRANSMISSION

By default, when transferring data from the device black box, new entries have the highest priority. Due to this, if the device did not get in touch for some time, and then the data upload started, you will most likely receive up-to-date information about the current location of the device. If you need to unload strictly in order from the old points of the track to the new ones, you should check the option: "**Preventing priority sending of new messages ahead of messages from the black box**" Thus, new messages will continue to accumulate in the black box in the meantime, as old messages will be uploaded until the queue reaches new messages.

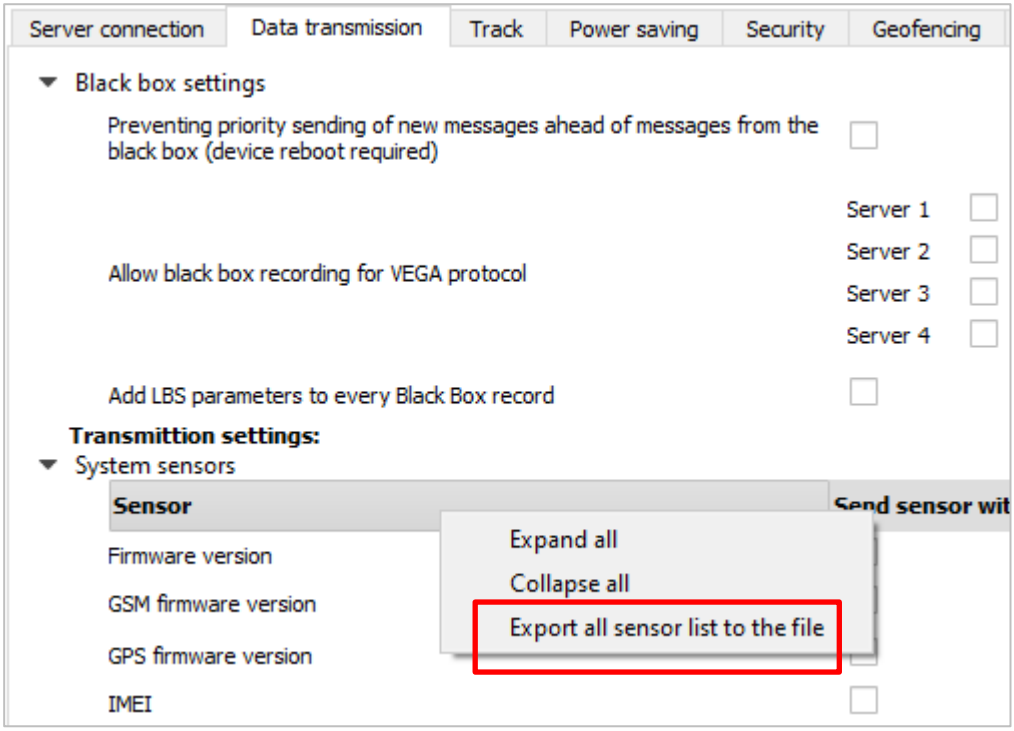


Allow black box recording for VEGA protocol on the checked servers - here you should select the servers configured in the "Connection" tab to work on the VEGA protocol. It should be remembered that the VEGA engineering server does not work with telematic data and it does not make sense to select it for writing to the black box, although this will not lead to any negative consequences.

Add LBS parameters to every Black Box record - by default, LBS parameters are not added to every track point record to save traffic.

In this settings item, it is also proposed to **set sensors**, i. e. to choose exactly what data the device will transmit to the monitoring server, as well as events for which information will be generated for a specific indicator.

By clicking the right mouse button anywhere in the tab, you can **export the list of sensors** to the *.csv file, which then opens as a table.

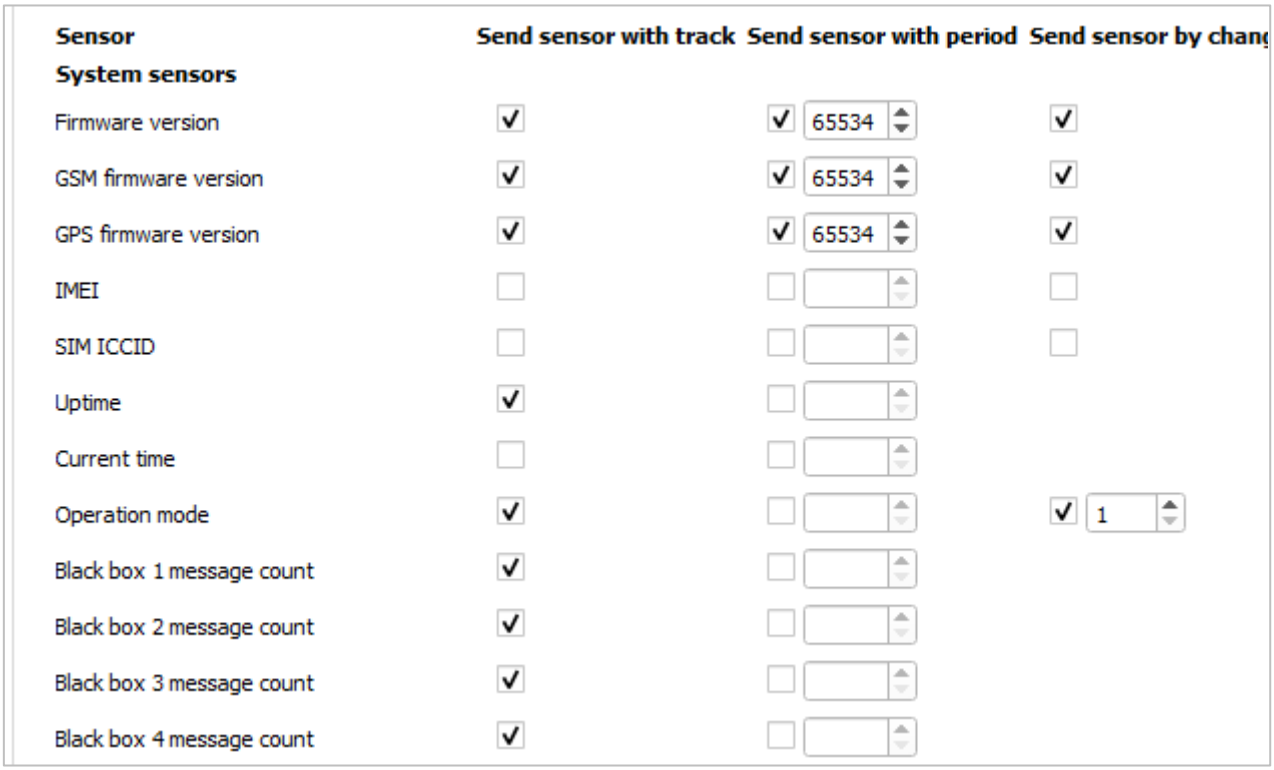


Send sensor with track – means that the sensor will be added to each track point record being generated and transmitted along with it.

Send sensor with period – means that the sensor will be recorded and transmitted every N second (the period is specified in seconds).

Send sensor by change – means that the sensor will be recorded and transmitted each time it changes to the value specified in the right field.

Example of setting up the transmission of readings.



In this example, with each track point generated, the following sensors will be also transmitted:

- Uptime of device operation
- Operation mode
- Black boxes messages quantity
- Device firmware version
- GSM firmware version
- GPS firmware version

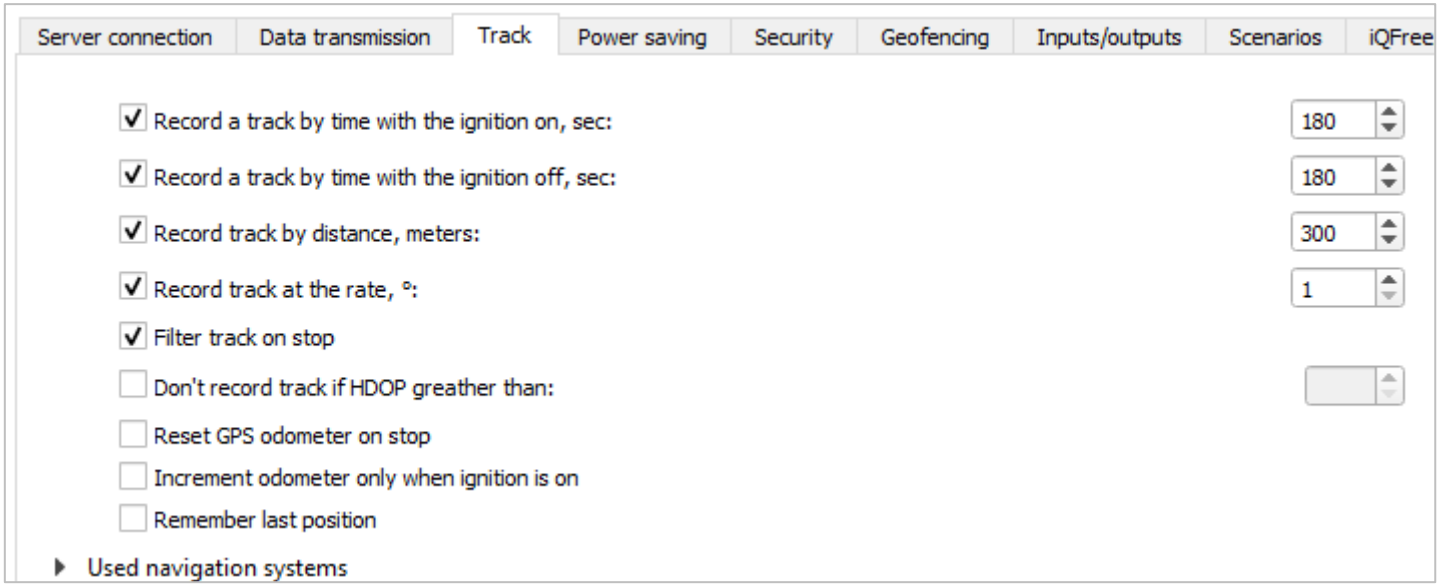
In addition, every 65535 seconds, a record will be generated with information about the firmware versions of the device, GSM module and GPS module. And these same sensors will be transmitted when changing, that is, if the firmware version changes, this information will immediately go to the server.

Opposite the "Operation mode" parameter, there is a checkmark "Send by change" and the value "1" is specified. Since the device has two operation modes - the active mode and the sleep mode - the

"Operation mode" parameter is a logical parameter that can have a value of either 0 or 1. Therefore, in the field next to the "Send by change" checkbox, there is 1, which means - if mode is change, the block will form the corresponding record and transfer it to the server.

TRACK

The "Track" tab has settings for recording, filtering the track, resetting the odometer and the function of remembering the last coordinates.



1. Track recording settings

Record track by time - a track point will be formed every N second.

Record track by distance - a track point will be formed every N meter.

Record track at the rate - the point of the track will be formed with each deviation of the vehicle's direction from the straight line by N degrees.

2. Track filtering settings

Filter track on stop - when the movement stops, the device stops redefining the coordinates of its location to avoid "star" tracks due to the error in determining the coordinates. Instead, he sends with the track those coordinates that he determined once after stopping.

Do not record track if HDOP greater than - track points determined with HDOP greater than a specified value will not be considered reliable and will not be recorded in a black box.

3. Odometer reset

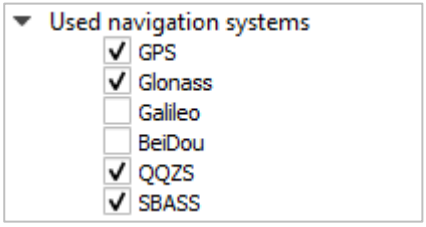
Reset GPS odometer on stop - resetting the GPS odometer after each parking fix.

Increment odometer only when ignition is on - mileage will not be considered when the ignition is off, even if the car is moving.

4. The function of storing the last coordinates

Remember last position - in case of loss of GNSS signals, the device will remember the last defined coordinates and will use them to form track points until communication with satellites is restored.

5. Also, on the "Track" tab there are settings of the used navigation systems. Possible combinations are shown in the table below. QQZS and SBASS add-ons can only be enabled at the same time as GPS.



GPS	Galileo	Glonass	Beidou	Comment
1	0	0	0	
0	1	0	0	Test mode only
0	0	1	0	Test mode only
0	0	0	1	Test mode only
1	1	0	0	
1	1	1	0	
1	0	1	0	By fefault
1	0	0	1	

POWER SAVING

In the sleep mode, the device turns off the modem and the main power of the navigation module, only its recharge for a hot start remains. Consumption of about 2 mA. The power indicator flashes every 3-4 seconds.

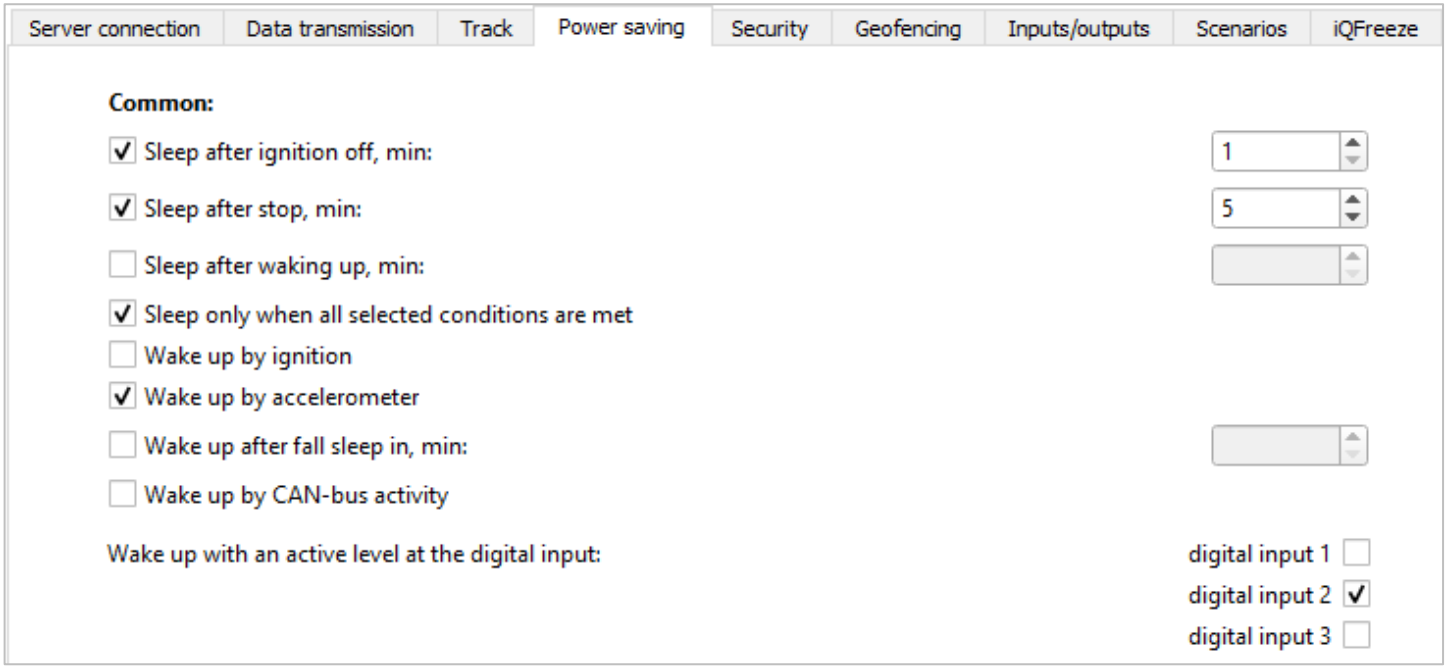
The “Power Saving” tab contains the settings for switching the device to sleep mode and from it. But there are a few non-configurable options.

1. The device always wakes up by connecting USB and opening the case (tamper 1 or tamper 2).

2. The device does not fall asleep while USB is connected, or the case is opened.

3. The device does not fall asleep if at least one tick with the awakening condition is not set.

4. Battery always charging when the ignition is on, regardless of whether the device is sleeping or not.



1. Sleep Settings

Sleep after ignition off, min – the device goes into sleep mode after turning off the ignition after the specified number of minutes.

Sleep after stop, min – the device goes into sleep mode after stopping the movement after the specified number of minutes.

Sleep after waking up, min – the device goes into sleep mode after the specified number of minutes after waking up.

Sleep only when all selected conditions are met – the device enters sleep mode only when all selected events occur.

2. Awakening Settings

Wake up by ignition – the device will wake up immediately after turning on the ignition.

Wake up by accelerometer – the device will wake up immediately after the start of movement fixed by the built-in accelerometer.

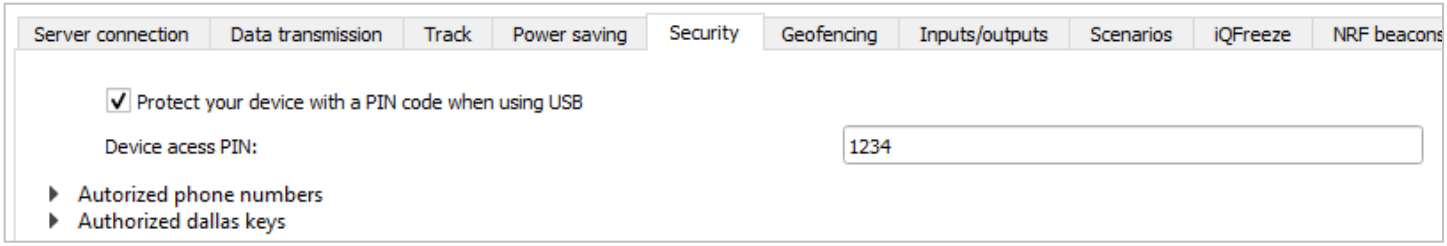
Wake up after fall sleep in, min – the device will wake up N minutes after falling asleep regardless of external events (ignition, start of movement, etc.).

Wake up with an active level at the digital input - the device will wake up when it detects activity at the selected digital inputs.

SECURITY

The Security tab contains settings for access to the device by PIN and a list of authorized keys.

The PIN indicated in the field on the right will be used to connect to the device through the Configurator program, as well as when connecting to any server using the WIALON protocol. Make sure that the same password is specified in the WIALON server settings in the "Password to access the object" section. By default, PIN access is enabled, and the password is “1234”.



Protect your device with a PIN code when using USB – if there is a checkmark - when you start the “Configurator” program, when you try to connect to the device, you will be asked for the PIN code specified

in the field on the right; if unchecked - when trying to connect to the device, the PIN code will not be requested.

In the "Authorized phone numbers" section, you can specify up to 10 phone numbers for use in "Scenarios".

In the "Authorized Dallas keys" section, you can add up to ten numbers of authorization keys of the I-Button type. To use the authorization service, you must enable the authorization sensor (see the "Inputs / outputs" part).

GEOFENCING

The Geofences tab allows you to configure the sizes and position of the geofences if you plan to use them. It is necessary to set the latitude and longitude of the center of the geofence in degrees, as well as its radius in meters. After setting the required number of geofences, it will be possible to control the location of the object inside or outside the geofences, as well as to program the device's behavior when entering or exiting geofences (see the "Scenarios" section). It is possible to set up to 50 geofences at the same time.

INPUTS/OUTPUTS

The “Inputs / Outputs” tab allows you to configure inputs and sensors in a specific way.

Multifunctional input 1, 2 and 3 - has the settings “Input Type”: Digital, Frequency, Pulse, Analog, - and “Active Level”: Low / High.

Frequency output 1 - can use the first digital output. To enable the digital output, you must go to the “State” section to the “Inputs/outputs” tab and press the “On” button opposite the “Digital output 1” inscription.

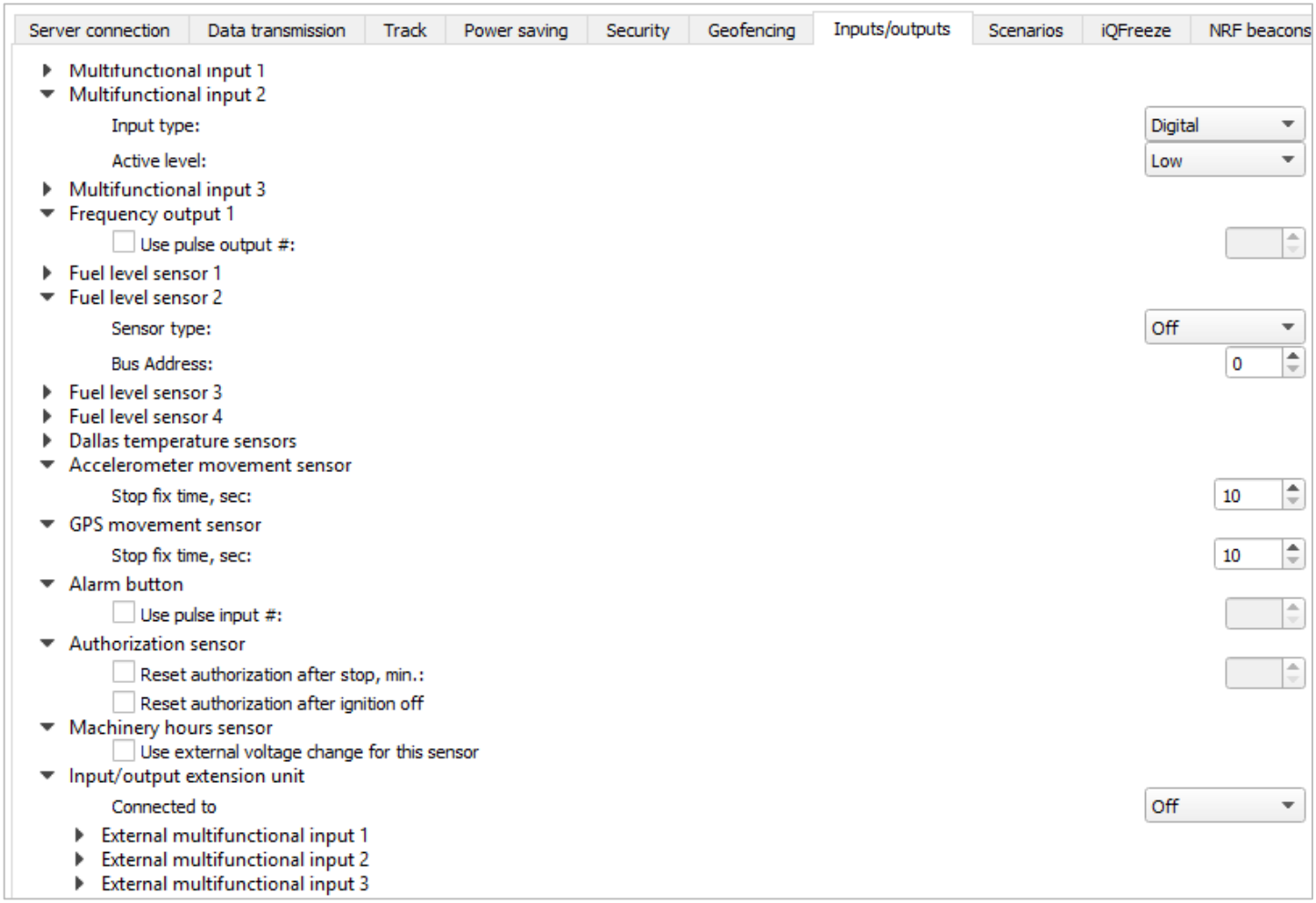
Fuel level sensor 1, 2, 3 and 4 - the ability to connect is up to 4 fuel level sensors to the RS-485 bus, specifying the address on the bus and selecting "Sensor type": RS-485.

Dallas temperature sensors - the ability to add up to 10 temperature sensors by specifying their numbers on the 1-Wire bus.

Accelerometer movement sensor and GPS movement sensor - allow you to set the time after which the vehicle is fixed as a parked (in seconds).

Alarm button - allows you to connect the alarm button to one of the multi-function inputs (MV), for this you need to configure the corresponding MV so that the “Input Type” is Digital.

Authorization sensor - used when working with authorized I-Button keys (see "Security” part).



Machinery hours sensor - allows you to configure the work on the voltage of the onboard network.

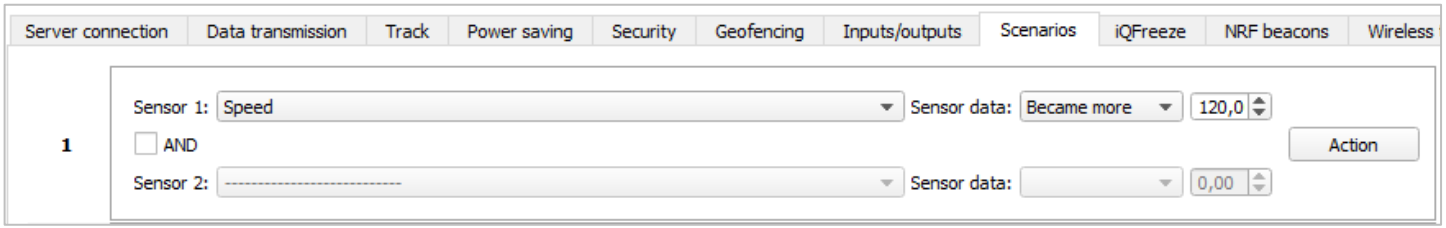
Input/output extension unit - used when connecting the VEGA BR-1 extension unit (see the " External equipment connection" part, the "Extension unit" section). When connecting an external board, it is possible to configure up to 15 additional multifunction inputs.

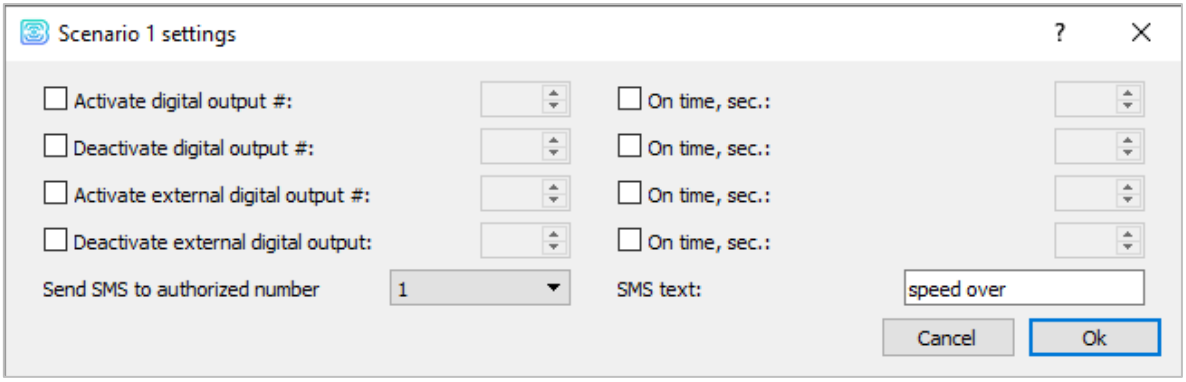
SCENARIOS

The tab “Scenarios” allows you to create up to 25 different scenarios of the device’s behavior when certain events are occurred. To create a script, you need to select a sensor from the "Sensor 1" drop-down list. Then choose what should happen to his readings to run the script. If you need to change the parameters of the two sensors, then check the box "AND" and select the second sensor from the list of "Sensor 2". Also choose how his readings should change. The scenario conditions on this are defined. Now we need to determine the behavior of the device when specified conditions occur. To the right of the customizable scenario there is a “Action” button where you can choose one or several device’s actions. After configuring these parameters, the script is ready.

Scripting Example.

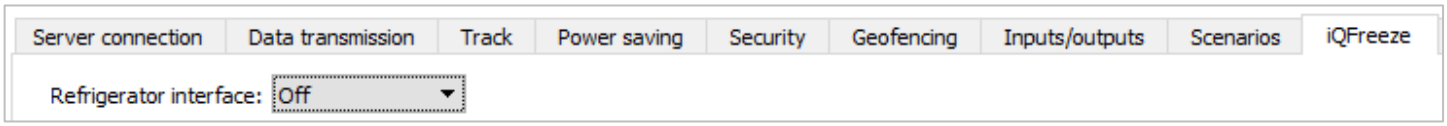
For example, send SMS when speeding exceeds 120 km/h. To set up such a scenario, you need to select the **speed** in the “Sensor 1” list, select “Sensor data: Became more” and specify the value 120 in the field on the right. Click the “Action” button and in the window that appears, configure the settings for sending SMS messages. Thus, every time the vehicle speed becomes more than 120 km/h, the device will send SMS to the specified number. "Sensor 2" in this case does not need to be configured.





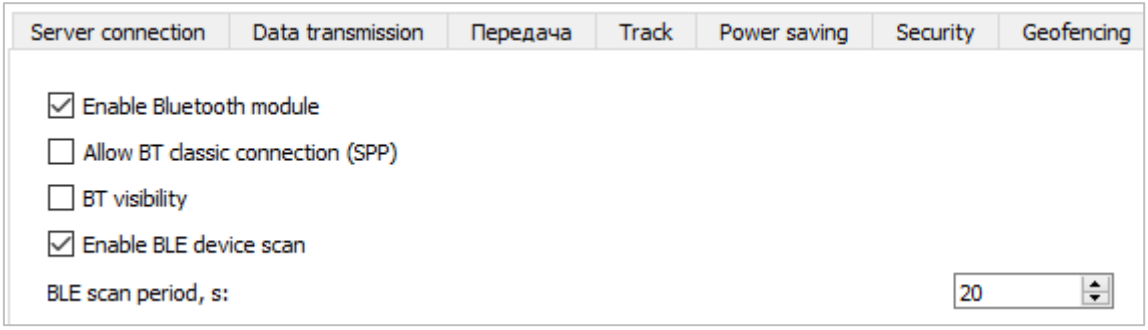
IQFREEZE

In the “iQFreeze” tab, select the interface used to connect the RS-232 or RS-485 temperature recorder. Or select “Off” if the interface is not used.



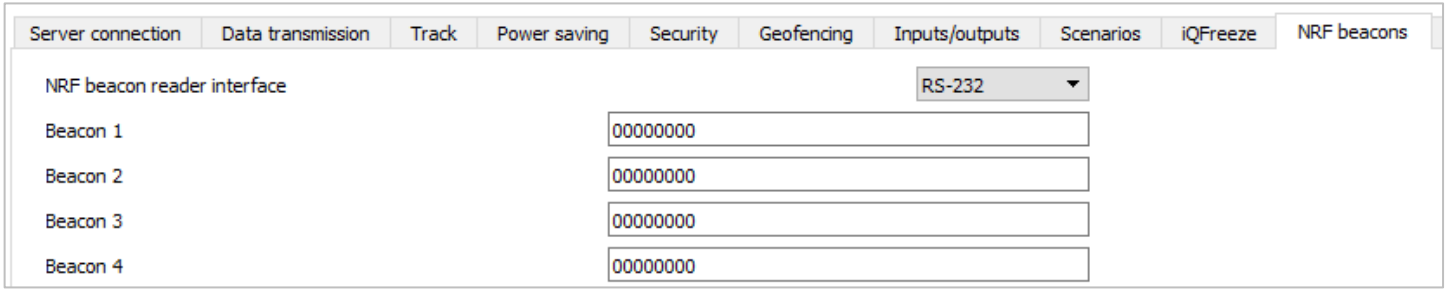
BT/BLE

In the “BT/BLE” tab you may configure Bluetooth. It is necessary for BLE sensors operation to enable BT module and BLE device scan and set the BLE scan period on 20-30 seconds optimally. Use other settings use in depends on situation. For example, if you choose “BT visibility” other devices will see the monitoring device while scanning.



NRF BEACONS

In the “NRF beacons” tab select the interface used to connect the reader: RS-232 or RS-485 interface. Or select “Off” if the interface is not used. Also, here you need to enter the individual numbers of NRF beacons, in total you can set up to 160 numbers.



WIRELESS THERMOSENSORS

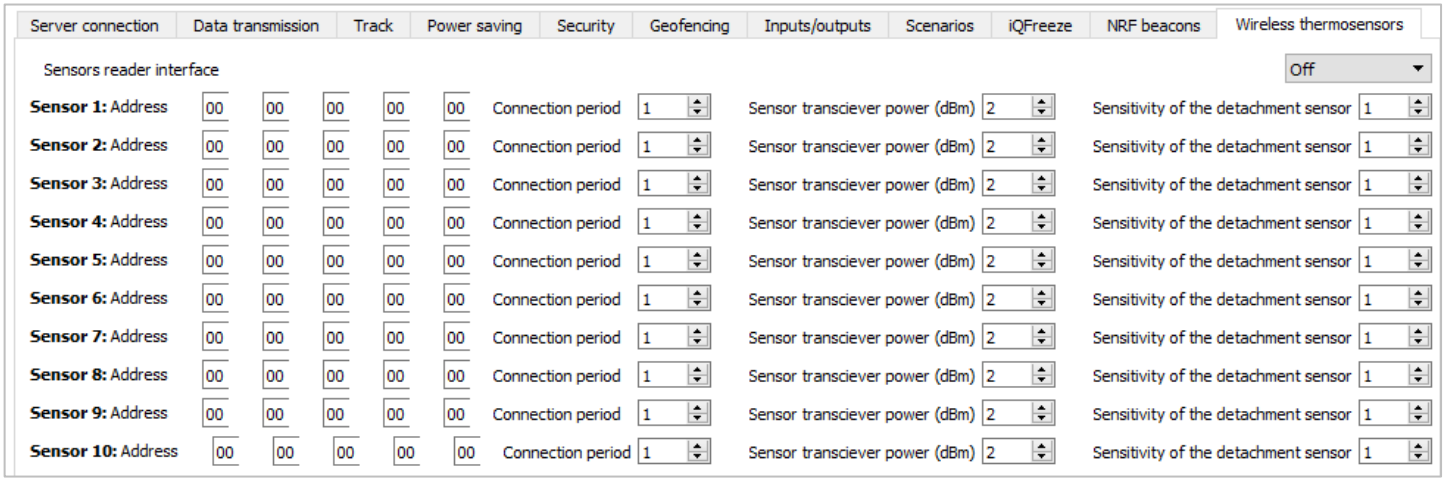
The tab "Wireless thermosensors" is used to configure temperature sensors with an integrated LoRa radio module.

Here you should select the interface used to connect the RS-232 or RS-485 temperature sensor reader. Or select “Off” if the interface is not used. Here you also need to enter the individual addresses of the temperature sensors, in total 10 addresses can be set.

Communication period – it is set in minutes for each sensor individually. This is the period with which the temperature sensor will transmit the accumulated temperature readings to the LoRaWAN network.

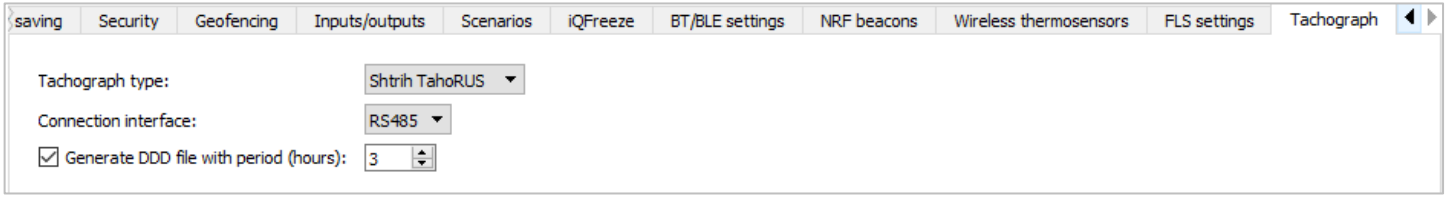
Sensor transceiver power (dBm) – varies from 2 to 20 units, the larger the value, the further the sensor will be “heard”, but the faster the battery will be discharged.

Detachment sensor sensitivity – varies from 1 to 5. When the built-in detachment sensor is triggered, the temperature sensor initiates an extraordinary communication session to transmit an alarm.



TACHOGRAPH

The “Tachograph” tab allows you to set up the device’s interfaces for operation with the supported tachograph models (see part 5, “Tachographs”).



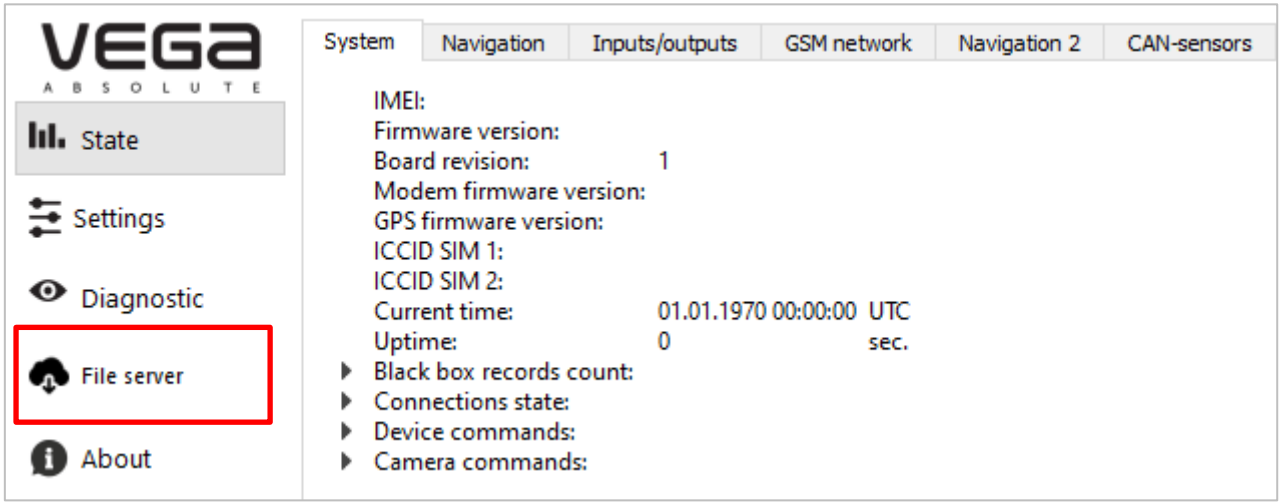
Here you need to specify the tachograph model, select the interface through which it is connected and set the period for generating the DDD file.

10 DIAGNOSTIC

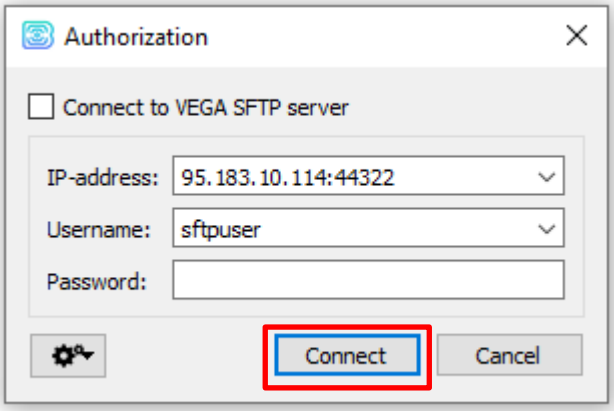
The Configurator program allows remote diagnostics of the device and save the diagnostic results to a file for further sending to a technical support. To do this, go to the "Diagnostic" section and click "Read LOG". Diagnostics can also be done by connecting to the device directly via the USB port, in which case the LOG file will be read much faster. After the download of the LOG-file is completed, it can be saved by clicking on the “Save to file” button.

11 FILE SERVER

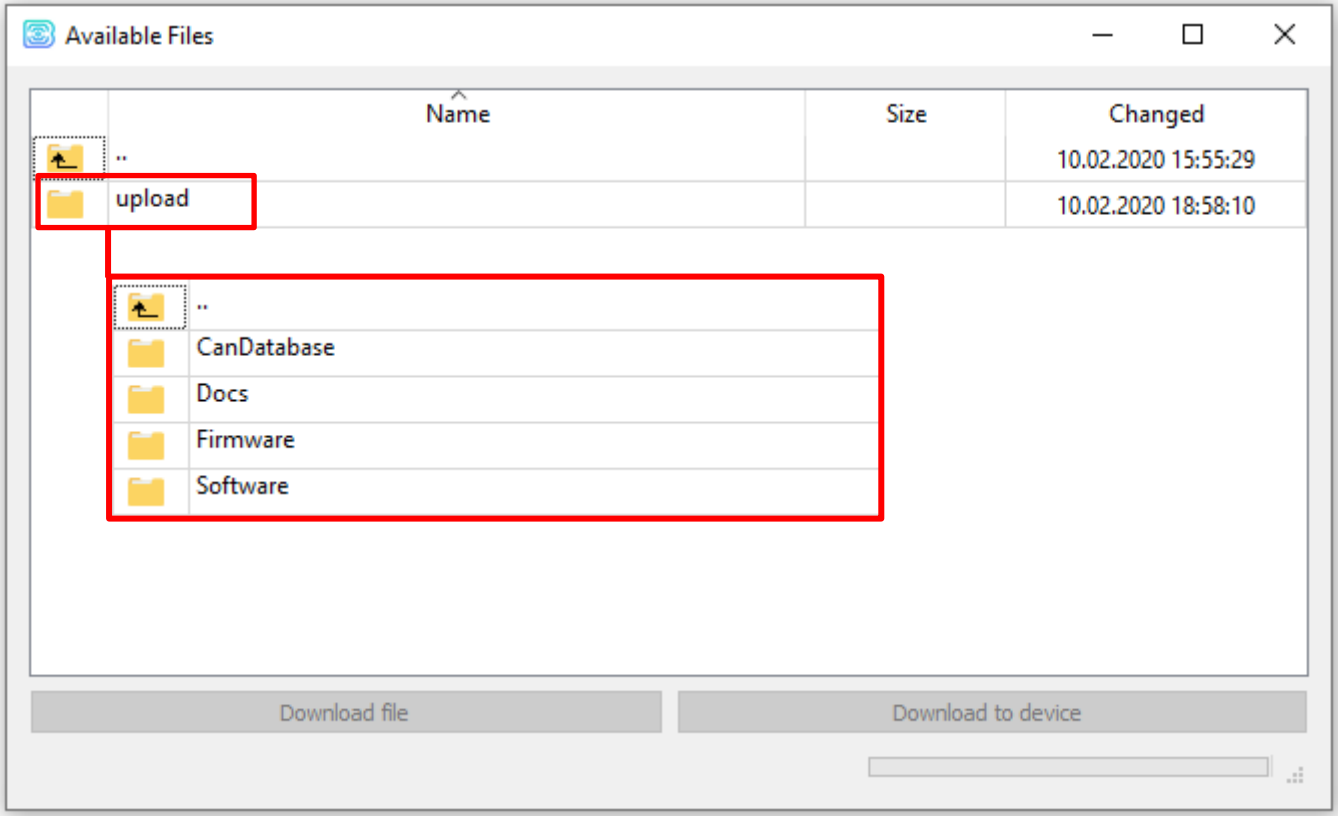
In the "Configurator" program, it is possible to download various files from the VEGA server both to a computer and directly to a connected device. To start browsing the repository, you need to log in to the server. For that, click the "File Server" button.



An authorization window will appear in which all data except the password is entered. Password to access the repository is **temppwd**.



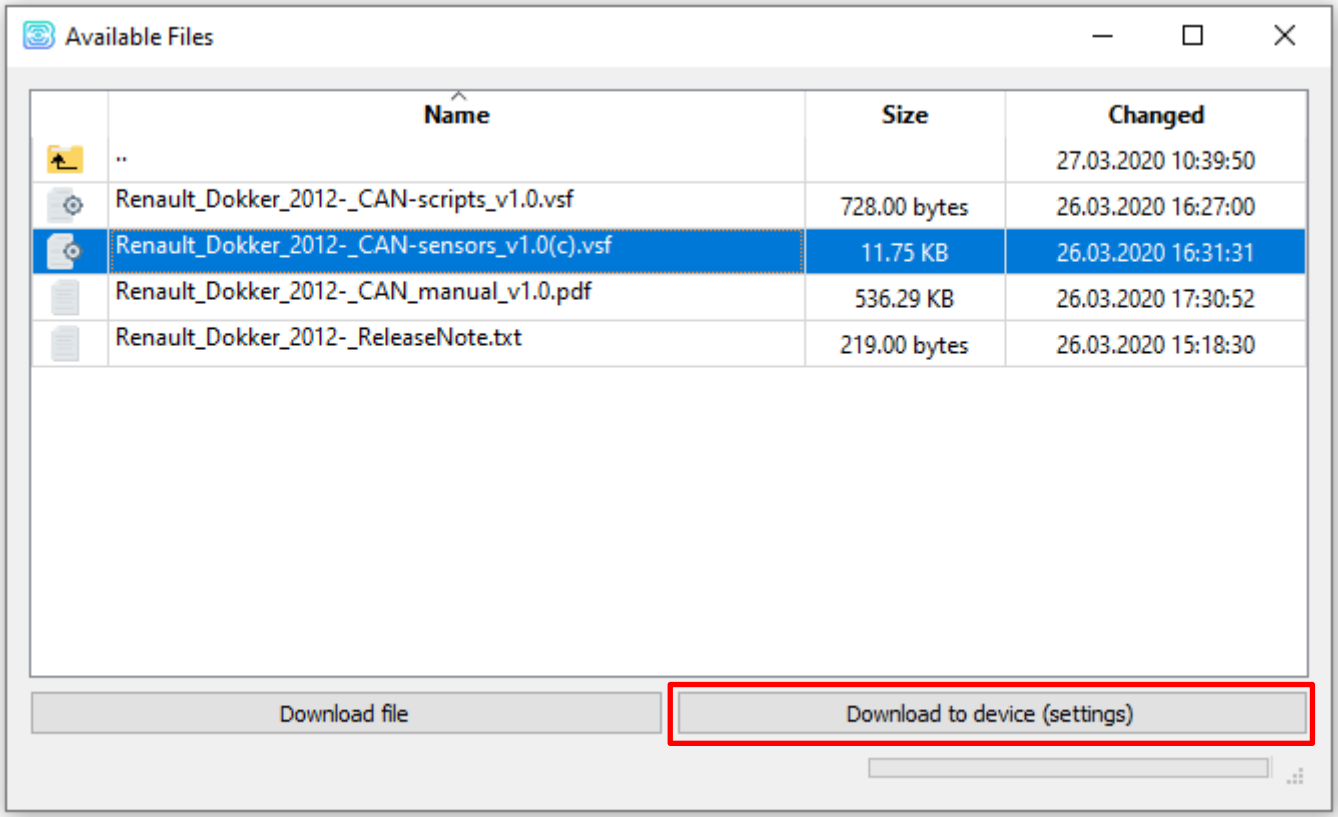
After authorization, a window with storage appears.



In the **upload** folder there are four main folders with the following file types:

CanDatabase

- Ready-made configurations of CAN sensors ("closed") - files marked *sensors* - can be downloaded to the device
- Ready-made configurations of CAN scripts – files marked *scripts* – can be downloaded to the device
- Description for each configuration (description of CAN sensors, description of CAN scripts, CAN connection points) - files marked *manual*



Docs

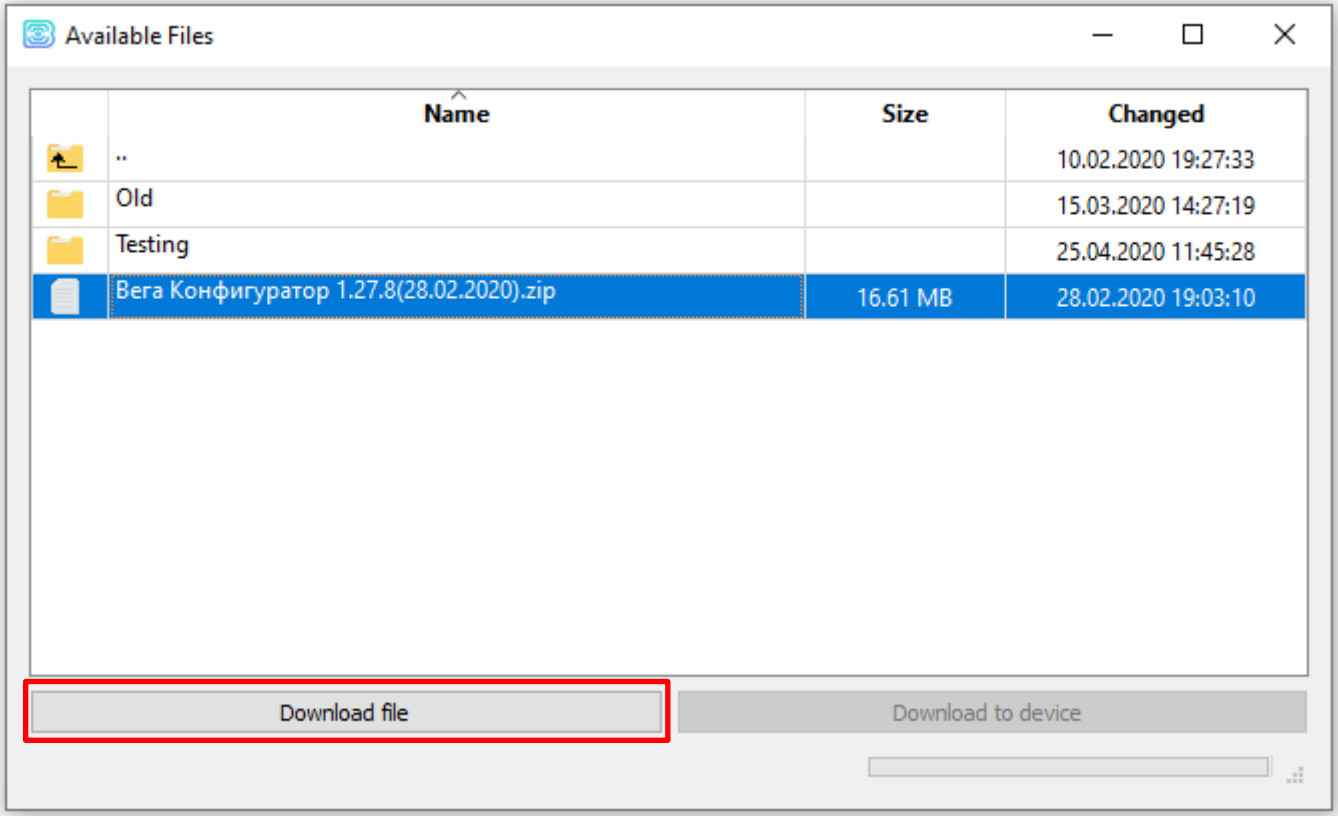
- User Manual
- Exchange protocol description

Firmware

- Actual firmware - located in the root of the folder - can be downloaded to the device
- Old firmware versions - in the *Old* folder - can be downloaded to the device
- Test versions of firmware - in the *Testing* folder - can be downloaded to the device

The test firmware was successfully tested in the office environment but was not tested in the field. Please report all noticed problems with the firmware for their further improvement and re-release

- Required Drivers and Libraries
- Installation files for the Engineering Server
- Configurator (relevant, old and test versions)
- Utility for loading a single configuration onto multiple devices simultaneously

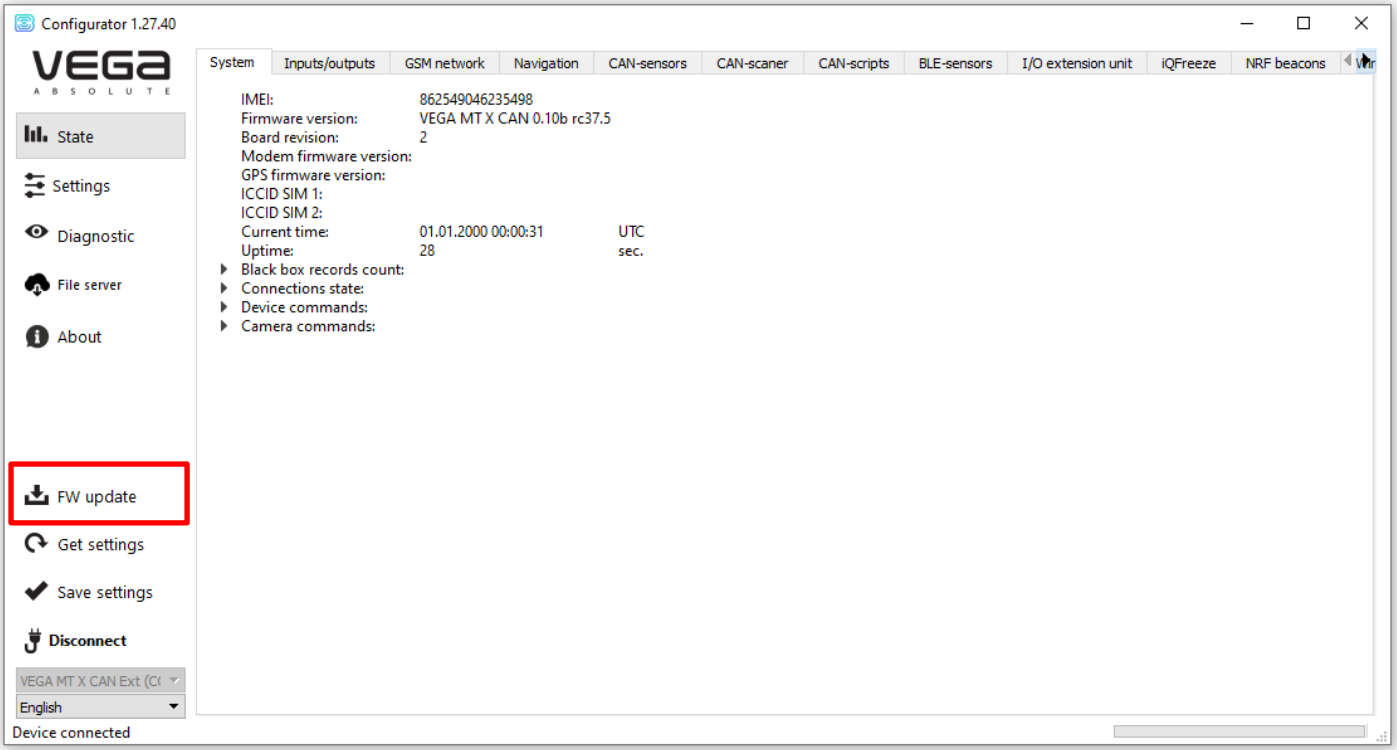


«Download file» – save file on the computer.

«Download to device» – download on the connected device (firmware and settings).

12 FIRMWARE UPDATING

Through the Configurator program, you can update the device firmware (remotely or via USB) using the corresponding file. To do this, click the "Update" button in the lower left corner of the window - a dialog box will appear asking you to select a file with the new firmware file. Select the file and click “OK” - the device firmware will be updated.



Do not turn off the device during a firmware update

13 COMMUNICATION PROTOCOLS

The Vega MT X CAN monitoring device supports several protocols: EGTS, WIALON IPS, WIALON Combine, VEGA, NDTP. The current protocol description is contained in a separate document, which can be found on the website fmsvega.ru.

14 MANAGING USING SMS-COMMANDS

Some settings of the Vega MT X CAN monitoring device can be managed remotely via SMS commands. General command format is @PIN:command, where PIN is a four numbers PIN of the device (See "Security" part). There are also two information commands, in response to which an SMS message with information about the device settings.

Command	Format	Example
nosleep – not switch to the sleep mode	@PIN:nosleep	@5555:nosleep _____ PIN – 5555
reboot – device reboot	@PIN:reboot	@3333:reboot _____ PIN – 3333
tofactory - factory reset	@PIN:tofactory	@1234:tofactory _____ PIN – 1234
bboxclear – clear black box	@PIN:bboxclear	@1234:bboxclear _____ PIN - 1234
setout – set the output state	@PIN:setoutY=Z _____ **Y** – output number **Z** – state (0 or 1)	@4321:setout2=1 _____ PIN – 4321 Output number – 2 State - 1
server – set the server address	@PIN:serverY:addr:port&protocol&period&terminal_addr _____ **Y** – server number **addr** – server address **port** – server port **protocol** – protocol type: off vega – engineering server egts – EGTS server wcombine – Wialon Combine server wips – Wialon IPS server ndtp – NDTP server **period** – communication period with server **terminal_addr** – device address for NDTP or device ID for EGTS protocol	@2222:server3:193.193.165.165:20332&wips&0&90008 _____ PIN – 2222 Server number – 3 Server address – 193.193.165.165 Server port – 20332 Exchange protocol – Wialon IPS Communication period – 0 (constantly in touch) NDTP address or EGTS device ID – 90008

setapn – set APN	@PIN:setapn:apn&user&pass _____ **apn** – APN **user** – username **pass** – password	@1234:setapn:internet.beeline.ru& beeline& beeline _____ PIN – 1234 APN – internet.beeline.ru Username – beeline Password – beeline
info? – current device state request	@PIN:info?	@1234:info? _____ PIN – 1234
server? - request **monitoring server** settings	@PIN:server?	@4444:server? _____ PIN – 4444
runcanscript – run CAN script number X	@PIN:runcanscriptX **X** – CAN number that is needed to run	@4444:runcanscript3 _____ PIN – 4444 CAN script number 3
t:unixtime – set lifetime for the command	@PIN:XXXX/t:unixtime **XXXX** – command for which is needed to set a lifetime **unixtime** – time in UTC when the command will not execute even the SMS with it just comes. For example, we send the command for device rebooting at the 14.00 and set lifetime for that command until 14.10. So if the device receives the command from 14.00 to 14.10 the command will execute as usual, but if the SMS will delayed, will not be delivered immediately etc., and the device receives the command at the 14.15 the command will not execute because lifetime is up. After the time has passed, the message "Execution time has expired" will come	@4444: reboot/t: 1577196600 _____ PIN – 4444 Command – device reboot Lifetime of the command is until 14:10:00 24.12.2019
changesim – change current SIM	@PIN:changesim	@4444:changesim _____ PIN – 4444
changesim1 – change SIM to the first	@PIN:changesim1	@4444:changesim1 _____ PIN – 4444

changesim2– change SIM to the second	@PIN:changesim2 Answer examples: *changesim:2 ok* – command successfully done; *changesim:2 err, already in use* – SIM2 already used.	@4444:changesim2 _____ PIN – 4444

When requesting the current state of the block, a message arrives with the following contents:

Vega MT X CAN v3.10 0.4b – device name and firmware version

imei: 355217043382910 – device IMEI number

lat: 55.1173, lon: 37,9475, - device coordinates (latitude and longitude)

sat inview: 22, - number of visible satellites

sat inuse: 14, - number of satellites used

valid: 1 – validity of certain coordinates (0 – no, 1 – yes)

ign: 0, - ignition (0 – no, 1 – yes)

acc: 4.1, ext: 12.1, - built-in battery and vehicle voltage

temp: 19,5, - environment temperature

move: 0 – moving (0 – no, 1 – yes)

black box: 0, 4, 0, 0 – the number of messages in black boxes in order in the 1st, 2nd, 3rd and 4th.

When you request monitoring server settings, a message appears with the following contents:

server1:

193.193.165.144:20333&wips&0&0

server2:

46.183.183.4:16122&egts&15&43382912

server3:

193.193.154.154:20453&off&0&0

server4:

37.194.197.213:5604&vega&0&0

Here in order are indicated - server address: port & protocol (if enabled) or off (if data exchange with this server is turned off) & communication period in minutes & device address for NDTP or device ID for EGTS protocol.

If you enter an incorrect PIN, the device does not respond to the sender

15 STORAGE AND TRANSPORTATION REQUIREMENTS

Vega MT X CAN devices shall be stored in the original packaging in heated room at temperatures +5°C to +40°C and relative humidity less than 85%.

The device shall be transported in covered freight compartments of all types at any distance at temperatures -40°C to +85°C. After transporting the devices at low temperatures, it is recommended to hold them at room temperature for 24 hours before starting operation.

16 CONTENT OF THE PACKAGE

Content of the package depend on the model of the Vega MT X device.

VEGA MT X INT

Vega MT X Int monitoring device – 1 pc.

Wire connector – 1 pc.

Fuse – 1 pc.

Factory certificate – 1 pc.

VEGA MT X EXT AND VEGA MT X LTE

Vega MT X Ext or Vega MT X LTE monitoring device – 1 pc.

Wire connector – 1 pc.

Fuse – 1 pc.

Factory certificate – 1 pc.

GSM antenna – 1 pc.

GLONASS/GPS antenna – 1 pc.

17 WARRANTY

The warranty period for the device is 3 years from the date of sale. The warranty period for the battery is 12 months from the date sale.

The manufacturer is obligated to provide repair services or replace the failed device during the entire warranty period.

The consumer is obliged to comply with the conditions and rules of transportation, storage and operation specified in this user manual.

Warranty does not apply to:

- the device with mechanical, electrical and/or other damages and defects caused by violation of the transportation, storage and operation requirements;

- the device with traces of repair performed not by the manufacturer's service center;

- the device with traces of oxidation or other signs of liquids leaking inside the device.

In the event of a warranty claim, contact the service center:

113/1, Kirova Str., Novosibirsk, 630008, Russia.

Tel.: +7 (383) 206-41-35.

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