2024

FUEL LEVEL SENSOR NIKOLIN BLE

NIKOLIN
FUEL CONTROL

NIKOLIN

Instructions for setup and connection

01.01.2024

1. PURPOSE AND PRINCIPLE OF OPERATION.

1.1 Assignment

Fuel level sensor FLS.NIKOLIN.BLE (hereinafter referred to as BLE FLS) is designed to measure the level of non-electrically conductive liquids (diesel fuel / biodiesel / kerosene / mineral oil), in accordance with Figure 1.

Field of application - technological accounting in fuel tanks of vehicles, as well as at various stationary objects - diesel generator complexes, boiler equipment, stationary tanks, etc.

Figure 1 - External view of FLS.NIKOLIN.BLE

The BLE FLS converts the calculated fuel level into a digital code and transmits the obtained values via the Escort BLE protocol via Bluetooth radio channel with low power consumption.

The BLE FLS, is a self-powered device, powered by a lithium-thionyl chloride battery, maintenance-free.

The BLE FLS is made in a one-piece molded case of complex shape made of glass-filled polyamide. Through a hole in the bottom of the case the meter is installed, excluding contact of electrodes with each other.

The control board is installed inside the case. The board is fully sealed with Efix polyurethane compound, see Table 1. All electrical connections on the PCB are covered and no part extends beyond the compound fill. The height of the compound over the board elements is more than 3 mm.

Table 1 - Technical characteristics of polyurethane compound.

Mark	Efix 8103
Chemical basis	polyurethane
Polymerization mechanism	hardener
Operating temperature range	-40°C... +120°C
Odor	odorless
Color	Beige
Viscosity	8,000 - 10,000 mPa*s
Adhesive/hardener ratio:	5:1
Open Time	60-70 min.
Initial strength time	240-360 min.
Curing time (100%)	4-5 days
Tensile strength (after 7 days, t=25 °C): aluminum-aluminum	10 N/mm² (minimum gap 0.2 mm)
Shore D hardness (ASTM D 2240)	65

1.2 PRINCIPLE OF OPERATION.

The BLE FLS is based on the capacitive principle of fuel level measurement, the sensing element of which is a capacitor formed by two tubes (external and internal) coming out of the sensor body. When immersed in fuel, the capacitor, which is included in the reference oscillator circuit, changes its capacitance, resulting in a change in frequency in the circuit. The microcontroller measures the frequency in the measuring circuit, performs processing (check of permissible values, filtering, thermal compensation), and outputs the generated value, depending on the type of sensor.

2. TECHNICAL SPECIFICATIONS.

Table 2 shows the technical specifications of the BLE FLS.

Table 2 - Technical characteristics of FLS.NIKOLIN.BLE.

Characteristic	FLS.Nikolin.BLE
Supply voltage, not more than, V	3,6
Output signal type	Digital interface
Operating range (under normal operating conditions in the absence of interference and obstacles when working with the base), m, not less than	10
Digital code	0 to 4095
Interface	Bluetooth LE (BLE)
Data transfer protocol	RKT BLE ESCORT BLE
Present level measurement error, % of sensor length	± 1
Length of working part L, mm	300 – 2000
Overall dimensions, mm	(L+38)x78x78
Continuous operation time	Not limited
Operating temperature range, °C	-40 to +50
Relative humidity of ambient air at temperature not more than +40 °C, %	Not more than 95
The degree of protection of BLE FLS components located on the outer surface of the tank against water penetration is not lower than	IPX7
The degree of protection of BLE FLS components located on the outer surface of the tank against dust penetration is not lower than	IPX6

3. DELIVERY KITS.

Table 3 lists the BLE FLS delivery set.

Table 3 - Delivery set of FLS.NIKOLIN.BLE.

Name	Quantity
Fuel level sensor FLS.NIKOLIN.BLE	1 pc.
Mounting kit	1 pc.
Passport	1 pc.
Packaging	1 pc.

4. OPERATING RULES.

- Installation and operation of the sensor should be carried out by the personnel who have studied this manual;
- Before installing the sensor it is necessary to carry out an external inspection, if there are any mechanical damages (cracks, chips, dents, etc.) it is not allowed to use the sensor;
- Do not supply the BLE FLS with a supply voltage other than that specified in this manual;
- The BLE FLS does not contain any parts that could be a source of ignition;
- Do not disassemble the sensor;
- When mounting the sensor on a vehicle, special equipment or stationary storage object, follow the approved safety requirements (e.g. evaporating the fuel tank of the truck before mounting and connecting the sensor) related to this work according to the type of object to which the sensor is mounted;
- Do not use the sensor to measure the level of electrically conductive liquids (e.g.: water, dairy products);
- After installing the BLE FLS on the vehicle, it is recommended to seal the sensor;
- The sensor should be installed with the transmitter facing the receiver.

5. TRANSPORTATION AND STORAGE.

1. BLE FLS shall be stored in a storage facility in a package at ambient air temperature from minus 50 °C to plus 40 °C and relative humidity up to 98 % before putting into operation.

2. The sensor should be transported at air temperature from -50°C to +40°C and relative humidity not more than 98% at +25°C.

6. DISPOSAL.

1 The product must be disposed of by the operating organization in accordance with the regulations and rules established in the country.

2. The BLE fuel level sensor includes parts that must be disposed of specifically due to potential environmental damage.

3. The device does not contain precious metals in quantities that require accounting.

7. INSTALLING THE SENSOR.

7.1 Installation procedure

1. Select the place of sensor installation. It is recommended to install the BLE FLS as close as possible to the geometric center of the tank, avoiding contact with the partitions inside the tank, as well as elements of the fuel intake and the standard fuel level sensor, in order to avoid fuel fluctuations during driving and parking on the clone, in accordance with figure 2. When installing BLE FLS in tanks of complex shape, it is necessary to install the sensor in the deepest part of the tank. In tanks of large volumes (L=2*H), it is recommended to install two remote control units diagonally, according to figure 3.

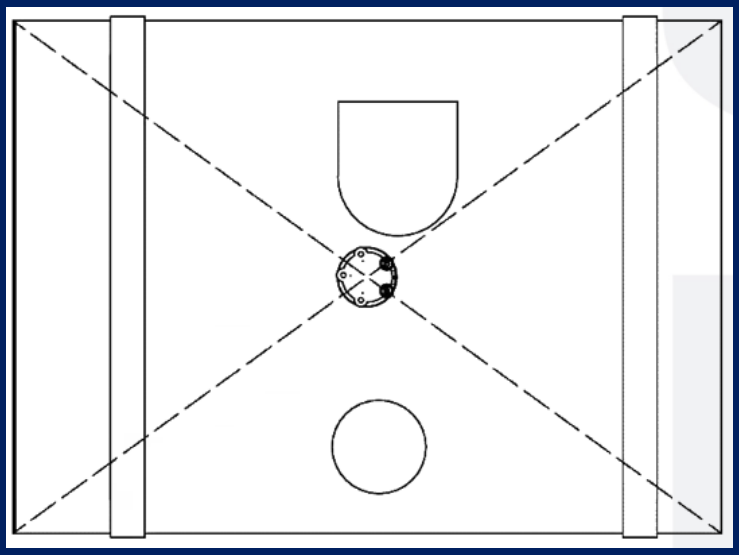


Figure 2 - Installing the BLE FLS in the center of the tank

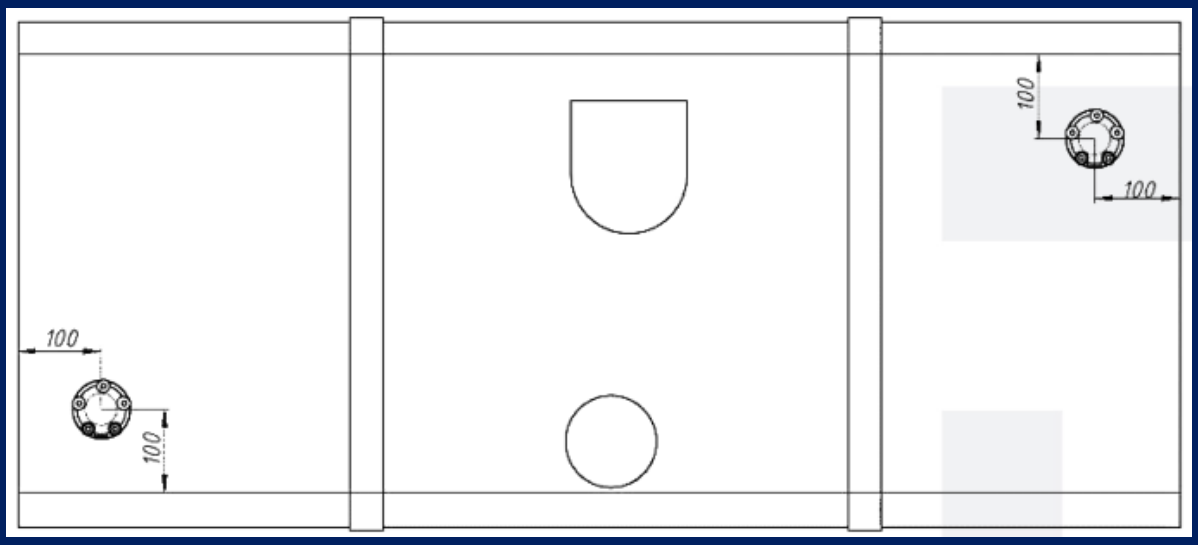


Figure 3 - Installation of two BLE FLS on the edges of the tank

2. Drill a center hole with a diameter of 32 - 35 mm for mounting the sensor, according to Figure 4.

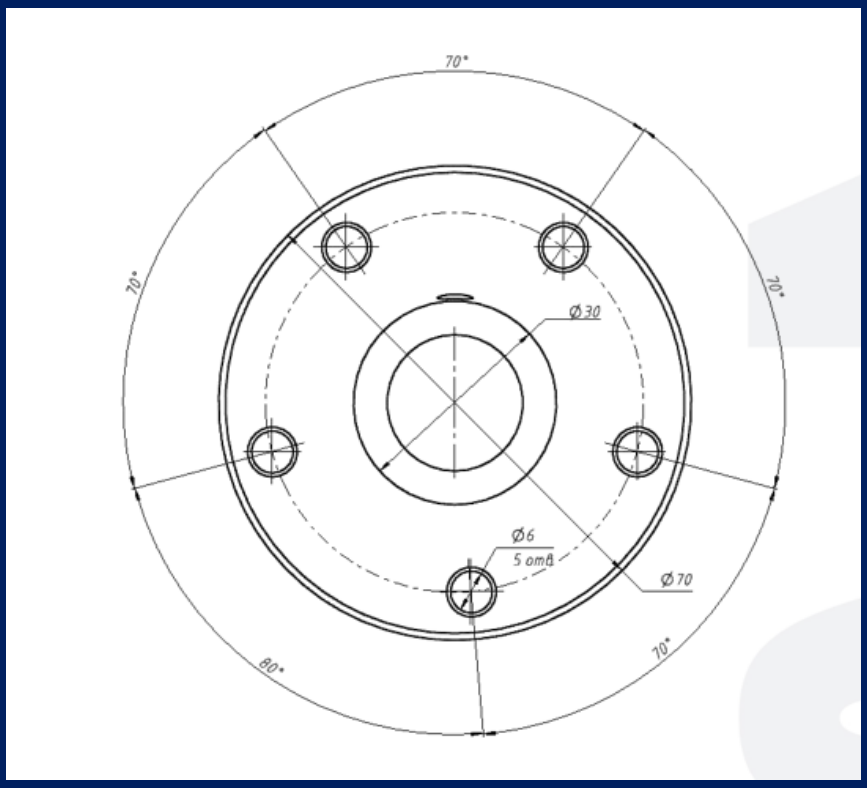


Figure 4 - Dimensional view of the bottom of the transducer head

Note - before drilling holes, the fuel tank on diesel engine vehicles must be fully filled! The fuel tank on vehicles with gasoline engine must be evaporated or completely filled with water!

3. Cut the sensor to the required height. To avoid water and dirt getting into the measuring part of the sensor it is necessary to cut the BLE FLS 20 mm shorter than the tank height in the place of installation, according to Figure 5.

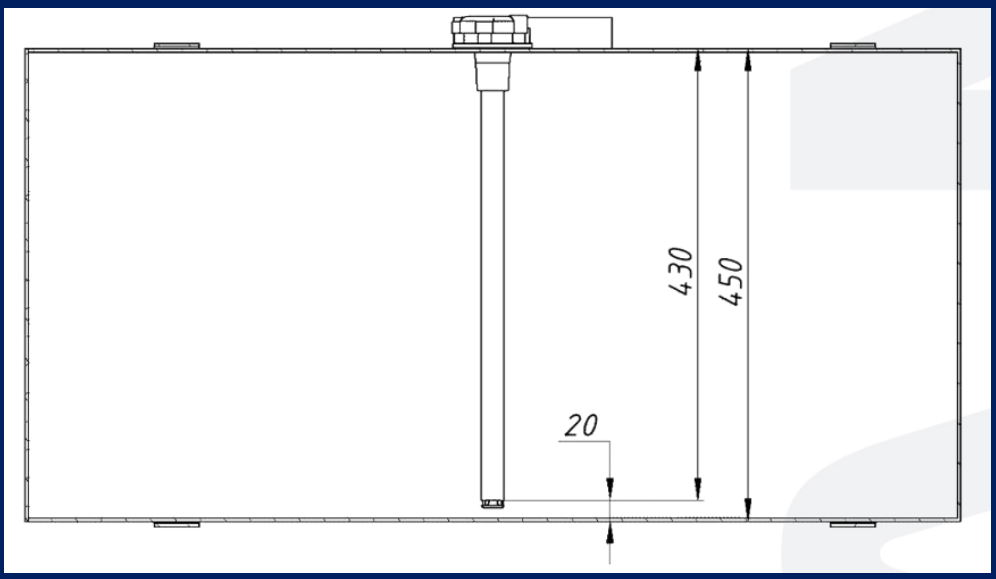


Figure 5 - Trimmed BLE FLS mounted on a fuel tank

4. Thoroughly clean the aluminum filings between the spigots.

5. Insert the retainer supplied with the sensor into the end of the tubes according to

Figure 6. In order to avoid short-circuiting of the measuring element connections and their damage from vibration during operation.

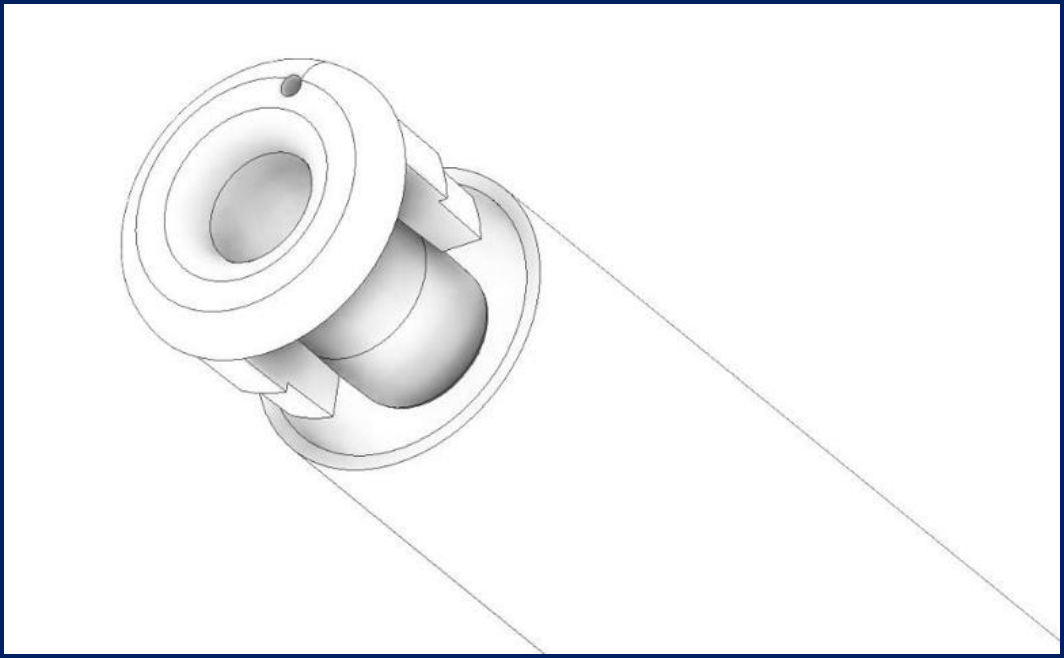


Figure 6 - Image of the retainer

6. Connect and configure BLE FLS (see chapter 8).
7. Calibrate the BLE FLS (see Chapter 8).
8. Install the sensor in the center hole and fasten it with self-tapping screws.
9. Sealing the BLE FLS mount.

8. CONNECTING AND SETTING BLE FLS.

8.1 Connecting to BLE FLS

Before trimming the BLE FLS to the required height for installation in the tank, it is necessary to connect to the sensor via the mobile app to check its functionality.

To connect to the BLE FLS via a mobile device, you need to enable Bluetooth and location on your phone. Bluetooth on the sensor is already enabled.

After that, open the «RFL» application pre-installed on the mobile device, as shown in Figure 7.

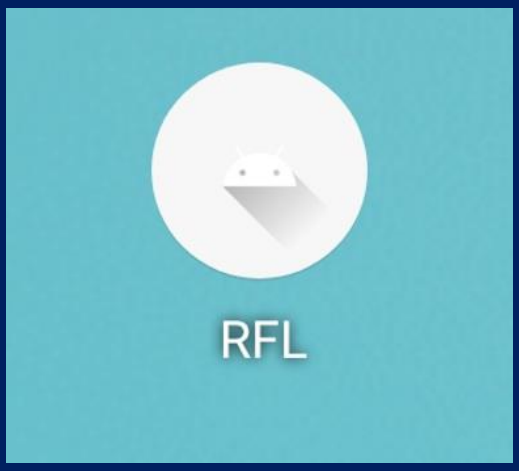


Figure 7 - Application on mobile device «RFL»

In the «RFL» application find the BLE FLS by its name and connect to it by pressing «CONNECT» according to figure 8. The sensor name is taken from the BLE FLS housing.

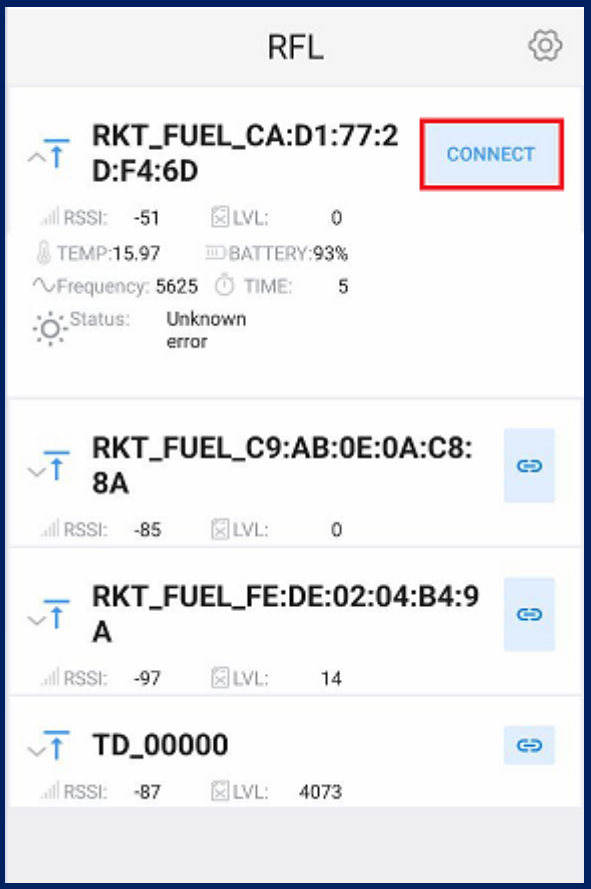


Figure 8 - Connecting to the BLE FLS

If the BLE FLS is correct and it is possible to connect to it, the «RFL» application will open the sensor configuration window according to Figure 9.

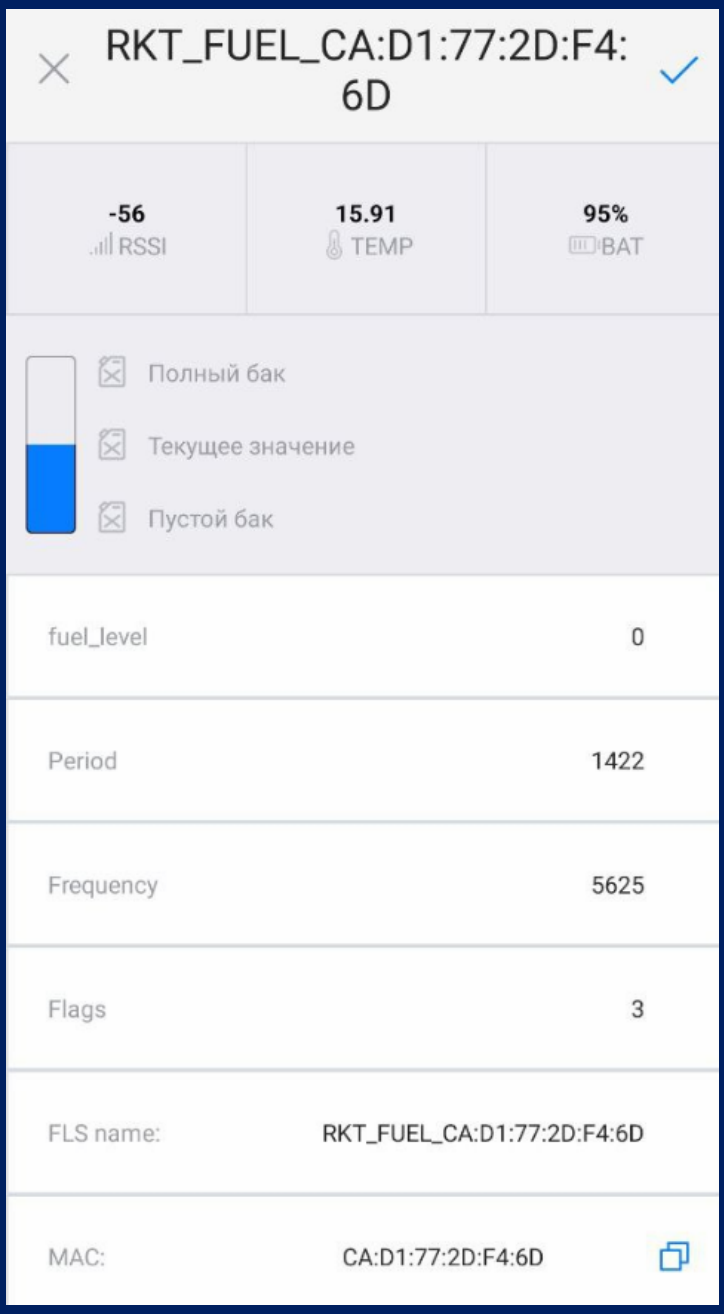


Figure 9 - BLE FLS setup window

After making sure the sensor is good and responding you can trim the «BLE FLS» to the desired tank height.

8.2 SETTING BLE FLS.

Once the BLE FLS has been trimmed to the proper height to install it in the tank, the initial setup of the BLE FLS must be done.

8.2.1 Calibrating BLE FLS to full and empty

The initial setup is to calibrate the BLE FLS to full and empty. To do this, in the mobile application «RFL» find the «Calibration» column, according to Figure 10.

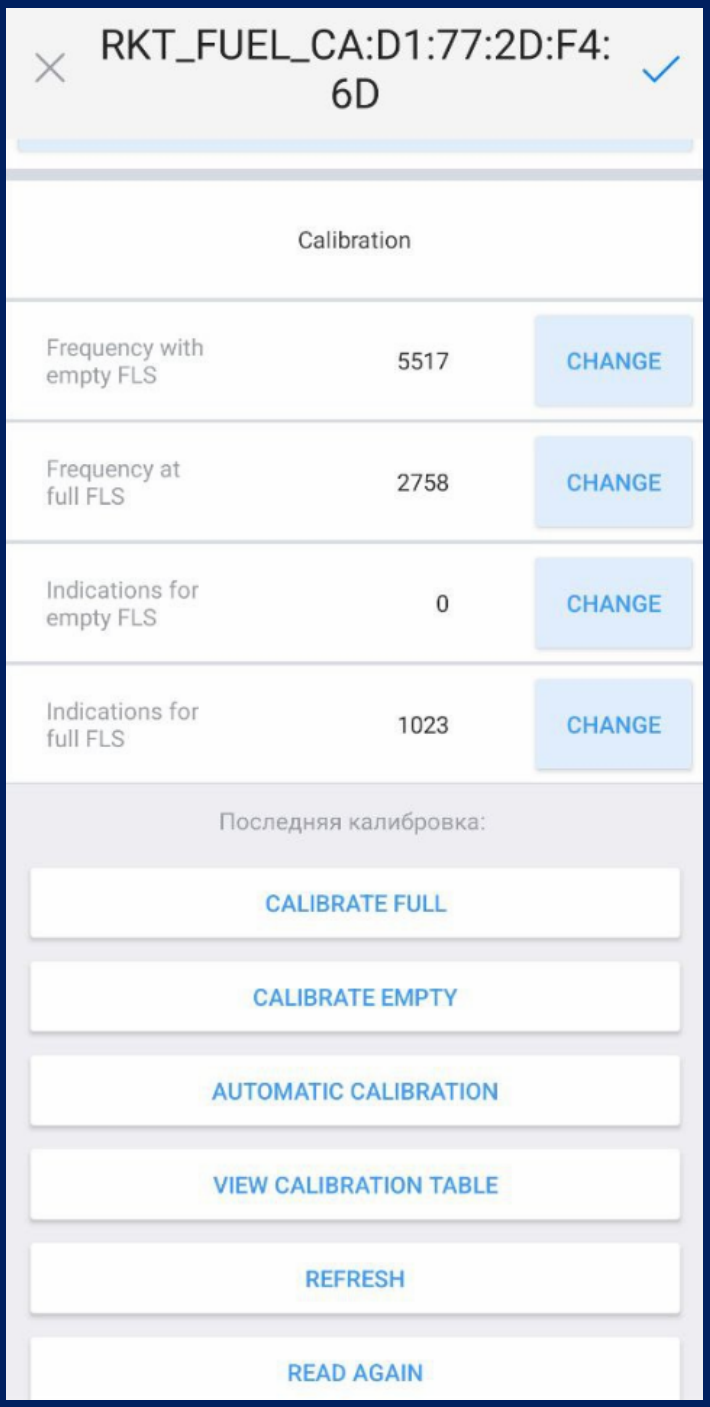


Figure 10 - Sensor calibration column

Start calibrating the «empty», for this purpose press «CALIBRATE EMPTY», enter the value «0» and press «OK», according to figure 11.

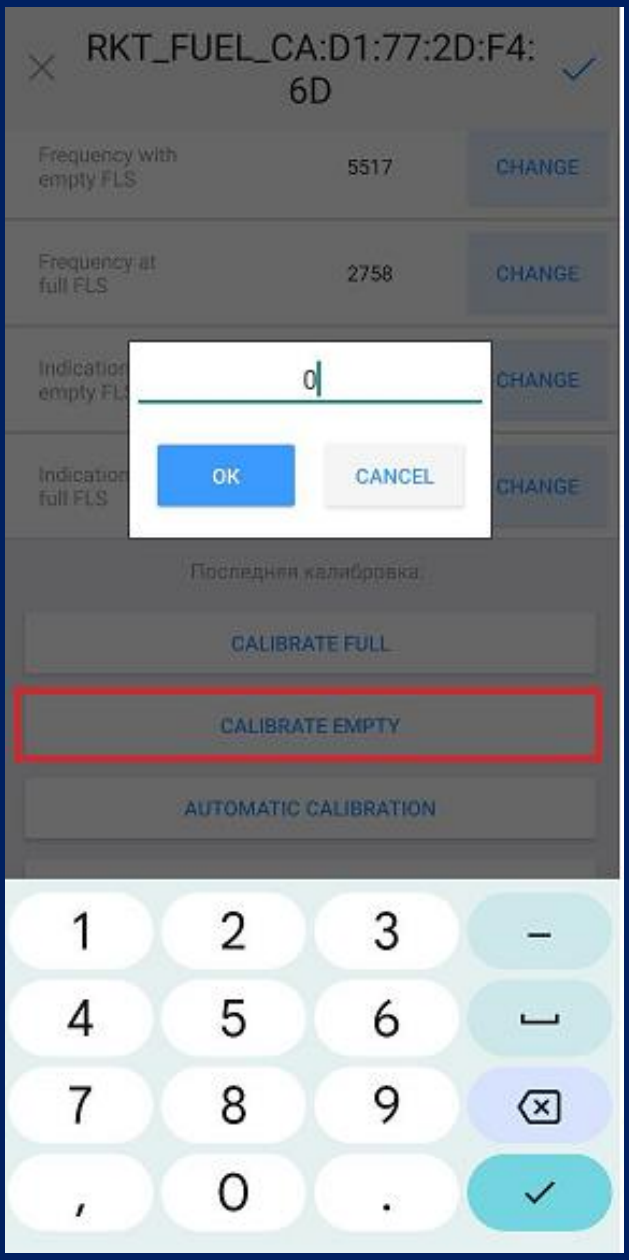


Figure 11 - Calibrating an empty

After that, it is necessary to cover the hole on the BLE FLS body with tape and pour fuel into the sensor tube until it is full. Then in the mobile application press «CALIBRATE FULL». In the window that appears enter the value «1023» or «4095» and press «OK», according to Figure 12.

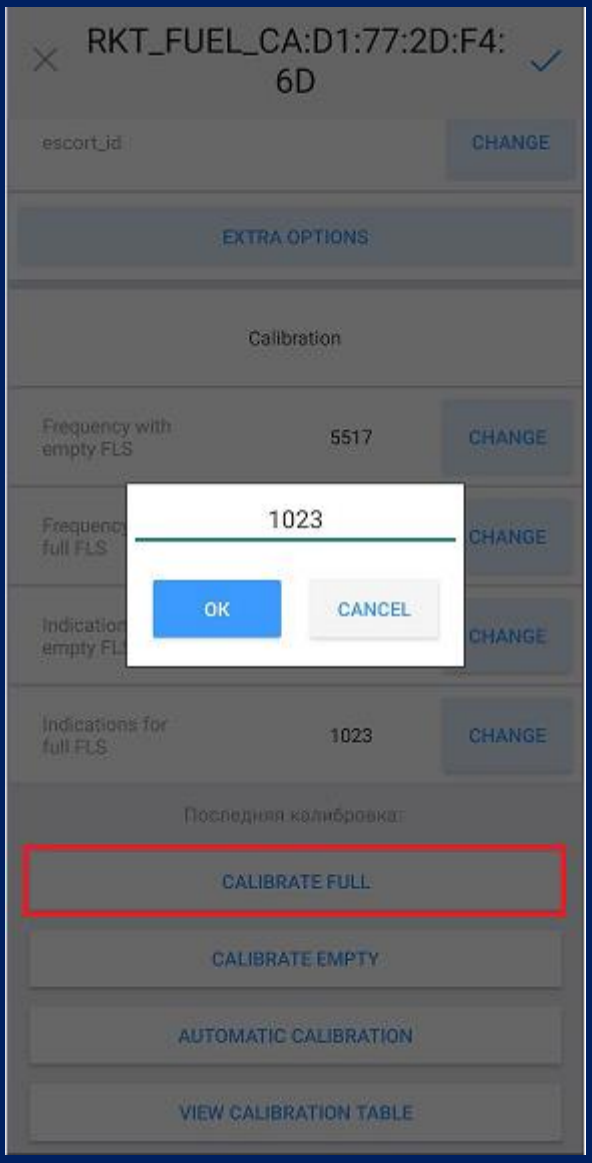


Figure 12 - Calibrate full

Afterwards, the fuel must be completely drained from the sensor.

8.2.2 BLE FLS Calibration

After having calibrated the BLE FLS for empty and full, it is necessary to install it in the tank. After installing the sensor, it is necessary to drain all fuel from the tank, if any.

After that we start calibrating the BLE FLS. To do this, feed fuel into the tank in equal portions and record the level values. It is necessary to record the values in excel table, indicating the number of liters in the tank and the corresponding level value from the mobile application «RFL».

Knowing the approximate amount of fuel in the tank, it is necessary to divide this value in liters by a number from 20 to 30 to get the amount of fuel supplied in one portion. So, we feed fuel into the tank and record its level value at each portion and enter the obtained data into the table.

After the calibration is completed, in the «RFL» application in the «FLS parameters» column, check the «Escort emulation» box, as shown in Figure 13.

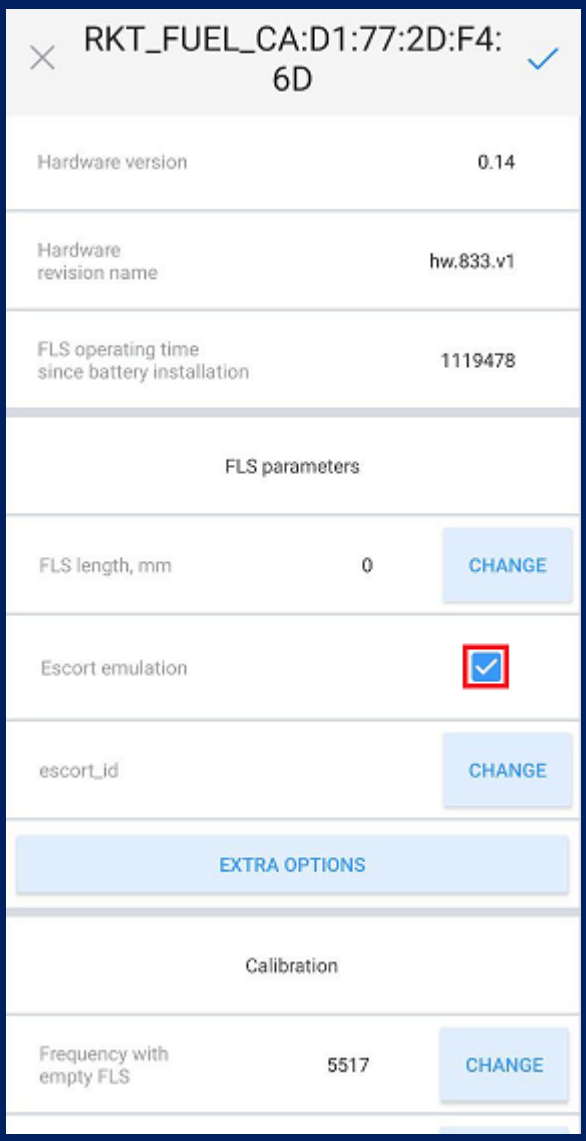


Figure 13 - Setting emulation «escort»

Then click on «CHANGE» against «escort_id» and in the window that appears specify «1» and click on «OK», if one BLE FLS is used, according to Figure 14. In case two or more sensors will be used, set an individual «escort_id» for each sensor, starting from one and ascending.

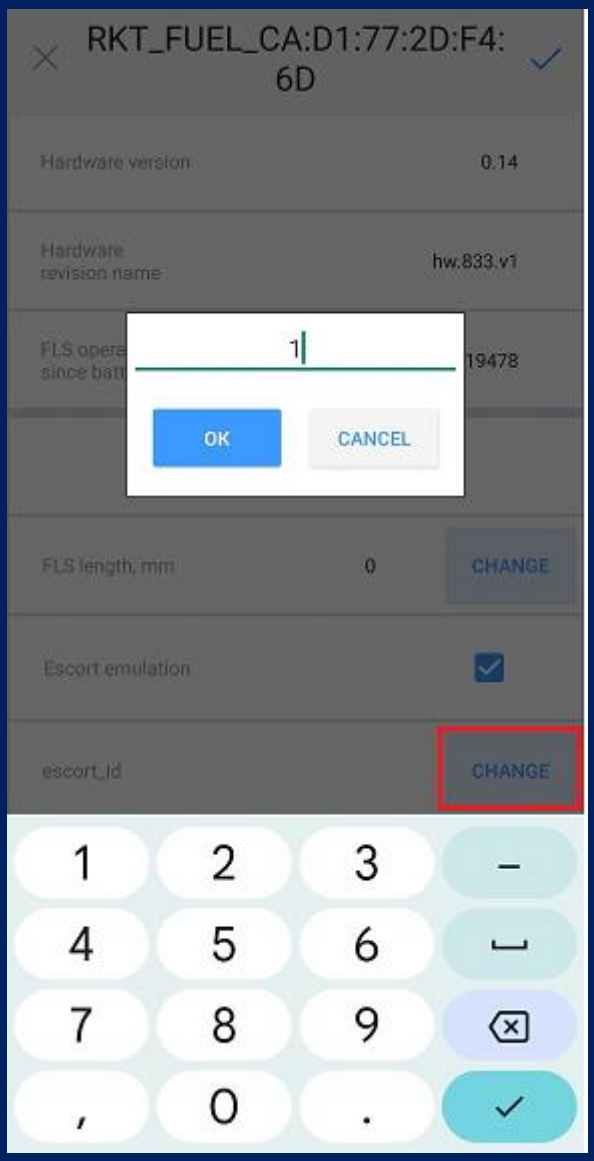


Figure 14 - Setting escort_id

Then click on «EXTRA OPTIONS» and in the window that appears in the column «Data averaging» enter the value «50», according to Figure 15.

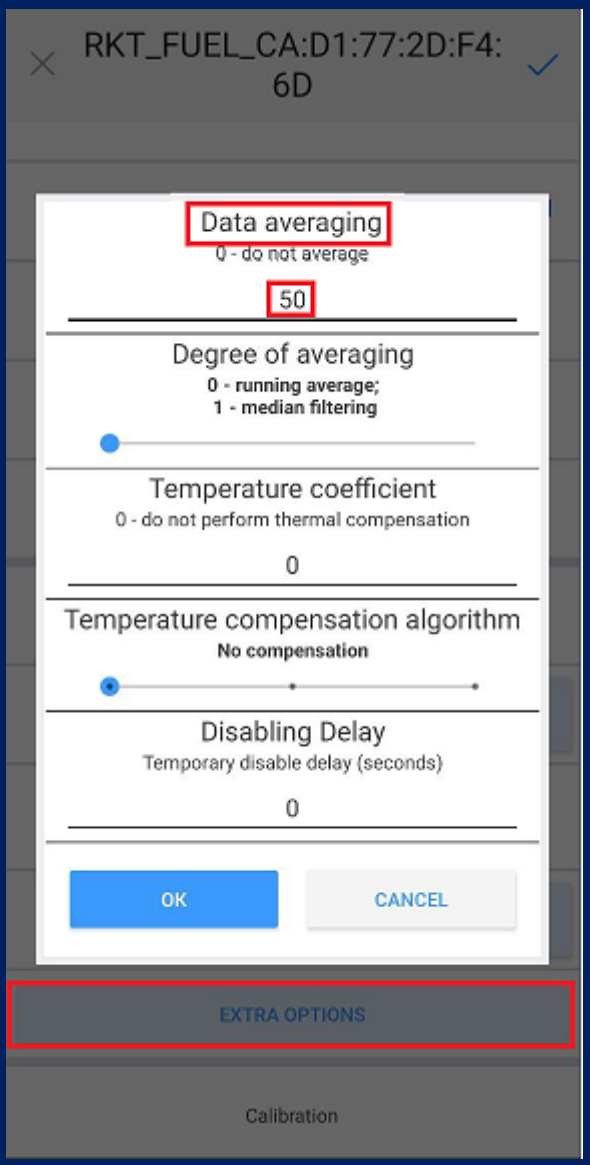


Figure 15 - Entering data averaging

After entering, press «OK» and press «SAVE CHANGES». Then press «DISCONNECT» and you will see the «BLE FLS» configured in green, as shown in Figure 16.

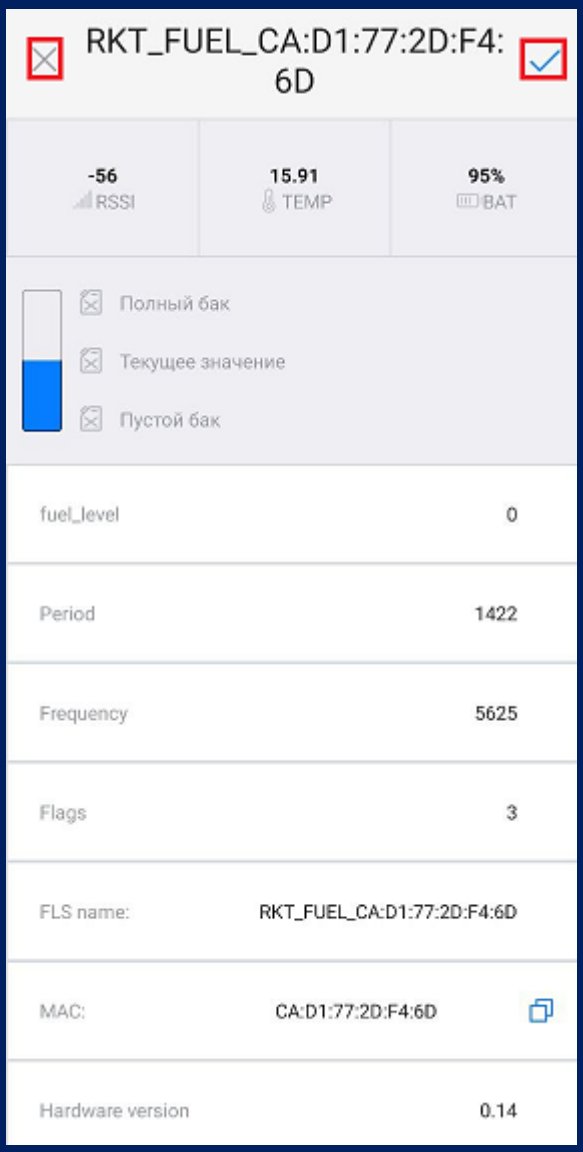


Figure 16 - Saving BLE FLS changes and disconnecting from the sensor.

After we disconnected from the sensor, we can see the configured BLE FLS with the name «TD_000001», according to Figure 17. The name can be changed by changing the «escort_id», see Figure 14.

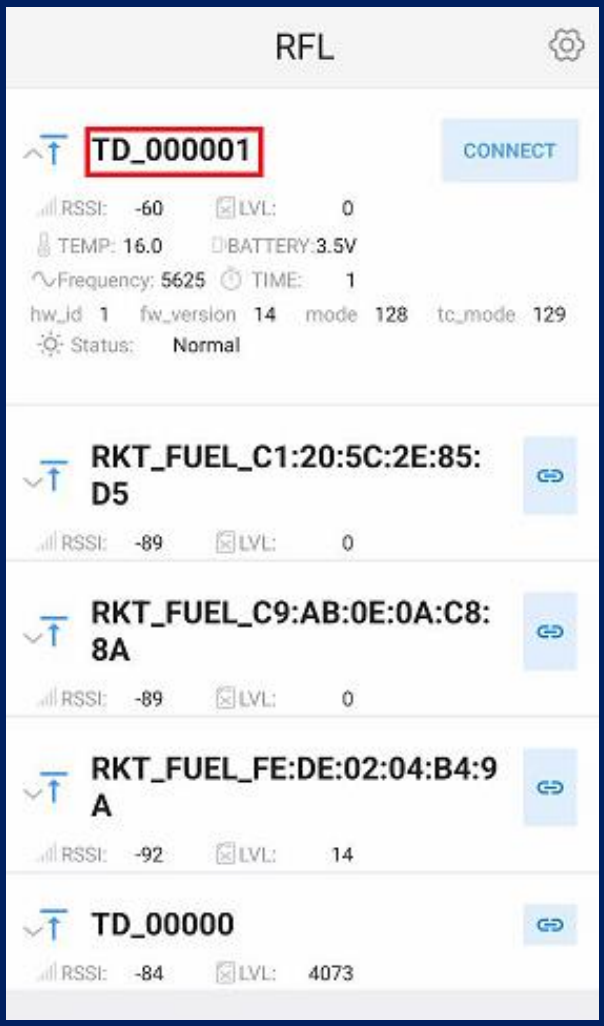


Figure 17 - Configured BLE FLS

Next it is necessary to connect BLE FLS to the tracker, as well as to write the table with calibration values to the tracker.

9. CONNECTING BLE FLS TO THE TRACKER.

Let's consider BLE FLS connection, by the example of connection to the tracker «SMART S-2423» by «Navtelecom» LLC. In order to connect the sensor to the tracker, you must first turn on the laptop with the installed software «NTC Configurator», in accordance with Figure 18, and connect the cable from the laptop to the tracker. It is also necessary to connect the tracker to the on-board system of the car beforehand.

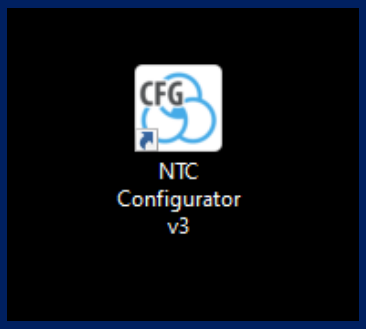


Figure 18 - NTC Configurator laptop software

Open the software on the laptop and check the tracker device type and its IMEI. Data from the tracker case and data from «NTC Configurator» software should match, according to Figure 19.

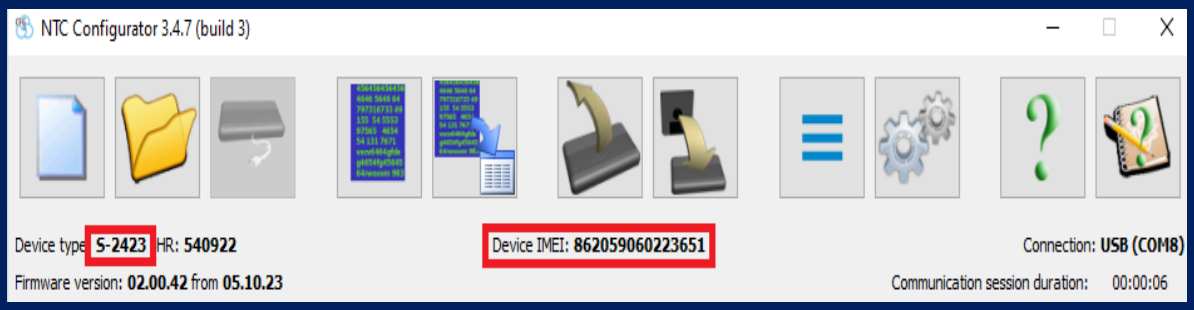


Figure 19 - Starting the «NTC Configurator» software

Open «Read device configuration», according to Figure 20.

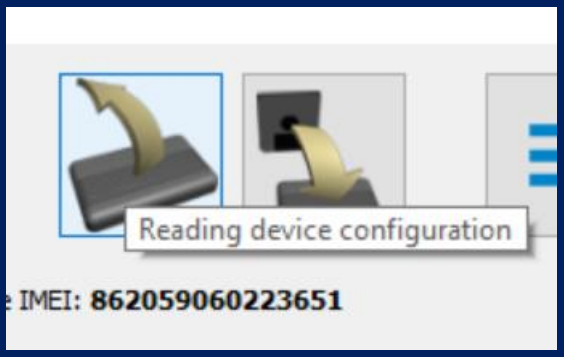


Figure 20 – Reading device configuration

In the window that appears, click the «Bluetooth» tab, as shown in Figure 21.

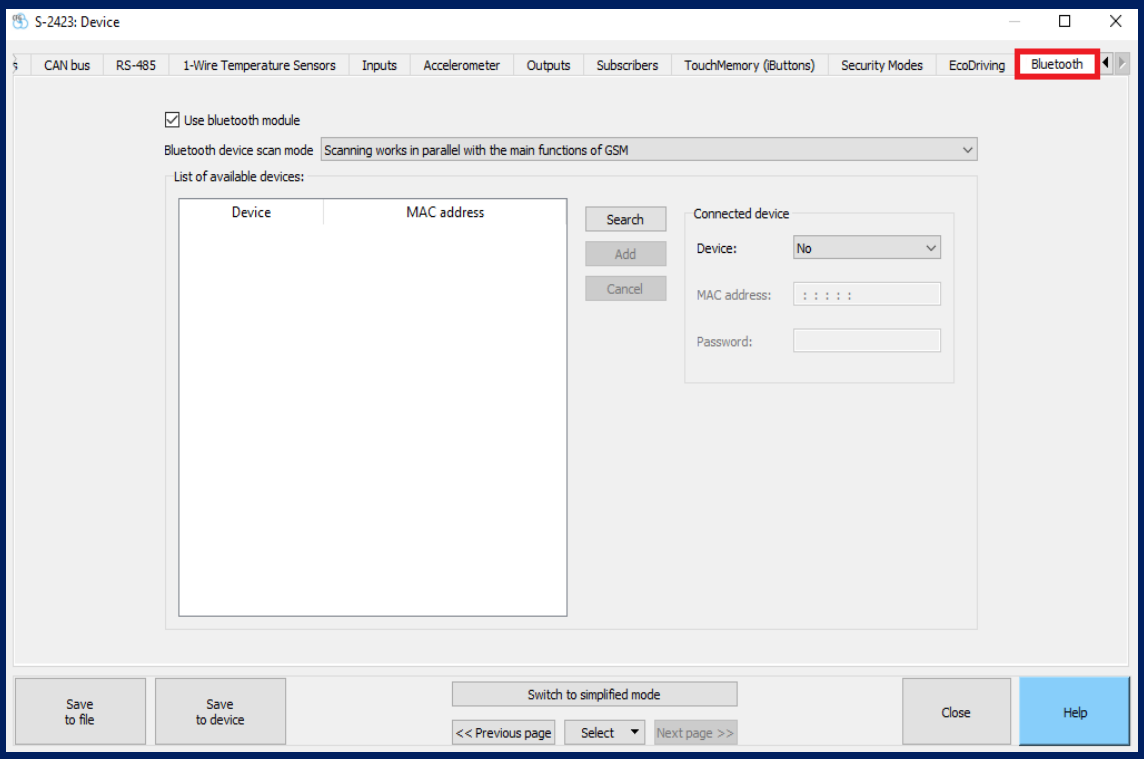


Figure 21 - The «Bluetooth» tab

Then find «Connected device» in the «Device» type, select «Sensors» and click on «Search» as shown in Figure 22.

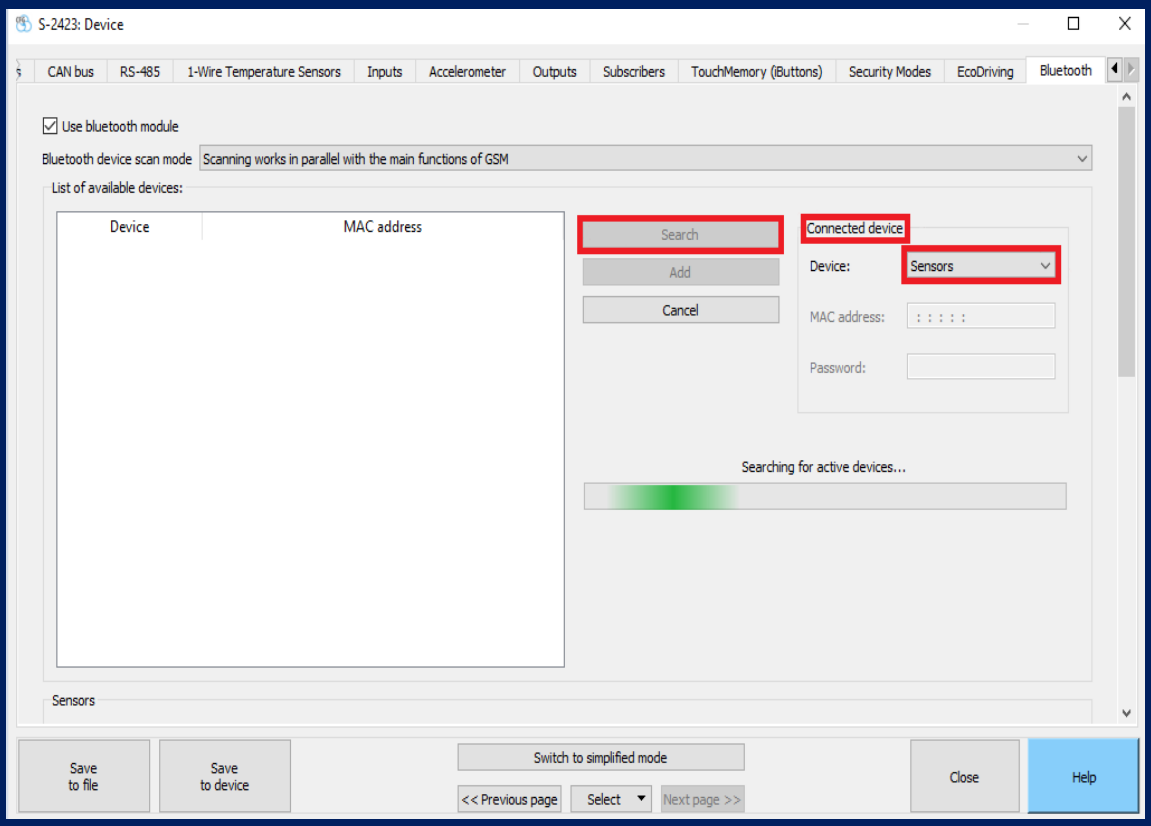


Figure 22 - Searching for BLE FLS

When the search is completed, we will observe devices in the vicinity with «Bluetooth» enabled. Among the list of available devices find our BLE FLS by name and MAC-address. Select the BLE remote control to be connected to the tracker and click «Add» as shown in Figure 23.

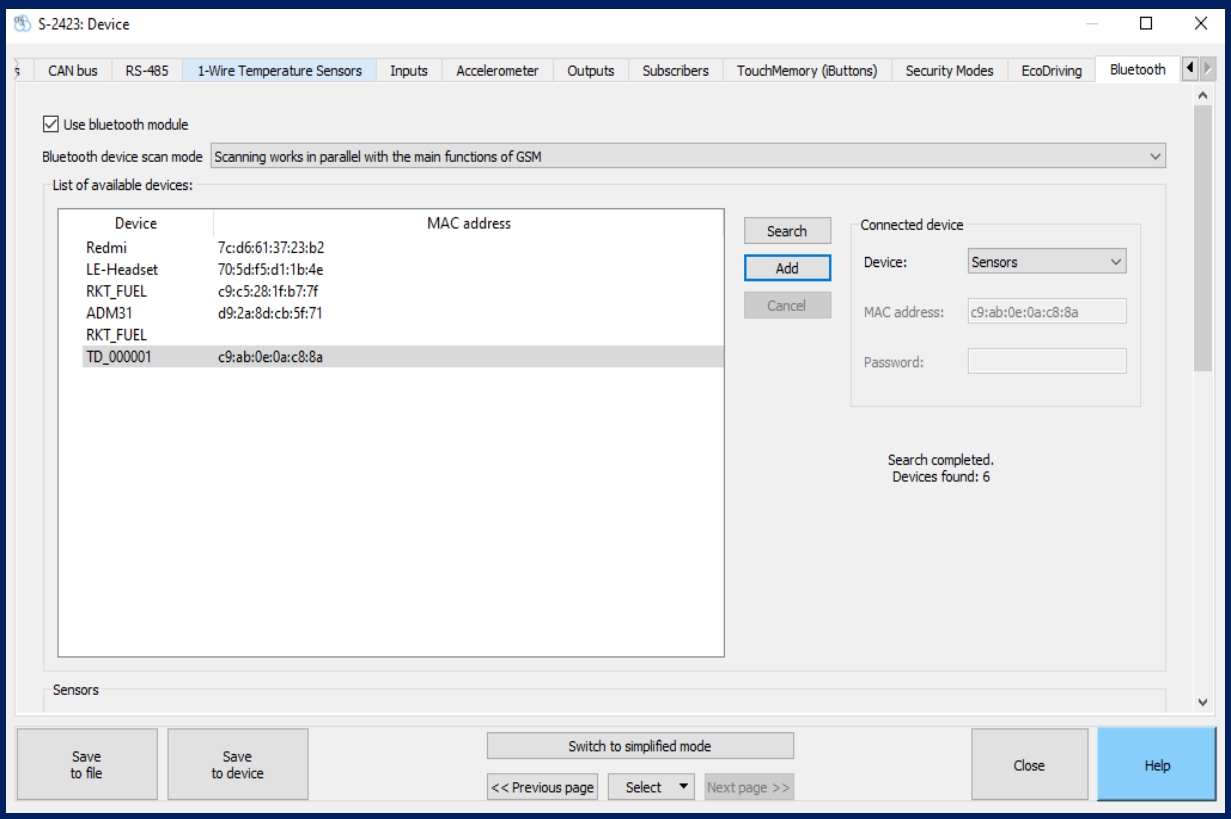


Figure 23 - Adding a BLE FLS

In the «Bluetooth» tab, go down to the «Sensors» column and in the «Sensor 1» item configure BLE FLS, according to Figure 24.

First, select «Fuel level sensor» in the «Sensor TYPE» field and enter the MAC address in the «MAC address» field. Then in the additional settings set «ESCORT TD» and «Fuel level sensor 1» for the fields «Fuel level sensor type» and «Transfer as» espectively.

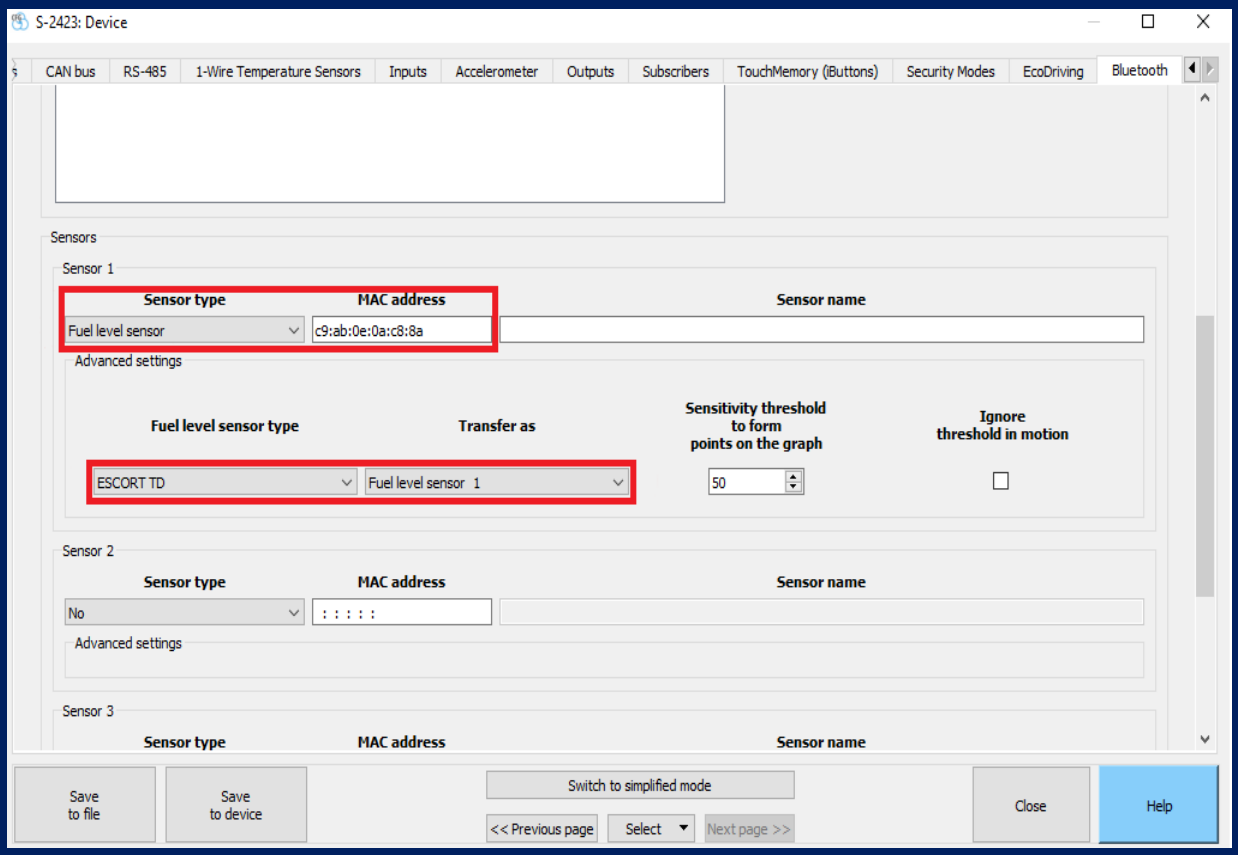


Figure 24 - Setting BLE FLS in the «Sensors» column

After configuring the BLE FLS, click «Save to device» and in the first window that appears click «Yes» and in the second window click «OK», according to Figure 25.

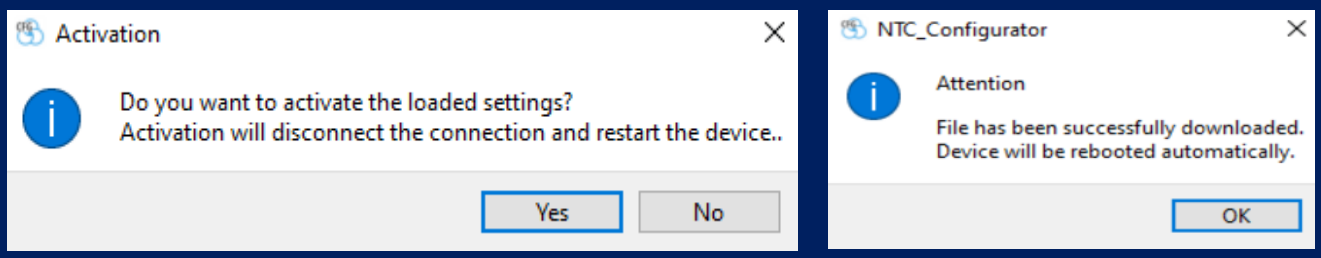


Figure 25 - Loading settings

After loading the settings go to the «Protocol settings» tab and open «Fuel level sensor RS-485/BT». In the window that appears, at the intersection of the line «Sensor 1» and the column «Level and temperature» check the boxes according to Figure 26. When the configuration is completed, click on «Save to device».

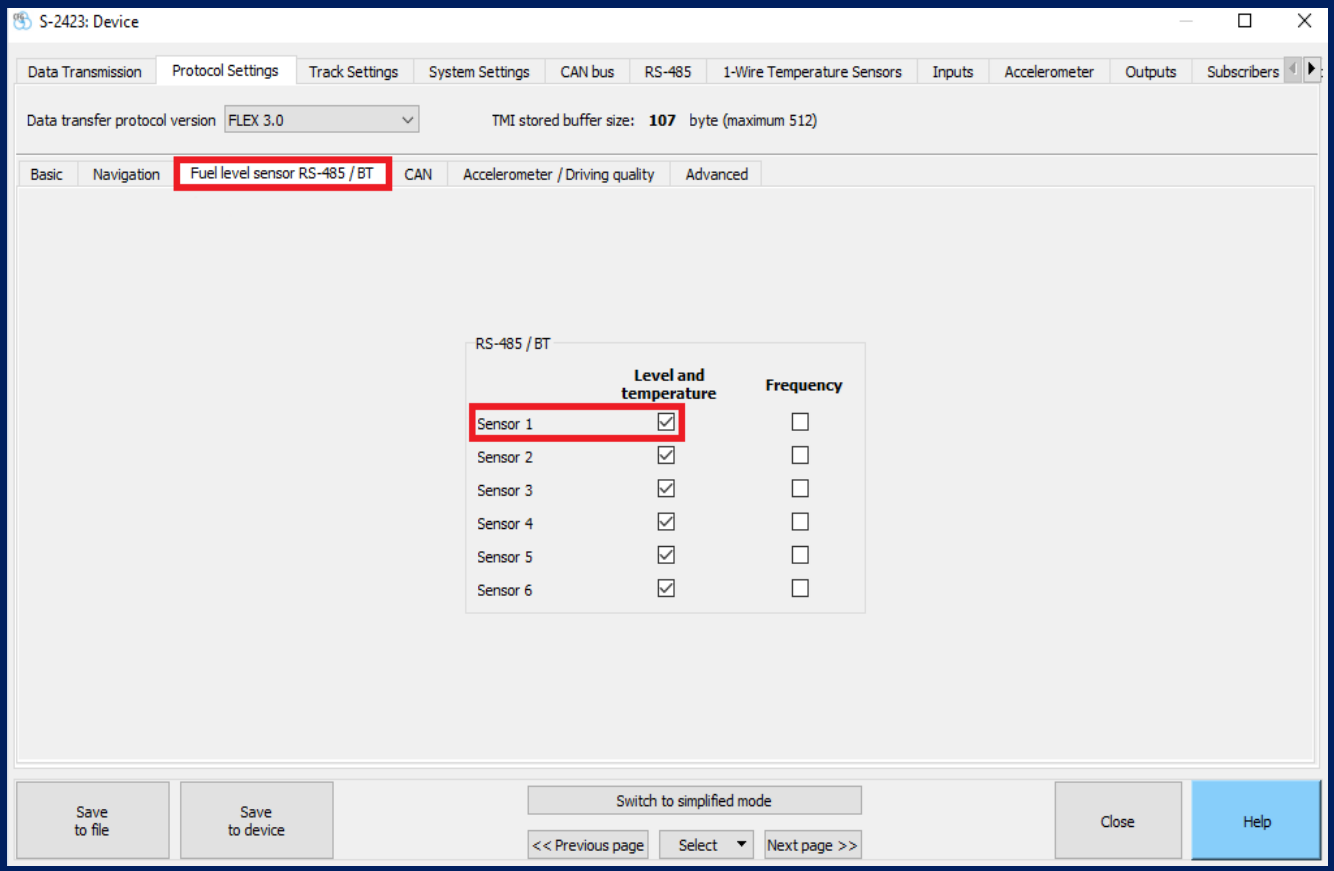
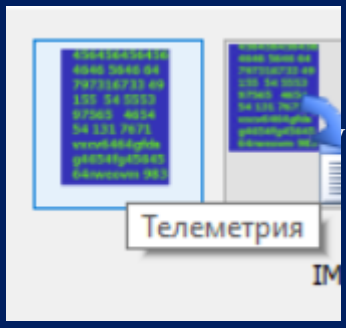


Figure 26 - Configuring the display of BLE FLS parameters

The next step is to open «Telemetry» in the program «NTC Configurator», according to Figure 27.



In the window that appears, open the «Fuel level sensors» tab, where you can observe fuel level and temperature readings, according to Figure 28.

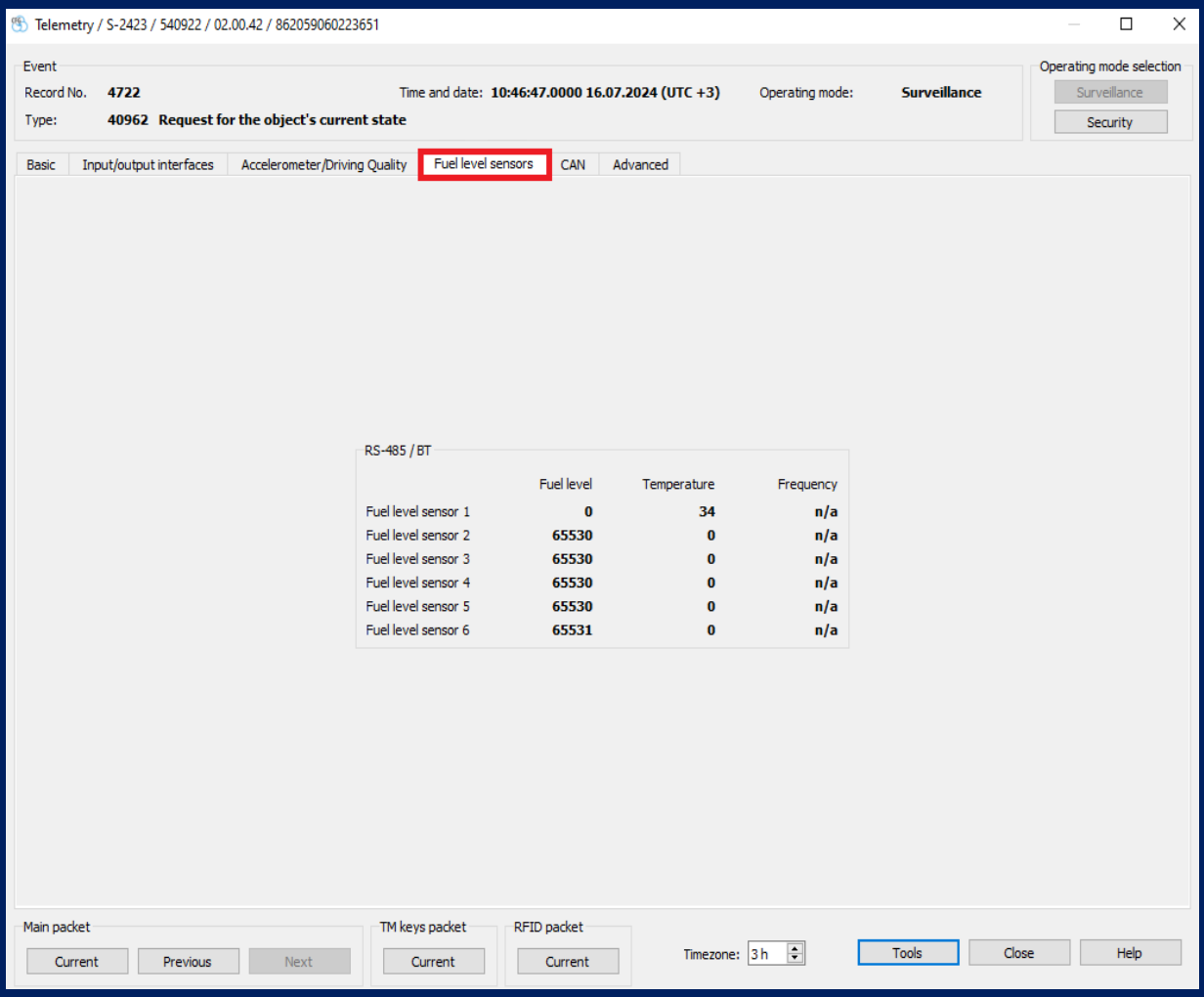


Figure 28 - Checking BLE FLS operation.