



NEOMATICA

**Wireless multifunctional sensor
ADM35/ADM35H**

Operation manual

edition 1.1

EAC

Neomatica LLC, +7 (342)2 111 500, <http://neomatica.com>

This Operation manual relates to the wireless multifunctional sensor ADM35 (hereinafter referred to as sensor) and wireless multifunctional sensor ADM35H (hereinafter referred to as sensor). The manual describes sensor operation, procedure of its installation and its integration with the monitoring system using the related tracker from the devices manufactured by Neomatica LLC.

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

Sensor proper work can be guaranteed if it is installed and set by qualified professionals. To use the sensor properly it is necessary to familiarize with the monitoring system work principles in general and to understand the function of all its components

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1 Application

The sensor is used for being installed on moving and stationary objects to measure temperature, illumination and humidity (only for ADM35H), presence of magnetic field.

2 Technical features

The ADM35 model (figure 1) measures temperature more accurately, its temperature measuring element has higher protection from moisture, but the model does not contain a measuring element to measure the level of relative humidity.



Figure. 1 - View of the sensor

The ADM35H (figure 2) model contains a measuring element that measures relative humidity level, but the accuracy of temperature measurement is less than that of ADM35.



Figure. 2 - View of the sensor

2.1 Technical features of ADM35

- Operating temperature: from - 40°C up to + 85°C;
- Margin of error for temperature measurement: $\pm 0,3^{\circ}\text{C}$;
- Range of illumination measured: 0,01 lux... 83000 lux;
- Type of Hall detector: discrete, omnipolar;
- Frequency range of radio interface: 2400..2483,5 MHz;
- Transmitter power: up to +8 dBm;
- Receiver sensitivity: -96 dBm;
- Data exchange technology: Bluetooth Low Energy (BLE),
Bluetooth Low Energy Long Range (BLE Long Range);
- Coverage in the mode of BLE: up to 100 m in line-of-sight;
- Coverage in the mode of BLE Long Range: up to 500 m in line-of-sight;
- Number of stored records: 19700;
- Battery: ER14505 3,6V 2700 mA/h;
- Operation time with one battery: up to 3 years;
- Housing: IP65;
- Housing materials: polycarbonate;
- Material of detector: stainless steel;
- Dimensions, mm, not more than: 129 (73 without detector) x 68 x 32;
- Mounting seat size, mm, not more than: 73 x 68;
- Weight: not more than 105 g

2.2 Technical features of ADM35H

- Operating temperature: from - 40°C up to + 85°C;
- Measurement error of temperature:
 - ±0,4°C (in the range of -10°C up to +85°C),
 - ±0,9°C (in the range of -40°C up to -10°C);
- Range of relative humidity measurement: 0%..100% without moisture condensation;
- Measurement error of relative humidity at ambient temperature of +30°C:
 - ±4% (in the range of 0% up to 80%),
 - ±6,5% (in the range of 80% up to 100%);
- Range of illumination measured: 0,01 lux..83000 lux;
- Type of Hall detector: discrete, omnipolar;
- Frequency range of radio interface: 2400..2483,5 MHz;
- Transmitter power: up to +8 dBm;
- Receiver sensitivity: -96 dBm;
- Data exchange technology: Bluetooth Low Energy (BLE),
Bluetooth Low Energy Long Range (BLE Long Range);
- Coverage in the mode of BLE: up to 100 m in the line-of-sight;
- Coverage in the mode of BLE Long Range: up to 500 m in the line-of-sight;
- Number of stored records: 19700;
- Battery: ER14505 3,6V 2700 mA/h;
- Operation time with one battery: up to 3 years;
- Housing: IP65;
- Housing materials: polycarbonate;
- Detector cover material: ABS plastic;
- Dimensions, mm, not more than: 124 (73 without detector) x 68 x 32;
- Mounting seat size, mm, not more than: 73 x 68;
- Weight: not more than 105 g

3 Design and Operation of the System

The sensor contains a temperature measuring element, a humidity measuring element (only for ADM35H), an illumination measuring element, Hall detector, a microcontroller with integrated radio interface Bluetooth Low Energy (hereinafter referred to as BLE). Power supply to the sensor is made with a battery ER14505. The values measured are available in real time via radio channel using BLE technology and are stored with a set frequency in the non-volatile memory of the sensor with the possibility of their subsequent unloading.

4 Installation and Setting

4.1 Preparation and installation process

4.1.1 Preparation for operation

The sensor is supplied switched on and ready for operation. If the battery was removed, install it, observing the polarity. 30 seconds after the power supply, the sensor will be ready for use.

4.1.2 Installation

The sensor is fixed on a flat metal surface with the help of the magnets included in the delivery set. On other surfaces the sensor is fixed with the help of screws with a press washer or on a double-sided adhesive tape, which must correspond to the operating conditions of the sensor. If you need to fasten more tightly, the methods listed above can be combined.

The transparent lid of the sensor should be clean. Impurities present on the sensor lid or housing or detector cover may result in decrease in precision when measuring temperature and illumination. It is not allowed to use abrasive cleaning agents or organic solvents for cleaning the sensor housing.

It is important to avoid the sensor installation near large metallic elements, since the coverage for data transmission via BLE may be reduced. The sensor must be oriented with the BLE antenna towards the tracker. Before the final fixing of the sensor and the tracker, it is necessary to make sure that the signal level is sufficient for stable operation.

The signal strength is checked at the receiving device side (tracker or Android smartphone). The signal strength of the last readings can be viewed in the Windows version of the tracker configurator, or in the response to the BLESENSORINFO command (see section [4.3.4](#) for the description of the command). You can also use the Android application "ADM BLE-Configurator" (for a description, see section [4.2.1](#)).

The signal level of -100 dBm is considered as critically low, at this level it is recommended to change the installation location. The signal level of -70 dBm is considered as normal for stable

operation. The signal strength from -85 dBm up to 90 dBm is considered as sufficient for operation, but problems may occur at a slight deterioration of conditions.

4.1.3 Setting

The sensor is supplied with optimal factory settings. If the factory settings are suitable for the task, no sensor configuration is required. You can immediately connect the sensor to the tracker.

By default, the data transfer period is set to 15 seconds and all sensors are active, except for the Hall sensor. If you need to use a Hall sensor, you should enable the corresponding option.

Recording to the archive is disabled by default, to use this function, you should enable the corresponding option and configure the frequency of recording to the archive.

The readings of all active sensors are recorded in the archive.

Main sensor parameters available for configuration:

- Mode of data transfer

This parameter determines the technology via which the data will be transmitted. Bluetooth Long Range technology allows increasing the distance from the sensor to the receiving device and to increase the reliability. The receiving device should support data receipt via such technology.

BLE technology allows transferring data over shorter distances. Such a technology is supported by most devices. Mode BLE is given by default.

- Data transmission period

This parameter determines transmission frequency of the data via the Bluetooth LE radio channel, as well as the frequency of measurements. The measurement is performed by all active detectors before sending the readings. In the intervals between the measurement and sending readings, the sensor is in a sleep mode.

Increase of the transmission period extends the battery life, but reduces the frequency of readings update, and also increases the time switch to the setting mode. By reducing this parameter you decrease the battery life. The recommended value is 15 seconds.

- Hall sensor

Activation / deactivation of the Hall sensor

It is recommended to activate this sensor only when it is necessary to use it, because its activation leads to an increase in energy consumption. When the Hall sensor is activated, an extraordinary exit from the sleep state and sending readings may happen.

- Archive

Activation/deactivation of recording sensor readings into the archive. The readings from all active measuring elements are recorded in the archive with reference to a time point. Enabling or disabling this option does not affect the data transmission mode via the Bluetooth LE radio channel, but its activation leads to a reduction of the battery life.

Other parameters are described in clause [4.2.2.](#)

4.2 «ADM BLE-Configurator»

«ADM BLE-Configurator» application is available in Google Play.

To work with the application, you need the permission of the «Geolocation» or «Location». This is due to Google requirements for applications that provide data exchange with BLE devices, since BLE technology includes positioning by BLE beacons. You also need permission for the access of photos, media and files because this is used when updating the sensor software, working with the archive and other operations that require interaction with the smartphone memory.

The Android application «ADM BLE-Configurator» performs the following functions •

- viewing readings in real time;
- sensor setup;
- data download from the archive;
- generating of report in the form of a table.

Using the application, you can solve the following tasks:

- sensor checking;
- view of the current sensor readings;
- assessment of the signal level when passing through obstacles;
- assessment of the battery status;
- determination of the sensor address;
- determination of the sensor firmware version.

4.2.1 View of the readings in «ADM BLE-Configurator» application

- Launch «ADM BLE-Configurator» application.
- Make sure that the application has been given all the necessary permissions. For correct operation, you need not only to permit the use of the «Geolocation» or «Location», but also to enable this function if it is disabled.
- The sensor will be found as soon as it sends another message with readings.

The following parameters are available for viewing:

- Sensor model;
- Sensor MAC-address;
- Temperature;
- Illumination;
- Humidity (only for ADM35H);
- Hall element;
- Battery voltage;
- Firmware version;
- RSSI –level of received radio signal;
- The time passed since the last data message was received;
- LR-data received by Bluetooth Long Range technology
- Archive status.

ADM35H	FC:CA:84:E4:EC:4E
Temperature:	26.97 °C
Humidity:	46.53 %
Light:	593.28 lux
Hall sensor:	0
Voltage:	3.6 V
Firmware:	0x01
RSSI:	-82 dBm

Sync. in 14:08 28.06
LR 3 sec.

This section presents the most complete set of data. It may differ depending on the firmware version of the sensor, as well as on its modification.

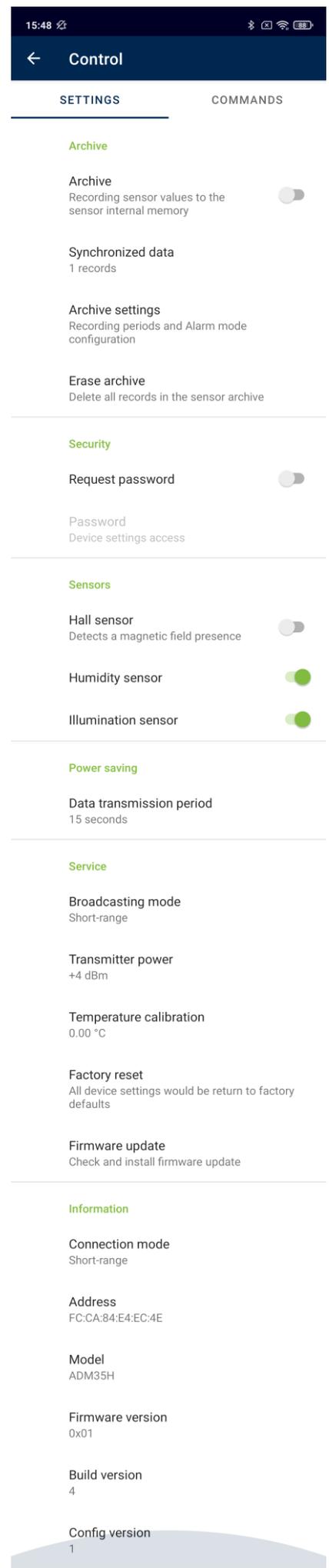
4.2.2 Sensor setting in «ADM BLE-Configurator» application

To view or change the sensor settings, wait until it is detected and click on the  icon to go to the «Control» menu.

Description of the parameters in «Control» menu:

- Archive.
- When the «Archive» option is active, readings are recorded at a set frequency. The readings of all active sensors are recorded in the archive with reference to time.

- Synchronized data
This parameter shows how many records were downloaded from the archive to the smartphone memory.
- Archive settings
A set of parameters that specify the frequency of data recording in the archive and the limits of the alarm range of readings
- Erase archive
Erase all records from the archive
- Security.
Setting the password that will be requested when entering the sensor settings. This password does not affect the receipt of readings by the tracker or viewing readings in the ADM BLE-Configurator.
- Hall sensor.
Enabling or disabling of the Hall sensor. To save battery power, it is not recommended to activate this detector if it is not planned to be used.
- Humidity sensor
Enabling or disabling the humidity sensor
- Illumination sensor
Enabling or disabling of illumination sensor
- Data transfer period
This parameter determines the frequency of data transmission via the BLE radio channel, the frequency of measurements and the sleep time. Increase of this parameter leads to an increase in the battery life, but reduces the frequency of the readings update. By reducing this parameter you decrease the battery life. The recommended value is 15 seconds.
- Mode of data transfer
Selecting data transfer mode via BLE or BLE Long Range Bluetooth Long Range technology allows increasing the distance from the sensor to the receiving device and to increase the reliability. The receiving device should



support data receipt via such technology. BLE mode is given by default.

- Transmitter power
By default, transmitter power is +4dBm. The higher the power the more the data transmission distance, but it leads to more power consumption. Reducing the power saves energy and reduces the data transmission distance. It is not recommended to change this parameter without a reason.
- Temperature calibration
Setting the offset of the temperature readings in the entire measurement range. It is not recommended to change this parameter if there is no need.
- Factory reset
All device settings will be return to factory ones.
- Firmware update.
Here you can update the firmware
- Information
Here you can see current connection mode with the smartphone (for sensor configuration).
Data are presented in the mode that was selected in «Mode of data transfer».

4.2.3 Report generation in «ADM BLE-Configurator» application

- Wait until the sensor is detected and see the date and time of the last data synchronization. Only the synchronized data will be recorded in the report
- Synchronize the records in case of necessity. For synchronization click on the icon  and switch to the «Control» menu. The synchronization is done each time when you switch to the «Control» menu. While performing this operation, the missing records are downloaded from the sensor memory to the smartphone memory.
- Make sure that the synchronization is completed. The incomplete synchronization process is indicated by the display of a running green bar (status bar) in the upper part of the configurator window. After the synchronization is complete, go back to the sensor search menu.
- To generate the report, click on the icon . This button is located at the top of the configurator.
- Select the sensor for which you want to generate a report.
- Select the time period for which you want to generate a report.
- Send the report or open it in your smartphone. The report is saved as a table in csv format.
File save path /Neomatica/ADM_BLE_Configurator/reports.

4.2.4 Firmware update of the sensor

- Wait until the sensor is detected
- To switch to the «Control» menu click the icon  .
- Click on «Firmware update»
- If the sensor firmware version is less than the version of the current firmware available on the update server, the message «Update available» will be displayed indicating the current version.
- To start the update process, click «update».

To check the relevance of the firmware version and download it from the update server, the application needs Internet access. At the same time, traffic may be consumed or a fee for communication services may be charged by your mobile network operator. The «ADM-BLE Configurator» application does not support a permanent connection via the Internet. Synchronization of firmware versions is performed no more than once a day. The sensor firmware has a size of not more than 100 kB.

4.3 Using the sensor together with the trackers ADM007 and ADM333, that contains BLE interface

4.3.1 Method of sensors catching

The sensor is caught on the tracker side. By default, the sensor is configured to measure temperature, humidity and illumination.

Sensor integration with the tracker ADM007 or ADM333, that contains BLE (hereinafter referred to as a tracker) is performed via sending commands via GPRS or SMS. It is also possible to configure the sensor in the graphical interface of the «ADM Configurator» application using the Bluetooth interface. Up to 5 sensors of ADM35(H) can be connected to one tracker. One sensor can be connected to several trackers simultaneously

Catching the sensor can be performed manually and automatically.

Manual catching requires entering addresses of each sensor. This method is suitable for the situation when in the Bluetooth coverage range of the tracker there are activated sensors, which should not be caught by the tracker.

Automatic catching is based on searching for the sensors and automatic record of addresses of all sensors found. This method is suitable for the situation when in the tracker coverage Bluetooth range there are only needed sensors.

4.3.2 Manual adding of sensors and checking the list of the sensors added

BLESENSOR command allows adding the sensors addresses as well as checking the list of addresses added. The sensor address is indicated on its sticker located on the housing.

When entering the address, no need to put the colon.

BLESENSOR X,Y – add the address Y in the box X where X=0..4;

BLESENSOR X,0 – clear the box X where X=0..4;

BLESENSOR Y – add the address Y in the end of the list;

BLESENSOR 0 – clear the list;

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

Example of commands entering:

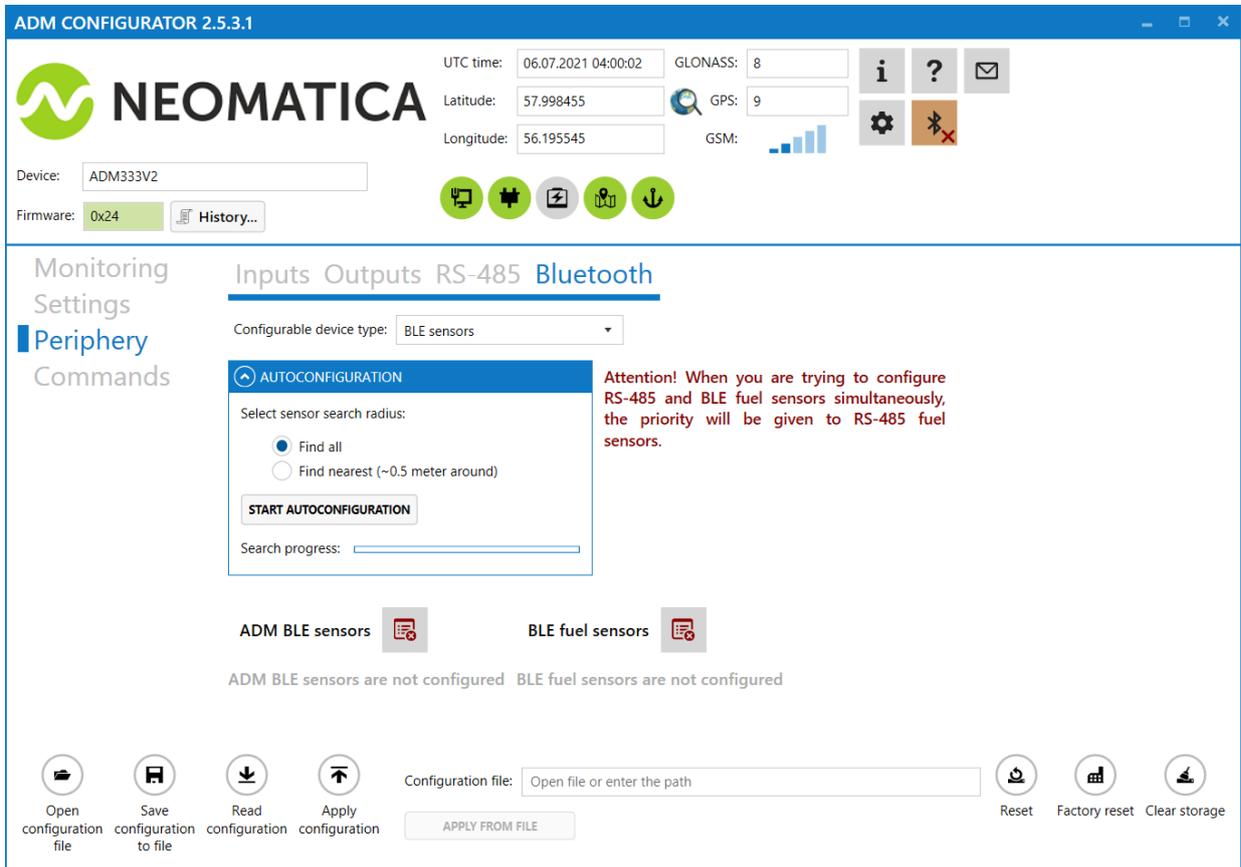
BLESENSOR 0,0C61CFEF5E31 – add the address 0C:61:CF:EF:5E:31 in the box 0;

BLESENSOR 0C61CFEF5E31 – add the address 0C:61:CF:EF:5E:31 in the end of the list.

4.3.3 Adding sensors automatically

Adding sensors in a graphical interface of «ADM Configurator» application.

- Connect the tracker to the configurator. The connection procedure is described in the tracker operation manual.
- Open the «Peripherals» section.
- Open the tab «Bluetooth».
- Place the sensors close to the tracker.
- Click «Autostart» and wait for the complete of the process.
- The caught sensors will be displayed below.



4.3.4 Adding sensors with the help of commands

The **BLEAUTOCATCH** command starts the search and automatically records the addresses of the found sensors. By default, the search is performed within two minutes without filters

BLEAUTOCATCH – automatic search of all supported BLE sensors without filters.

BLEAUTOCATCH 0 – stop current search.

4.3.5 Getting information from the sensors caught

BLESENSORINFO command allows requesting the last data received by the tracker from the sensor.

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

BLESENSORINFO – command without parameters displays data about all caught sensors;

Example of the answer:

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

Description of the answer parameters:

T - temperature

L - illumination.

H - humidity.

V – battery voltage.

R - RSSI level in dBm.

LMT - time of the data update from the sensor. Values: 0..120 seconds. If you exceed 120 seconds, the maximum value of 120 will be set.

S – sensor status.

DT – device type.

PT – package type.

F – firmware version.

5 Storage and Transportation

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

After transportation of the sensors in sub-zero temperatures they should be stored at room temperature within 24 hours.

6 Warranty

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

The warranty does not cover:

- sensors with mechanical damages and defects (cracks and chips, dents, signs of impacts, etc.) caused by consumer as a result of handling, storage and transportation rules violation. When there are signs of oxidation or other proofs of liquid penetration in the sensor housing;
- sensors with signs of electrical and/or other damages caused as a result of unacceptable changes in external power network parameters or improper use of the terminal;

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

7 Marking and Packaging

Marking is placed on the housing of the sensor. Both multipack and individual package is possible.

8 Disposal

Disposal of the sensor and discharged battery is performed according to national and local norms and requirements.

9 Scope of supply

Device name	Quantity	Comments
Wireless multifunctional sensor ADM35(H)		

10 Acceptance certificate

Wireless multifunctional sensors ADM35(H) in the amount of _____ pcs are considered to be ready for operation

Date of manufacture:

*Manufacturer: «Neomatica» LLC
614087, Russia, Perm, 24A Malkova Str., office 6.
Telephone: +7 (342) 2-111-500 (ext. 42).
E-mail: sales@neomatica.com
Web site: <http://neomatica.com/en>*

Annex A. Sensor usage with Teltonika FMB trackers

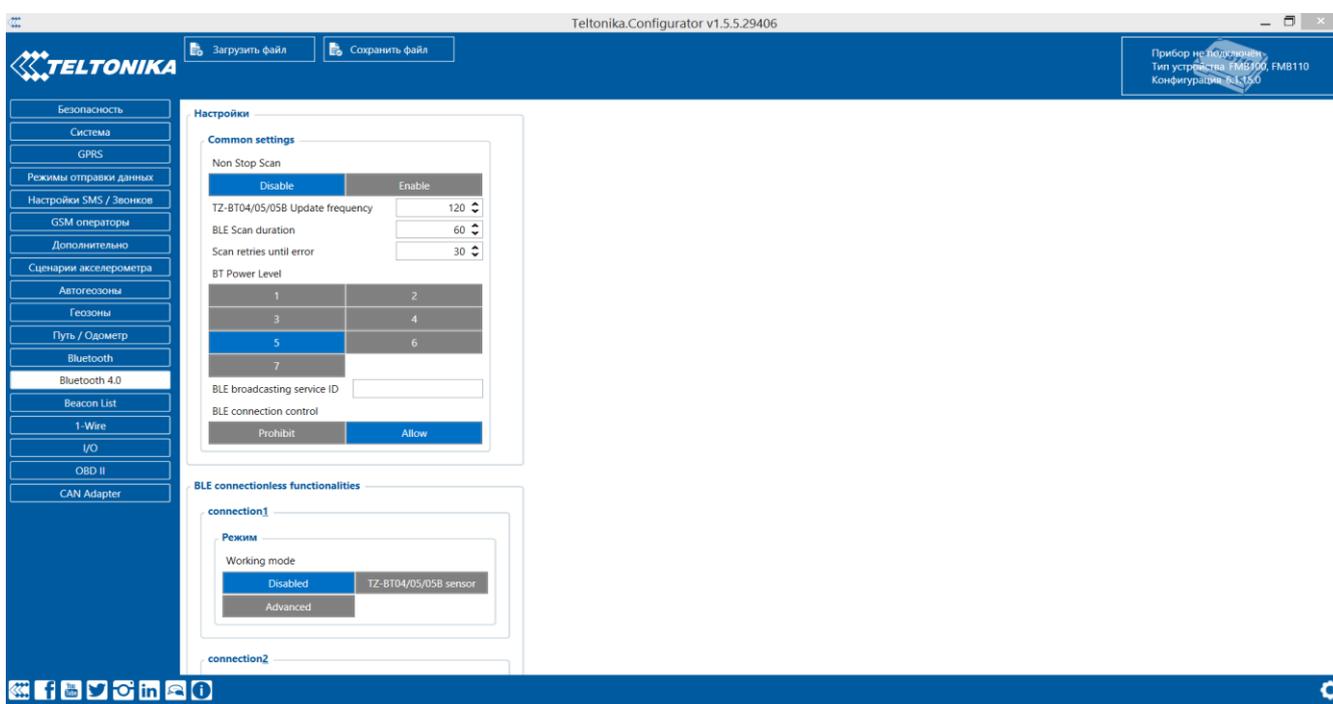
This application is only for information. If you have any problems or questions, please refer to the operation manual of the tracker you use.

By default, the sensor is already configured to send readings automatically. The sensor settings do not need to be changed. It is sufficient to prepare the sensor for operation according to clause 4.1. Installation.

To avoid problems, we recommend at first to update the tracker to the latest available firmware version.

Connect the Teltonika device to the Configurator by any convenient way. In the left menu, find the item «Bluetooth 4.0» and select it

In the opened menu you'll see the following:



The configuration of the joint operation of the tracker and ADM sensors is done with the help of BLE connectionless functions «setting». This default setting contains four subforms with the name «connection» and the serial number of the sensor under configuration.

In the «connection1» subform, select the “Advanced” option as the operating mode. The subform will automatically expand and will look as follows:

BLE connectionless functionalities

connection1

Режим

Working mode

Disabled
TZ-BT04/05/05B sensor

Advanced

Настройки

MAC

1st Sensor

Type	Data Offset	Data Size	Action	IO	Match	Endianess	Multiplier	Offset
	0	0	Match	None		Little Endian	0,9	0
	0	0	Match	None		Little Endian	1	0
	0	0	Match	None		Little Endian	1	0
	0	0	Match	None		Little Endian	1	0
	0	0	Match	None		Little Endian	1	0
	0	0	Match	None		Little Endian	1	0
	0	0	Match	None		Little Endian	1	0
	0	0	Match	None		Little Endian	1	0
	0	0	Match	None		Little Endian	1	0
	0	0	Match	None		Little Endian	1	0
	0	0	Match	None		Little Endian	1	0
	0	0	Match	None		Little Endian	1	0

In the MAC field, enter, without entering a colon, the MAC address of the ADM sensor from which the tracker will receive and process the data.

The table of data received from ADM sensor should be filled as follows:

BLE connectionless functionalities

connection1

Режим

Working mode

Disabled
TZ-BT04/05/05B sensor

Advanced

Настройки

MAC

1st Sensor

Type	Data Offset	Data Size	Action	IO	Match	Endianess	Multiplier	Offset
FF	9	2	Save	Temperature		Little Endian	1	0
FF	11	2	Save	Humidity		Little Endian	1	0
FF	8	1	Save	Custom1		Little Endian	1	0
FF	13	2	Save	Luminosity		Little Endian	1	0
FF	7	1	Save	Battery		Little Endian	0,1	0
	0	0	Match	None		Little Endian	1	0
	0	0	Match	None		Little Endian	1	0
	0	0	Match	None		Little Endian	1	0
	0	0	Match	None		Little Endian	1	0
	0	0	Match	None		Little Endian	1	0

You can do the same to configure 3 sensors

Table of correspondence of transmitted data and IO fields on the telematics server:

Parameter name	connection1	connection2	connection3	connection4
Temperature	25	26	27	28
Battery voltage	29	20	22	23
Humidity	86	104	106	108
Hall sensor	331	332	333	334
Illumination	335	336	337	338

The temperature parameter is transferred in an arbitrary field of the protocol and requires conversion from the server.

2 calculation formulas are used for two ranges of incoming values:

For the range of values from 0 to 32767-use the formula $X*0.01$

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

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

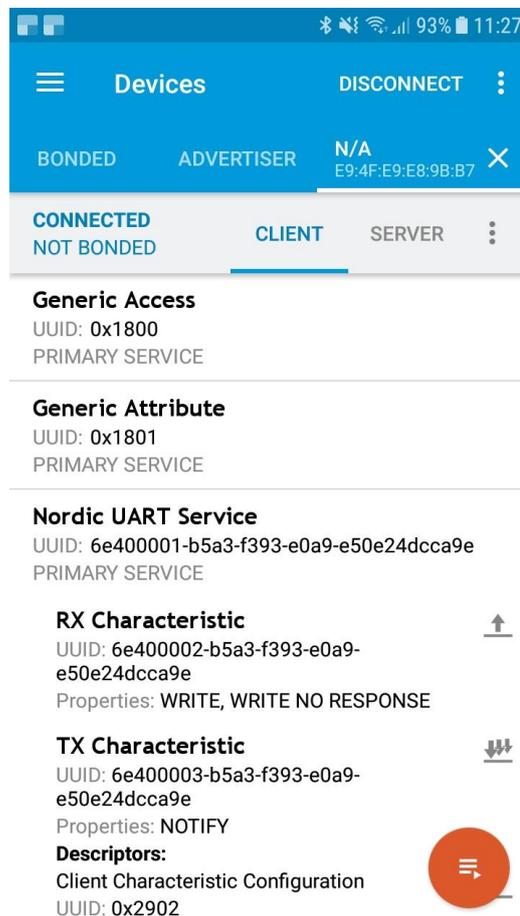
The acceptable range of values after calculation according to the formula is $-39...+150$.

The value 3000 (before the use of calculation formulas) is the error code «no signal from the sensor».

The light level is transmitted to the server in the float format. To convert it to a normal form, it is necessary to perform the appropriate conversion on the server side.

Annex B. Instructions for setting up the sensor via «nRF Connect» application

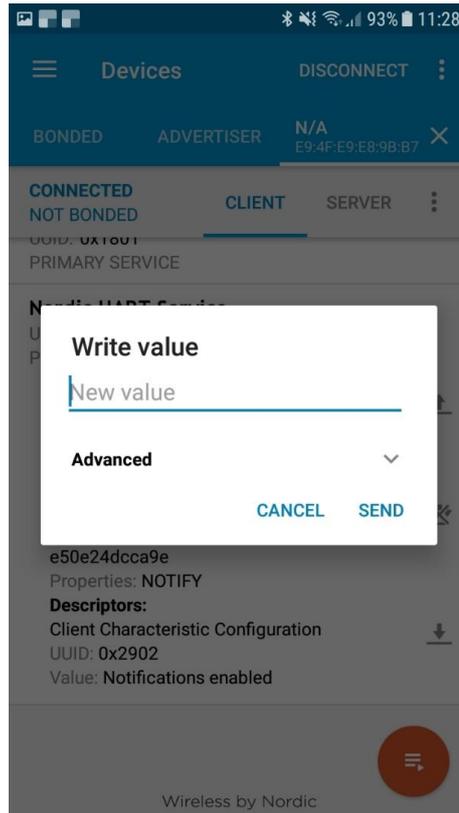
1. Download on your mobile phone a program «nRF Connect». Open this application. It is recommended to select Android mobile OS.
2. Put the sensor close to the mobile phone. Recommended distance is up to 1-2 meters.
3. Connect the sensor (black button «Establish connection» or «Connect» depending on the system language).
4. If connection failed- try to connect again. The connection will be set up as soon as the sensor sends the first Advertising message (once per 15 seconds by default).
5. After connection on the home tab you will see 3 blocks: «Generic Access», «Generic Attribute», «Nordic UART Service». Press «Nordic UART Service». The following menu will appear:



Field RX Characteristic will be used for settings and commands sending. Field TX Characteristic – for response;

6. Close to the field TX Characteristic you can see three arrows pointing downwards. Click onto them, they will appear to be crossed out. Now the sensor is ready to receive your commands;

- To send a command clicks the arrow upwards that is close to the field RX Characteristic.
You will see the following window:



- Commands list:

The commands should be sent in lowercase letters (lowercase).

- rs- read settings. By default, the response in TX Characteristic will be «10=15; 12=0». This means that the sleep period (parameter 10) is 15 seconds, and the Hall element (parameter 12) is disabled.
- sp x-set the sleep period. The limit values for the setting are 5 and 255. To set the sleep period to 30 seconds, send the command: sp 30. If the command is read correctly, the command name itself will be duplicated in TX Characteristic without a parameter.
- sf x-activation of additional sensor functions. Only the Hall element. To enable it, send the command sf 1. If the command is read correctly, the command name without a parameter will be duplicated in TX Characteristic.

- After the settings, you should save the changes. Otherwise, after a reboot (power off), the settings will return to their previous values. To save the settings, send the wf command- settings record;

- As soon as you save the settings disconnect from the sensor. To do this, click the “Disconnect” button in the upper-right corner. If the sensor firmware version is lower than 0x06 version, reboot the sensor by turning off the power (remove the battery and wait for 3 minutes).