ناوک هوشمند پویان
Edge Intelligent Enterprise

MIELTA
TECHNOLOGY

FUEL LEVEL SENSOR

Fantom

FLS – 3304-11-10
FLS – 3304-11-15
FLS – 3304-11-20
FLS – 3304-11-25
FLS – 3304-11-30

Setup and operation Manual

Firmware version 1.3.36
Configuration program version 3.6
Document edition from 20.01.2022

CONTENTS

1. Description

Wireless Fuel level sensor (FLS) Fantom MIELTA is designed to measure the level of light oil hydrocarbons (diesel, fuel, gasoline, kerosene and etc.) in various purposes containers. Sensor can be installed both on stationary objects and on automobile and railway transport.

Sensor uses the linear capacitor capacitance measuring method. The capacitance value depends on sensor immersion level in the dielectric liquid.

The sensor is made in a strong plastic case with IP67 protection class, it has a steel flange with holes for mounting. Sensor`s tube and electrode is made of stainless steel and it has oil-resistant dielectric coating. Radio communication antenna is Bluetooth Low Energy (BLE) and the battery is inbuilt.

2. Specification

CHART 1.

POWER SUPPLY	Battery Li-SOCL2 3.6 V, 2.7 A*h
MEASUREMENT PERIOD	from 1 to 10 sec
THE PERIOD OF SENDING DATA	from 1 to 10 sec
AVERAGING INTERVAL	from 1 to 60
RELATIVE MEASUREMENT ERROR	No more than 1%
DATA TRANSFER FORMAT	0 – Mielta 1 – analog №1
WIRELESS TRANSMITTER	Bluetooth Low Energy 5.0, 2.4 GHz
FREQUENCY RANGE	2400-2483,5 mHz
TRANSMITTER POWER	Adjustable, <11 dBm EIRP
TILT ANGLE MEASURER	Inbuilt accelerometer, +/- 1G α°=arcsin(Z/127)
TEMPERATURE MEASURER	inbuilt, +/- 2°C
INBUILT MEMORY	4 Mb
WIRELESS SOFTWARE UPDATE AND CONFIGURATION	YES
DEGREE OF PROTECTION	IP67
EXPLOSION PROTECTION MARKING	0ExiaIIBT6X
OPERATING TEMPERATURE	from - 40 to +85 °C
OPERATING PERIOD	7 years
THE LENGTH OF THE MEASURING PART	*990 (1490, 1990, 2490, 2990) mm
DIMENSIONS OF HOUSING	80x80x25 mm

DIMENSIONS OF SENSOR	80x80x1015 (1515, 2015, 2515, 3015) mm

*When mounting sensors with a length of more than 990 mm on moving objects, additional fastening of the sensor tube is required

Mielta hereby declares that the type of radio equipment the FANTOM fuel level sensor complies with Directive 2014/53 /EU.

2.1 Power supply

FLS Fantom has a lithium-thionyl chloride battery, a voltage of 3.6 V and a nominal capacity of 2.7 A*h., which is designed for the entire service life in accordance with the manufacturer's recommendations for setting the frequency of measurement and sending data. After a malfunction, the battery can be replaced in the Mielta production laboratory, for this you need to contact the technical support service.

The sensor detects its position in real time and when it deviates from the vertical by an angle of more than 60 degrees, the power saving mode will be activated. The FLS switches off the measuring device and continues sending the last recorded value, while still being able to connect and configure. Therefore, the sensor can be stored in the warehouse in a horizontal position. In this case, the power consumption is reduced to 30% from the rated one. The sensor operation is guaranteed in the battery voltage range from 3.0V to 3.6V.

2.2 Measurer part

FLS Fantom is equipped with a unique integrated measuring device that converts the capacity of a linear sensor element into a digital value used in fuel level calculations. A essentially different method of measuring capacitance from the competitors allows you to make measurements with high resolution and stability.

It has been implemented a new algorithm for self-diagnosis in emergency. If the measurement range specified during calibration is exceeded with error code, the sensor shows the deviation amount. Analysis of the error value may indicate the cause of the fault: incorrect calibration, changes in fuel quality, or water and dirt is in the fuel.

2.3 Radio communication

The sensor is equipped with a modern integrated Bluetooth 5.0 Low Energy radio transmitter and a built-in high-performance antenna, which allows providing high-quality radio communication with minimal power consumption.

The parameters measured by the sensor are transmitted in a BLE standard broadcast packet (chart 2).

CHART 2.

Parameter	Valid values	Description
Level	from 0 to 10000	The value of the fuel level. The range is configurable, by default 30 - 4095
	2xxxx	Error, level is below the minimum, where xxxx is value of the level decrease as a percentage of the operating range
	3xxxx	Error, level is above the maximum, where xxxx is the value of exceeding the level as a percentage of the operating range
	40000	No Calibration (required a calibration)
Temperature	from -50 to +100	Temperature of the housing FLS, °C
	-127	Error, temperature below -50 °C
	+127	Error, temperature above +100 °C
Battery voltage	from 10 to 40	Battery voltage in volts, multiplied by 10
	0	Error, voltage is below 1.0 V
	255	Error, voltage is above 4.0 V
Acceleration along the longitudinal axis of the sensor	from -127 to +127	The angle of inclination of the sensor relative to the horizontal position is calculated by the formula α°=arcsin(Z/127). The value of the parameter: 0 – horizontal position; +127 – vertical position, housing is up; -127 – vertical position, housing is down;

To monitor and change the sensor settings, its calibration and taring, you must use any mobile device with Bluetooth version 4.2 or later, as well as the program-Configurator for mobile devices Mielta Device Manager (Mielta DM) for the relevant operating system (Android, iOS). The program is available for free in the Google Play and App Store.

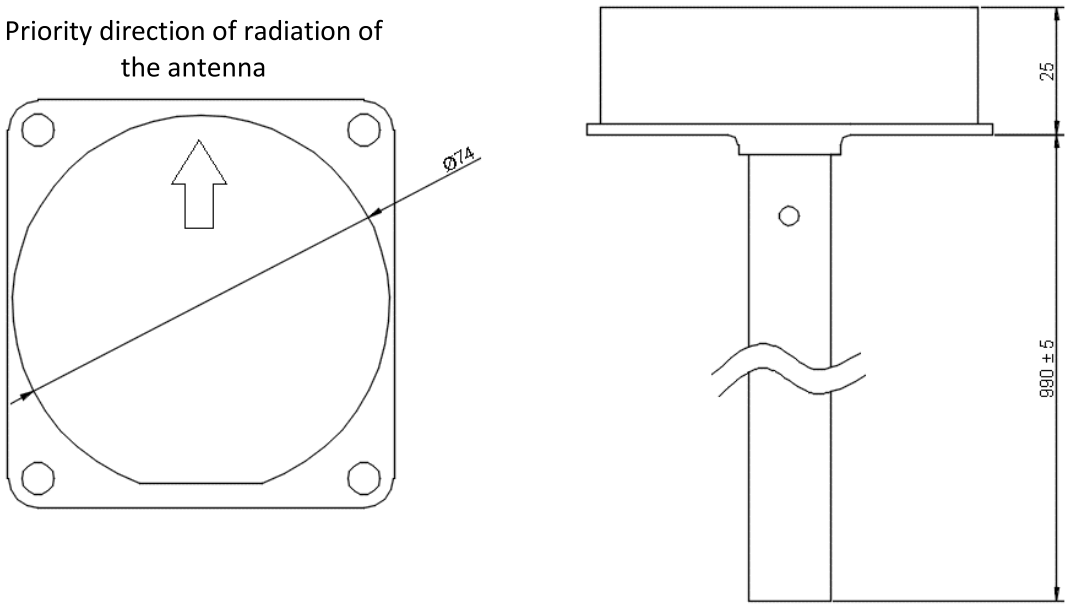
2.4 Active protection

Fantom has a built-in sensor that can detect attempts to cover it with any conductive material (metal) in order to destabilize or disrupt data transmission over the radio channel. The sensor will analyze data, will store in memory and will transmit this data into the terminal via a special Protocol.

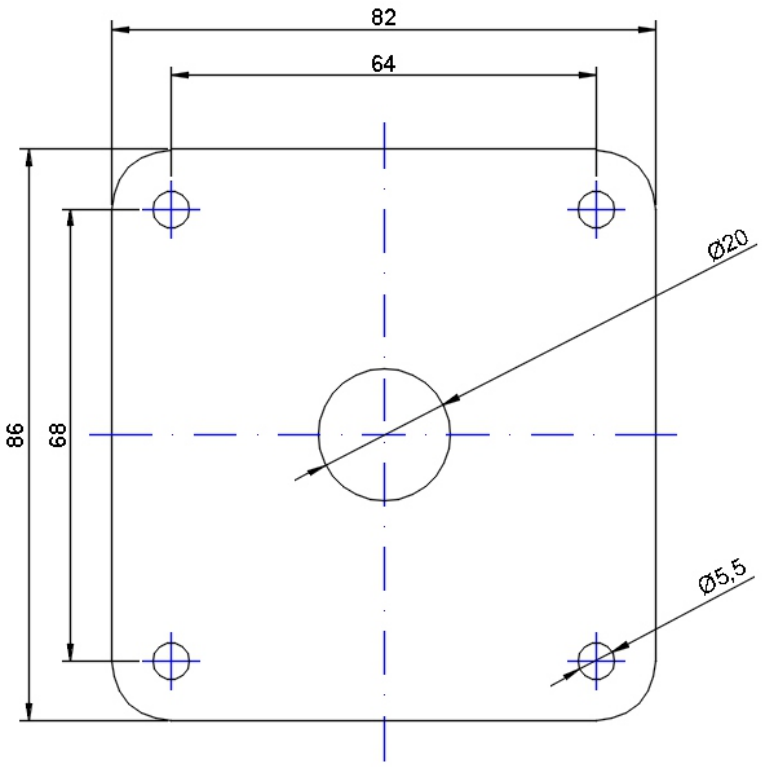
Even if the user succeeded in blocking radio communication for some time, data on the fact of sabotage will be transmitted immediately as soon as the connection is resumed.

3 Installation and connection

The sensor is mounted at the top of the fuel tank and opposite to the lowest point of the bottom of the tank. Preference is given to an layout that provides minimal overlaps of the space around the sensor housing with metal structures and has open access to the surrounding space. Around its axis, the sensor must be oriented in such a way that the priority direction of the antenna radiation (Pic. 1) is directed as much as possible in the maximum opposite direction to the metallic construction.



Picture 1. The installation dimensions of the FLS.



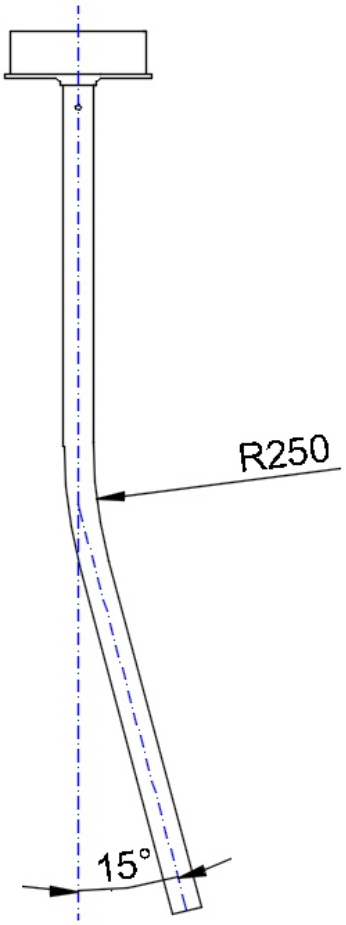
Picture 2. Sensor connecting dimension.

The surface for mounting the sensor must be horizontal and selected with regard to the availability and ease of installation. The central hole has a Ø20 mm. diameter (Pic. 2). The mounting holes diameter is chosen based on the material of the fuel tank and the attachment method. It is used self-tapping screws to fix the sensor. When mounted on a metal tank, 4 holes with a diameter of 4-4.5 mm are drilled or screws with a drill are used. When mounted in a plastic tank, 4 holes with a diameter of 3 mm are drilled and self-tapping screws without a drill are used.

Mounting procedure:

1. Select a location for installation, clean it of contamination.
2. Mark the holes according to the template, drill and remove the sawdust.
3. Measure the depth of the fuel tank from the bottom to the mounting surface.
4. Measure the sensor length from the mounting flange 20 mm shorter than the measured depth of the fuel tank.
5. Saw off the tube and the central electrode, deburr, insert the insulator into the end of the measuring tube.
6. Calibrate the sensor FLS.
7. Clean and degrease the mounting surface of the fuel tank. Apply a sealant to the surface, glue the rubber seal. Apply the sealant to the gasket and install the sensor.
8. Secure the sensor with screws.
9. Seal the mounting screws with a wire seal.

If necessary, to bypass obstacles in fuel tanks with complex shape, the measuring tube of the sensor can be bent. Bending is performed using specialized pipe benders with a bend radius of at least 250 mm. The bend angle should not exceed 15 degrees (Pic. 3).



Picture 3. Sensor tube bending.

Bending sensor tube procedure:

1. Calculate the location of the fold, mark it on the sensor tube;
2. Place the sensor tube in the pipe bender with the label in the middle;
3. Open the FLS connection in the mobile APP Configurator and monitor the value Level row;
4. Bend the tube until the required angle is reached, preventing the closure of the central electrode and tube.
5. If there is an electrical short circuit of the central electrode and tube, it is necessary to reduce the angle of the bend by applying force to the folding position on the reverse side, until the guaranteed isolation of the electrode from the tube is achieved.
6. Saw the measuring tube to the required length.
7. Calibrate, install and do taring the sensor.

If necessary, the sensor tube can be bent in two or more places to give it a complex shape.

Please, note that the bent measuring tube loses its symmetry and linearity, which directly affects the values of the sensor. A bent sensor without taring can have non-linear

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distortions in the readings at different levels. During taring of the sensor, it is recommended to do more number of measuring points (30-50 points per meter) to compensate nonlinearity.

4 Sensor setup

To configure the sensor, use The Mielta Device Manager Configurator program, it is available for free in the Google Play and App Store app stores. For full operation, you must confirm all the permissions requested by the program.

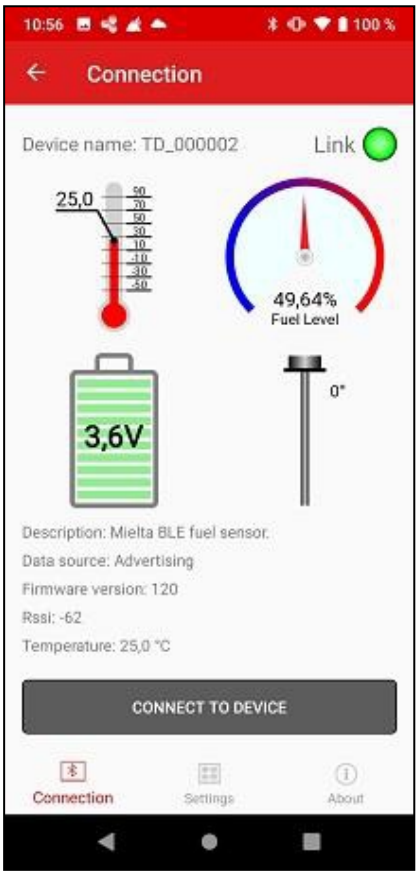
After installing and running the program, the "Connection" tab will show a search for BLE devices (Pic. 4). Swipe down activates the next search. Found a FLS Fantom device in the list will have a name, it contains the prefix "MD" and last 4 digital serial number of the sensor. When you select one sensor from the list, the parameters window will be open (Pic.5) which will show all the data transmitted by the sensor in common mode with a specified interval.

To configure the sensor, you must activate the two-way connection. In this mode, the sensor will show an expanded list of parameters in real time (Pic. 6).

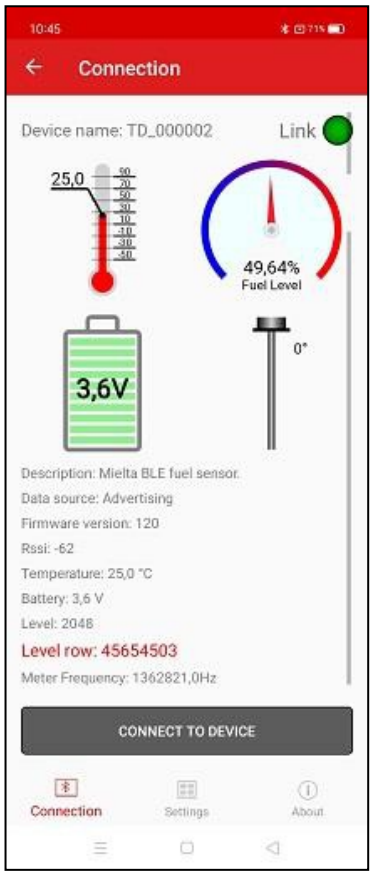
The value of fuel level is set to the value 2048, if there is no calibration parameters, a calibration must be made.

There is a data reception indicator “Link” in the upper right corner of the window. When the data packet comes from the sensor, the indicator flashes green every time. When the sensor is in the “Connection” mode, the data transmits faster and the indicator lights up constantly.

Picture 4. Search window.



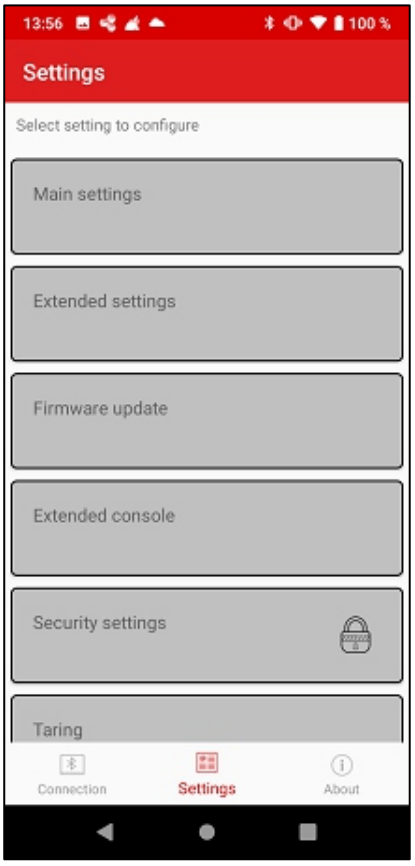
Picture 5. Parameters window



Picture 6. Connecting

"Settings" tab shows list of settings (Pic. 7).

The Main settings include calibration of the fuel level sensor, parameters os the sensor and settings of the date and time.



Picture 7. Settings list

4.1 Calibration

The "empty tank" and "full tank" calibration values set the measurement range in conventional units which measures within the specified range of output values. Calibration must be done after cutting the measuring tube to the required depth and installing the insulator-plug.

First step is the "full tank" calibration. It must be performed by dipping the sensor into the fuel tank till to the level of the drain hole. After the current value from the sensor is stabilized, you can write this value into parameters. (Pic. 8).

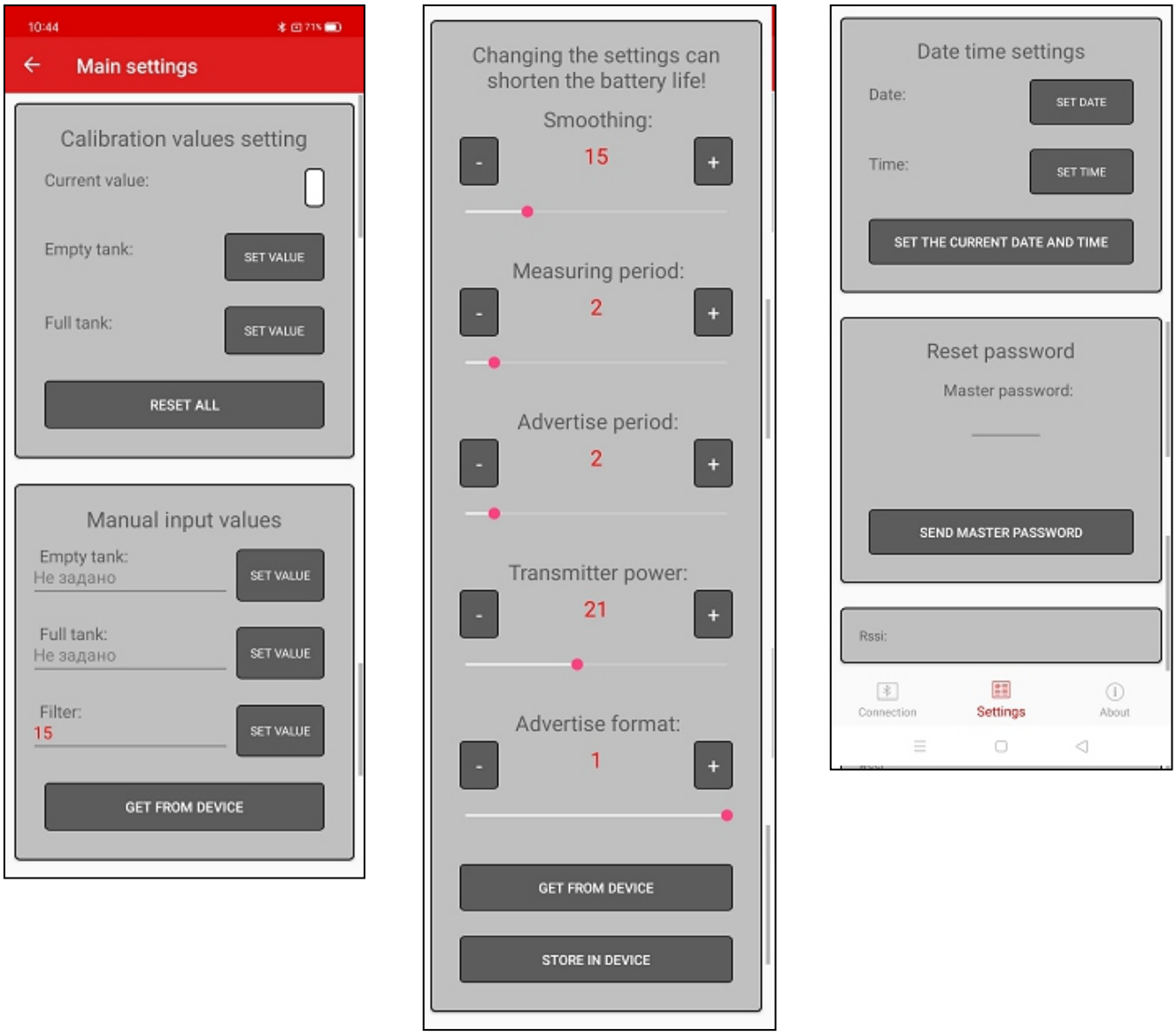
The second step is the "empty tank" calibration. For this, remove the FLS from the fuel and let the remaining fuel flow out of the tube for 5 minutes. After stabilization, you can write the value from the sensor for the empty tank in the relevant parameter.

⚠ **If you do first "empty tank" calibration, without wetting the sensor (before "full tank" calibration), it will cause the operating range to be set incorrectly**

If necessary, the calibration values can be written manually in the relevant section of the window (Pic. 8)

4.2 Anti-aliasing

The sensor has "anti-aliasing" parameter, to reduce fluctuations in the level value. This parameter sets the number of recent measurements value and calculate the average value. (Pic. 8). The parameter has a range of acceptable values from 1 to 60. The value 12 is set by default. This parameter may have a value of more than 30 for some types of equipment or tanks without partitions.



Picture 8. Main settings

4.3 Measurement and transmission

The values of the measurement period and the transmission period (advertising) directly affect the speed of the sensor's response to changes in the level and its power consumption. These parameters should be in the range from 1 to 10.

By default, the following values are set: the measurement period is 5 seconds, and the transmission period is 2 seconds. These values are used in calculating the guaranteed period of operation on a single battery.

⚠ **Changing the parameters, the frequency of measurement and transmission to less multiplies the consumption and reduces the life of the sensor. The manufacturer does not guarantee the service life in case of changes of these parameters.**

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