OPERATION AND INSTALLATION MANUAL

Electric current measuring sensor – FRIDGE SAVE

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General information

The FRIDGE SAVE is advanced technology indoor sensor applied for the full sensing of the status and health of the refrigeration system. FRIDGE SAVE is enclosed in industrial box and is designed to DIN rail or magnet mounted. FRIDGE SAVE is completely wireless and powered by 3.6V AA lithium batteries. The integrated advanced intelligent (AI) computational algorithm enables reliable capability of the measurement the magnitude of the temperature, and RMS current value. The data transmitted

The main technical characteristics and benefits of FRIDGE SAVE sensor:

- Compatible with LoRaWAN® specification 1.0.3;
- Measures electric current;
- Temperature sensor;
- Measurements at regular intervals with integrated advanced intelligent (AI) computational algorithms;
- Indoor use;
- Easy to use and deploy;
- Powered by batteries;
- Data transmission up to 10 km;
- Battery life is up to 13 years depending on settings and environmental conditions;
- Auto self-calibration;
- Robust enclosure dedicated for industrial and harsh environment;
- Perfect for monitoring Fridges, pumps,

Markings

One the backside of the senor there will be label indicating sensor name, serial number, production date and QR code.

UAB " Nano sensorics"
Pakaunės g. 70, LT-47243 Kaunas
www.nanosensorics.com
info@nanosensorics.com

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Applications

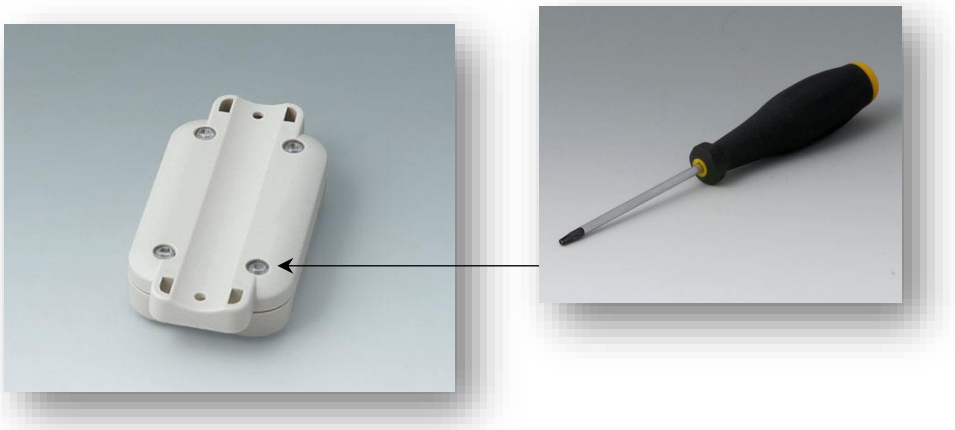
- Monitoring of the refrigeration system health / maintenance;
- Pumping fluid flow status;
- Food industry;
- Environment measuring;
- Industrial factories.
- Factories;

Product features

- LoRaWAN communication
- Computational AI algorithm.
- Temperature sensor
- Indoor CT
- Configuration over the air
- Robust enclosure
- Auto self-calibration

Installation and MAINTENANCE

- Use a screwdriver to open the back cover as showed in the picture:



- Use the lithium batteries type AA 3.6V (2 units) to install in the FRIDGE SAVE sensor as showed in the picture:

- Close the back cover as showed in the picture.
- Screw with two appropriate screws to the wall as showed in the picture.

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Push button and LED indicator description:

- Once batteries are installed or reset button will be pushed in the sensor, it will automatically attempt to connect to the LoRaWAN network and the LED indicator will start to be blinking / flashing for 15 seconds.
- In case of the successful connection to the LoRaWAN network LED indicator will stay on for 3 seconds and LED indicator will stop flashing and go dark. This means sensor successfully connected to the LoRaWAN network.
- If the sensor will not connect on the initial try, it will attempt to connect to the LoRaWAN network after 10 seconds, then after 60 seconds, then after 10 minutes, then after 1 hour, then after 24 hours till successful connection to the LoRaWAN network.
- The sensor will restart by pressing the button on the sensor and it will attempt instantly to connect the LoRaWAN network.

The FRIDGE SAVE sensor has to be installed reliably and with appropriate screws. The sensor must not be placed near any air vents windows, door openings where the constant fresh air flow is possible. The sensor is not suitable to be installed for the outdoor locations. The sensor cannot be stored at dusty or dirty areas with excess operation and storage temperature. The sensor is not washable, paintable. The open holes of the case must not be blocked, glued with any material. Do not throw the battery into a fire to prevent the battery from exploding. Damaged batteries may also explode. All of the above suggestions apply equally to your device, battery and accessories.

The FRIDGE SAVE sensor is maintenance free except replacement of the batteries.

Calibration

Factory calibrates the FRIDGE SAVE sensor when it is produced. The FRIDGE SAVE sensor is maintenance-free in normal indoor environments due to the Nano sensorics integrated intelligent computational algorithms (AI) and Automatic Baseline Correction (ABC) technology.

Regulations

UAB “Nano sensorics” is the company which develops and produce highly innovative sensors with integrated intelligent computational algorithms (AI) enabling extremely low power data transmission. Declaration of conformity Hereby, UAB „Nano sensorics“ declares that FRIDGE SAVE complies with the essential requirements and other relevant provisions of Directive CEM 2014/30/UE, BT 2014/35/UE, RED 2014/53/UE, CE, RoHS

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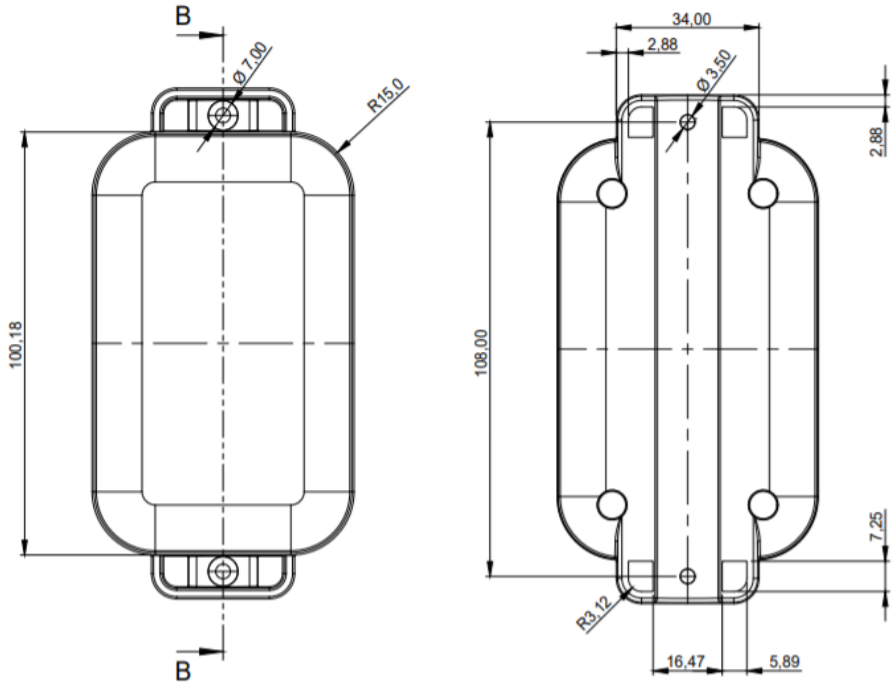
posted herein to inform yourself of any changes. Nano sensorics and Nano sensorics. All products, UAB “Nano sensorics” names, logos, trademarks are property of UAB „Nano sensorics.

Sensor dimensions:



Important safety information

Read this manual before attempting to install the device. UAB „ Nano sensorics” will not accept responsibility for any damage or injury resulting from not following the instructions in this manual.

- The sensor is for indoor use;
- Do not disassemble, crush, puncture, short internal circuits;
- Remove batteries if the sensor is not used, discharged battery has to be removed from the battery sensor, in this case left batteries might leak and damage the sensor;
- Keep the battery or device dry and away from water or any liquid as it may cause a short circuit;
- Replace batteries only with the same or equivalent type recommended by the manufacturer;
- Discard used batteries according to the manufacturer’s instructions;
- Do not bend, deform, shred, microwave, paint the sensors, or other hardware;
- Do not insert external material into any opening on the sensors;
- Disassembling or puncturing the battery (whether integrated or removable) can cause an explosion or fire;
- Do not dry the sensors or battery with an external heat source such as a microwave oven or hairdryer;
- Observe proper precautions when handling batteries. Batteries may leak or explode if improperly handled;
- The sensor is not applied as a metrological, commercial accounting purposes and UAB „Nano sensorics“ will not be held liable for any damage which may result from inaccurate readings;
- Do not use any detergent or alcohol to clean the device;
- Clean gently with softly moisture cloth.

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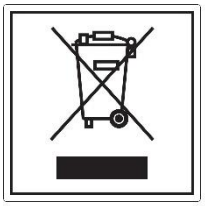
Waste disposal

The sensor disposed according to the Waste Electrical and Electronic Equipment Directive, (WEEE Directive) 2012/19/EU. The sensor and its individual parts has to be disposed according to local laws and regulations your product should be disposed of separately from household waste and industrial waste. When this product reaches its end of life, you have to bring the sensor, its components to the collection point designated by local authorities in order to protect the environment and to reduce waste through recycling. The battery must be disposed of separately.



Sensor technical details

Sensing characteristics	
Temperature	-40 to 105 °C
Temperature Accuracy	Max '+/-0.8°C@ -40— -10°C Max '+/-0.4°C@ -10°C—105°C
Electrical current RMS	1 phase, non – intrusive, clamp on.
Sensing cable length	Temperature- 2m, CT clamp on-1m. Other lengths are optional
Mechanical specification	
Weight	200 g without battery, 248 g with battery
Dimensions	121 x 62 x 26 mm
Enclosure	Plastic ASA+PC-FF
Storage Temperature	-40 to 85 °C
Sensor Power Supply	
Battery Type and voltage	1x 3.6 V or 2x3.6 V AA Lithium Battery ER14505 AA lithium batteries (3.6V2400mAh/section)
Expected Battery Life	<10 years (Depending on configurations and environment)
Sensor logging Function	
Sampling Interval	Configurable via downlink, NFC configuration is optional
Data Upload Interval	Configurable via downlink, NFC configuration is optional
Wireless specification	
Wireless Technology	LoRaWAN® 1.0.3
Wireless Security	LoRaWAN® End-to-End encryption (AES)
LoRaWAN Device Type	Class A End-device
Supported LoRaWAN® features	OTAA, ABP, ADR, Adaptive Channel Setup
Supported LoRaWAN® regions	EU863 – 870 Optional: US902 – 928, EU863 – 870, AU915 – 928, EU433, RU864, IN865
Link Budget	137 dB (SF7) to 151 dB (SF12)
TX Power	14dBm±1dBm (Region specific)

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Rx Sensitivity	132 dBm (LoRa, Spreading Factor=12, Bit Rate=293bps) -118 dBm (FSK, Frequency deviation=5kHz, Bit Rate=1.2kbps)
Communication range	10 km (line-of-sight, actual transmission distance depends on the environment)

Data sizes		
Measurement	Data size	Elaboration
Temperature	2	MSB byte -128 to +128 C, LSB byte, value after decimal point 0 to 100
RMS current value	1	One byte integer value
Battery	2	MSB byte represent Volts before decimal point , LSB byte represents two digits after decimal point expressed as unsigned 2 byte value, first byte – integer Volts, second byte – Volts (two digits after decimal point).

Downlink messages

The downlink data messages must be sent via port No. 3 in the specific format. Minimal data size is 3 bytes.

Header	**Payload length**	**Payload**	
Settings ID	**Settings data**		
0xBA	1 byte	1 byte	0-n bytes

The downlink data messages are as follows:

Setting ID	**Setting Length**	**Comment**
0x1A	2 bytes	Set sensors measurement time (Tx) period in seconds. Minimum value is limited to 30 s. Minimum value is 65536 s (1092 min / 18.2
0x1B	1 byte	LED control: • 0x00 – green LED OFF • 0x01 – green LED ON • 0x02 – green LED toggle for 5 s
0x1C	0 byte	Reset device

The examples of the downlink single messages:

- BA031A0384 – set measurement time to 15 minutes (900 s);
- BA021B01 – green LED ON.
- BA011C – Reset device.

It is recommended to send downlink data messages each by each after setting actual operational validation. When downlink message is sent for the setting of the Tx, the new Tx setting is deployed after time interval which is equal to the previous Tx value plus 30 s. The forced new Tx setting deployment can be performed after resetting the sensor in order to shorten new Tx deployment time duration.

In case if downlink message is sent to the sensor working on “ABP” mode, the Tx change will take effect only after the time interval equal to the previous Tx value.

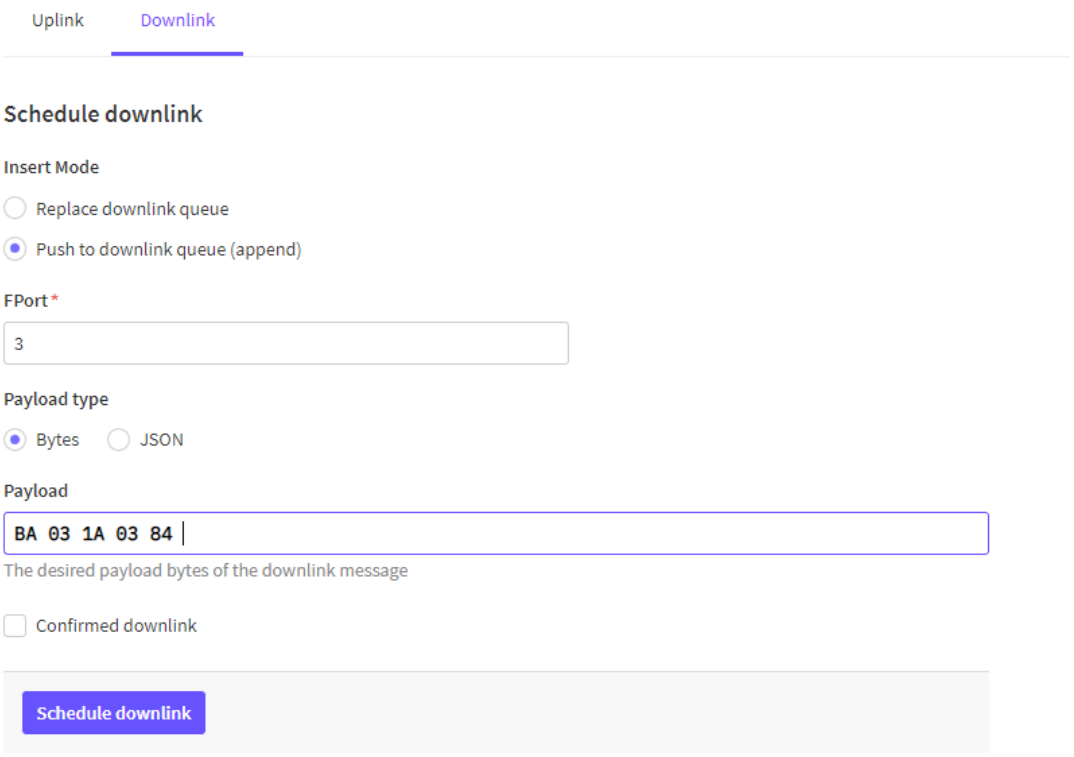
The multiple settings can be sent through the downlink single message. The sum of the bytes has to be indicated without counting of the header.

Header	**Total Payloads length**	**Payload 1**		**…**	**Payload n**		
Setting ID	**Settings data**	**Setting ID n**		**Settings data n**			
0xBA	1 byte	1 byte		0-n bytes	…	1 byte	0-n bytes

Multiple commands:

* BA051A03841B02 – Set measurement time to 15min and toggle green LED for 5s

The example to send the downlink message through the “Things Of The Network”:



Transportation and Storage

Packed sensors may be transported in any type of covered vehicle. Equipment should be anchored reliably to avoid shock and possibility to shift inside vehicle. Sensors should be protected against mechanical damage and shock. No aggressive chemical substances should be stored together because of corrosion hazard.

Warranty

Manufacturer gives warranty that sensor parameters will meet the technical requirements, listed in the “Sensor technical details” paragraph of this document, if transportation, installation, storage and operation conditions will

be followed. Warranty period is 12 month from manufacturing date, with additional possibility to extend it for additional charge. Warranty apply, when device is used as intended and if there was no tampering done with the device or other external damage done to the device from outside sources.

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