GENERAL SPECIFICATIONS

SigFox ventilation sensor

Document revision history

DATE	REVISION	OBJECT	Author
08/12/2014	0	Creation	MC
07/09/2017	1	Precision regarding temperature conditions for the battery's theoretical service life	MC

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1. OBJECT OF THE DOCUMENT

Describe the operation and technical characteristics of the product "SigFox ventilation sensor" (pressure, temperature (as a variant) and SigFox radio technology).

2. APPLICABLE DOCUMENTS - REFERENCE DOCUMENTS

General specifications of the SigFox ventilation sensor: 50-09-034_SPG _SigFox _Ventilation_Sensor.doc

3. DEFINITIONS - TERMINOLOGY

SigFox: the SigFox technology provides low bandwidth, long range, secured UNB (Ultra Narrow Band) radio communication with very low energy consumption. The star network covers an end-to-end transmission, from the equipment to the information system.

4. BACKGROUND AND OBJECTIVES OF THE STUDY

The SigFox ventilation sensor has been developed based on new electronics that incorporate the SigFox technology.
Important: the sensor must be placed under coverage of the SigFox public network.

Variant: the sensor measures the outside temperature.

The sensor has an embedded lithium battery. Its theoretical service life is approximately 12 years (10 years with the temperature variant) based on one measurement every hour and one transmission every 24 hours. For any other configuration with a lower measurement or transmission period, the service life will be reduced.

Physical measurements serve as an indication (sub-metering); they cannot be associated with a billing process for example.

Designed to be installed on the roof, associated with the ventilation box, this sensor measures the vacuum in the air flow generated by the fan, for the purpose of:
- regularly reporting the average vacuum level,
- issuing an alarm if the fan stops,
- and transmitting the temperature (variant).

Important: the costs associated with network access (subscription and volume) are borne by the customer.

5. GENERAL STRUCTURE OF THE PRODUCT

5.1 Mechanical presentation

The SigFox ventilation sensor board is housed in a grey ABS enclosure.

The sensor must be sheltered so as not to be subjected to excessively fast changes in temperature (sun radiation, wind, rainfall, etc.) that may be detrimental to the quality of the measurements. It must be placed at least 1 metre away from the metal ventilation box, since the latter can constitute a ground plane that significantly attenuates the radio signal.

To prevent damage to the pressure sensor, the product must also be positioned at a greater height than the CMV to prevent moisture from entering the sensor via the measuring tube. It is therefore essential that the tube descends from the product to the CMV, and that it does not ascend under any circumstances.
In order to be installed outdoors, the sensor enclosure is that of the Impulse model.

The enclosure is disassembled by unscrewing the fixing screws located on the front shell.
The sensor incorporates a SigFox radio transceiver associated with an antenna.
The enclosure includes two 10 mm protruding fittings, one made to receive a tube with a 6 mm inside diameter (not supplied) to be installed through the ventilation box, in the air flow, and the other to be left in the ambient air (at atmospheric pressure).

Note: On site, the air duct must be drilled in order to install the tube in the air flow. The length of the tube must not exceed 3 metres. It must not be pinched. A cable tie must hold it in place on one of the two fittings of the sensor.
Variant: The sensor incorporates NTC-type temperature measuring electronics. The temperature probe is placed outside, protruding from the enclosure through a packing gland.
The external dimensions are approximately 84 x 82 x 55 mm.
The IP55 enclosure complies with flammability standard UL94-V0 HB (no flame propagation).
There is no provision for tearing detection.

5.2 Installation recommendations

Below are the recommendations that should be followed when installing this sensor:

- To attach the flexible tube to the duct or to the ventilation casing: see commercially available fittings below

- The sealing around the drilling point must be respected and at least 10 cm of the tube must be inserted into the ventilation box.
- No special precautions are required to drill the ventilation ducts: once the drilling is completed, the fittings are fixed using 2 self-drilling screws.
- No special precautions are required to run the flexible tube or to attach it to the ventilation box: use cable ties, maintain and guide the tube so as to avoid any pinching/crushing.
- Do not loop the tube with a low point (moisture may condense inside the tube).

The product must be placed at least 1 metre away from the metal ventilation box, since the latter can constitute a ground plane that significantly attenuates the radio signal. It must also be positioned at a greater height than the CMV to prevent moisture from entering the sensor. It is therefore essential that the tube descends from the product to the CMV, and that it does not ascend under any circumstances.

Regarding the sensor support, we recommend the following:

- A supporting arm made of PVC tubing to be attached to the ventilation box to maintain the sensor away from the box
- A folded PVC sheet that protects the sensor, mainly from direct sunlight

The marking of the measuring tube must be checked in order to connect it upstream of the ventilation system.
The pressure measuring tube is marked on the box by the symbol "-":

- The "-" tube must be connected at the suction point of the air flow (where pressure is the lowest)

5.3 Power supply

The SigFox ventilation sensor board is powered by a lithium battery. The electronics are designed in such a way as to obtain a very low standby current that allows for a low lithium battery capacity.
The battery's theoretical service life is approximately 12 years (10 years for the temperature variant) based on one measurement every hour and one transmission every 24 hours.
For any other configuration with a lower measurement or transmission period, the service life will be reduced.
The battery is replaced at the factory.
This theoretical lifetime of the battery is valid for the operating temperature range of +10 °C to +25 °C.

5.4 Power supply self-test

The board measures the supply voltage of its battery before each radio transmission and is capable of detecting a low battery. If the voltage drops below a minimum threshold, an alarm is sent to the network after the data has been transmitted.

5.5 Configuration settings for the SigFox ventilation sensor

The sensor is supplied with factory settings, defined at the time of the order, and for a minimum volume of 100 sensors:

- Minimum interval between two measurements: 1 to 48 hours, in 1 hour increments,
- Period between two radio transmissions: 6 to 48 hours, in 1 hour increments,
- Alarm thresholds:
  - Minimum and maximum pressure for threshold overrun alarm (from 0 to 10000 Pa, i.e. from 0 to 10 kPa)
  - Minimum battery level for threshold overrun alarm (from 1 to 36 1/10V, i.e. from 0.1 V to 3.6 V)
  - Variant: minimum and maximum temperature for threshold overrun alarm (-200 to 600 1/10°C, i.e. -20°C to +60°C).
    - N.B. : If the minimum and maximum thresholds are identical, the measurement of temperature and associated alarms are deactivated.

The embedded software is updated using a dongle plugged into the board.

The settings of the sensor configuration file are specified in the document " SPDL_SIGFOX_Sensor.pdf".

5.6 Pressure measurement

The board is fitted with a sensor that measures the vacuum.
This measurement in the CMV duct is performed using a tube that must not be pinched. A cable tie must hold it in place on the corresponding fitting of the sensor.

At regular intervals, the sensor wakes up to perform a measurement. For every radio transmission period, the sensor deduces an average pressure = sum of measurements * measurement period / transmission period.
This average of measurements is transmitted at regular intervals by SigFox.
The microcontroller manages its consumption optimally according to its measurement period.

The sensor supports pressure measuring electronics compatible with the measurement range from 0 to 10 kPa. The resolution is 15 Pa in this measurement range.

5.7 Variant: outside temperature measurement

Variant: the sensor is equipped with outside temperature measuring electronics.
Temperature measurements are carried out every hour and are independent of the measurement period.
Prior to every data transmission, the system deduces a minimum, a maximum and an average - useful values for calculating the UDD.
As for the pressure measurement, these measurements are transmitted at regular intervals (see radio transmission period) via SigFox.
N.B. : in order to lock onto full 24-hour days and assuming that the products are activated on average around noon, we wait 12 hours after this activation to perform the temperature measurements from midnight onwards. Therefore, if a radio transmission is scheduled before the first 12 hours of operation of the system, the temperature measurements sent are not representative (average value at 0, minimum value at 600°C (which corresponds to the maximum value possible) and maximum value at -200°C (which corresponds to the minimum value possible)).

The microcontroller manages its consumption optimally according to its measurement period.

A cable gland allows the passage of a remote temperature probe designed to measure the temperature outside the enclosure. The measurement range is -20°C to +60°C with a 0.2°C resolution over the range.
The NTC (Negative Temperature Coefficient) active element is positioned so as to slightly protrude from the body of the gland and therefore be "immersed" in the outside air.
The sensor is intended to be attached to a vertical offset arm, **with the probe facing downwards**, at a height great enough to be:

- in an area that is representative of the measured quantity,
- sufficiently inaccessible (there is no provision for tearing detection).

5.8 Microcontroller

The microcontroller can be updated via the plug-in connector and a programmer.

5.9 NFC tag

An NFC tag attached to the enclosure is programmed to include a type, as well as a product identifier in order to simplify any intervention by the installer, who will retrieve this information by "tagging" the product.

6. FUNCTIONS OF THE PRODUCT IN INSTALLATION AND USE

6.1 Operation and communication

A magnetic sensor and an embedded confirmation buzzer allow the sensor to be taken out of storage mode and to initiate communication with the network (start "alarm").
Similarly, the system can be stopped by reactivating the magnetic sensor. When the sensor is stopped, it also transmits a stop "alarm".

The sensor sends the measurements made during each radio transmission period.
"Low battery" or "Measurement out of range" alerts are also sent during the radio transmission period that follows their detection.

In order to detect any communication problem with the network (see data losses), a SigFox frame transmission counter is sent together with the measurements made. This means that if this counter has been incremented twice between two data transfers, one transmission has failed between the two actual data transfers. Based on this principle, if this counter has been incremented three times, then two transmission attempts have failed.

6.2 Data transfer period and reference date

The data transfer rate (measurements or alarms, if any) of the SigFox ventilation sensor is one of the parameters of its configuration.
Transmission dates are calculated from a first transmission date and by adding the transfer period.
The data structure (format of each measurement) of this sensor is specified in the document "SPDL_SIGFOX _Sensor.pdf".

6.3 Measurement data resolution

Pressure measurements are directly stored in Pa (Pascal).
Variant: temperature measurements are stored in 1/10th of the corresponding physical unit (°C).

6.4 Alarm data

Important: between two measurements, the sensor goes into standby mode. No alarm shall be detected (e.g. fan that stops between two measurements). It is not until the next wake up that a possible alarm will be detected and sent during the next radio transmission period.

The different types of alarms are:

- Product activation/deactivation alarms
- Power supply alarms (low battery)

- Physical quantity alarms (pressure and as a variant: temperature)

If a preset threshold is exceeded (pressure, battery voltage or as a variant: temperature), the alarm is transmitted during the next radio transmission period.

A "hysteresis" function is implemented to avoid the transmission of false alarms or unnecessary alarm repetitions.

7. MANUFACTURABILITY

In order to limit production costs, the electronic boards will have to follow a conventional manufacturing process involving a mix of SMD and through-hole components wave soldered onto FR4 epoxy printed circuit board with metallised holes.
In compliance with EMC standards and despite the additional cost generated, a 4-layer CAD with the most significant ground plane possible shall be favoured. The finish of printed circuit boards shall comply with the latest Lead Free / RoHS specifications.

7.1 Testability

An in situ test (or one similar in performance) is carried out at 100% once the components are inserted.
A functional check is performed by a test software embedded in each SigFox ventilation sensor and specific tooling.
Mounting pads for test probes shall be arranged on the traces of strategic signals. A PC software shall be used for programming the microcontroller and shall use a plug-in connector.

7.2 Identification-Traceability

Products are identified individually. Each board is programmed with a unique serial number.
Each sensor bears a unique internal identification code visible on the product identification label.

This label allows traceability and indicates:
- the NKE product group code (50-09-034-xxx)
- a unique NKE code for determining the manufacturing order (MO) number and the product number in the MO
- the serial number

7.3 Packaging

Each board is delivered mounted in an enclosure.
When shipped, the SigFox ventilation sensors are grouped in batches, in a cardboard box capable of withstanding transport constraints.

8. MAINTAINABILITY

There is no provision for preventive maintenance operations.
The product must be returned to the factory to carry out after-sales service or to replace the battery.

9. DESIGN CONSTRAINTS

9.1 Operating temperature and pressure

- Temperature probe:
  - Range from -20°C to +60°C
  - 0.2°C resolution over the range
- Pressure sensor:
  - Range from 0 to 10 kPa
  - 15 Pa resolution over the range

9.2 Temperature and humidity in storage

The temperature sensor integrated with the board imposes a storage range of -10°C to +30°C (limited by the battery) and less than 75% relative humidity.

9.3 Power supplies

Power is provided by a lithium battery.

9.4 Tightness - IP rating

IP55.

9.5 Autonomy

See paragraph above.

9.6 Mechanical stress - shocks - vibrations

N.B. : the enclosure is intended to be attached to a vertical offset arm.
Measures are taken to prevent the tool used during wiring (e.g. screwdriver) from tearing off a component if it slips.

Variant: the temperature probe will be facing downwards, at a height great enough to be:
- in an area that is representative of the measured quantity,
- sufficiently inaccessible (there is no provision for tearing detection).

10. NORMATIVE REQUIREMENTS

10.1 Electromagnetic compatibility

For CE marking purposes, products comply with the general EMC regulations for electronics. NKE takes care of the testing necessary to ensure the compatibility of its products
The selected radio component complies with standards EN 300-220 / EN 301-489.

10.2 Electrical Safety

N/A

10.3 Standards and regulations specific to the business segment

NF EN-60335-1
Products are designed and manufactured in accordance with Directive 2002/96/EC on Waste Electrical and Electronic Equipment and Directive 2002/95/EC on the Restriction of Hazardous Substances (RoHS).

11. MARKETING SPECIFICATIONS

11.1 Product service life

7 years minimum

11.2 Projected quantities

The product must be designated for up to 500 units produced per year.

11.3 Pricing structure

The applicable pricing conditions are those set out in the applicable commercial offerings.

11.4 Guarantee

Products are guaranteed 24 months from the date of delivery by NKE, subject to implementation in accordance with the rules set out in the technical specifications.

11.5 Maintenance

N/A. Except for battery replacement, which requires the product to be returned to the factory.

11.6 Product documentation requirements

Customer's responsibility.