GENERAL SPECIFICATIONS

ICT Sigfox Alarms Transfer Sensor

Document revision history

DATE	REVISION	OBJECT	Author
02/11/2015	0	Creation	PLG
07/09/2017	1	Precision regarding temperature conditions for the battery's theoretical service life	MC

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TABLE OF CONTENTS

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1. OBJECT OF THE DOCUMENT

Describe the operation and technical characteristics of the product "**SigFox alarms transfer sensor**".

2. APPLICABLE DOCUMENTS - REFERENCE DOCUMENTS

- General specifications of the SigFox alarms transfer sensor (Wmbus):
  50-09-029_SPG_Alarms_Transfer_Sensor.doc
- Detailed software specifications - SigFox sensors data exchanges:
  50-09_SigFox_SPDL_Sensor.pdf

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.

Differential coding: (also called **delta compression**) is a lossless data compression technique that consists in transforming data through the series of differences between successive data. This method based on the simplified Huffman coding is only interesting if the data to be compressed are subject to little change.

4. BACKGROUND AND OBJECTIVES OF THE STUDY

The SigFox alarms transfer sensor has been developed based on new electronics that incorporate the SigFox technology.
It allows the transfer of the alarm state of an equipment: garage door, boiler room, etc...

The sensor is to be connected to the equipment's alarms transfer contact using a multi-wire telephone cable with a maximum length of 100 metres on the high impedance input of the sensor.
Note: the sensor is supplied without cable.

Important:
- the sensor must be placed under coverage of the SigFox public network.

- 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 alarms transfer sensor board is housed in a grey ABS enclosure.

The sensor must be sheltered so as not to be subjected to excessive external stresses or excessively fast changes in ambient conditions (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 any metal element that can constitute a ground plane that significantly attenuates the radio signal.
When the sensor is installed indoors, extra attention must be paid to the SigFox network coverage, which is greatly reduced in this case.

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Model SPG.dot Rev1 of 14/12/04

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.
A cable gland allows the passage of the cable (2 (conductors) intended to be connected to the board.

Important: for cables intended to be connected to the alarms transfer sensor board, we recommend using moulded (not simply sheathed) circular multi-wire telephone cables with a maximum length of 100 metres to avoid any detrimental effect to the tightness of the product. Cables are not supplied with the products.
The minimum/maximum outside diameters allowed for the cable are 2 / 6.5 mm.

The electrical connection is made on a spring-type terminal block with 3.5mm pitch using a 2-conductor cable (max. length: 5 metres).
The position of the points is marked on the copper elements of the board.

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 Power supply

The SigFox alarms transfer 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 (maximum one change of state per day for the equipment's alarm transfer contact). This maximum time can be significantly reduced depending on the settings of the sensor, in particular the number of changes of state of the equipment's alarm transfer contact.
In the case of a more frequent change of state of the alarm transfer contact, 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.

5.3 Information frame and power supply self-test

Sensor information frames are sent during the period of radio transmission of these information frames set in the product configuration but also 5 minutes after the sensor is activated, and at every change in software or product configuration. These information frames can be deactivated by specifying "0" for the corresponding parameter in the configuration. The information sent in these frames are: the battery voltage measurement, the number of radio transmissions, the software and product configuration version and subversion.

Indeed, the board measures the supply voltage of its battery and sends the measurement during the period of radio transmission of sensor information frames set in the product configuration. The sensor is capable of detecting a low battery information. If the voltage drops below a minimum threshold, an alarm is sent to the network after the data has been transmitted.

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Model SPG.dot Rev1 of 14/12/04

The number of radio transmissions corresponds to the number of radio transmissions that the sensor has made since leaving the factory.

The software and product configuration versions and subversions have the following formats:
- Software: 01.00 (version: 01 and subversion: 00)
- Configuration: 02.05 (version: 02 and subversion: 05)

5.4 Configuration settings for the SigFox alarms transfer sensor

The sensor is supplied with factory settings, defined at the time of the order, and for a minimum volume of 100 sensors:
- Interval between two radio transmissions of sensor information frames (measured battery voltage, number of radio transmissions, software and configuration version and subversion): 0 to 30 days, in 1 day increments ("0": deactivation of sensor information frame transmission)
- Alarm thresholds: minimum battery level for threshold overrun alarm (from 1 to 36 1/10V, i.e. from 0.1 V to 3.6 V)
- Minimum interval between two Open → Closed or Closed Open → changes of state:: 1 to 240 minutes, in 1 min increments (this setting allows excessively frequent changes of state to be filtered out)
- Reversal of contact type by default. If the state of the non-alarm contact is NC (Normally Closed), i.e. in the resting state, the signal is grounded, then this parameter must be set to 0; if the state of the non-alarm contact is NO (Normally Open), i.e. in the activated state, the signal is grounded, then this parameter must be set to 1.

Later versions will allow these configuration settings to be updated locally using a micro SD card (connector present on the board) on which a configuration file that specifies the new values of these settings will be loaded.
The embedded software will also be updated locally using a micro SD card.

The settings of the sensor configuration file are specified in the document "50-09_SigFox_SPDL_Sensor.pdf".

5.5 Detection of a change of state of the equipment's alarms transfer contact

At every change of state of the equipment's alarms transfer contact, the sensor wakes up and transmits the new state in the form of an alarm over the SigFox network via radio link, after which the sensor is placed in standby mode.

The microcontroller manages its consumption optimally according to its period of monitoring of the alarms transfer contact and battery voltage measurement.

In order to detect cases of malfunction(s) of the alarm (change(s) of state detected during the minimum interval between two changes of state), an ascending malfunction alarm is sent at the end of the minimum interval between two changes of state if changes of state have been detected during this interval.

In this case of malfunction(s), the descending alarm is filtered by the minimum interval between two changes of state in order to preserve the autonomy of the sensor (otherwise the sensor could send too many alarms without providing any additional information, which would considerably reduce its autonomy).

Principle of operation:

- **Normal operation (Case no. 1):** After activating the sensor, an ascending alarm is sent at the first change of state detected, then a descending alarm is sent either at the end of the minimum interval between two changes of state if the state has returned before the end of this interval, or at the next

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change of state after this interval. (No filtering is performed on the descending alarm in the case of normal operation).
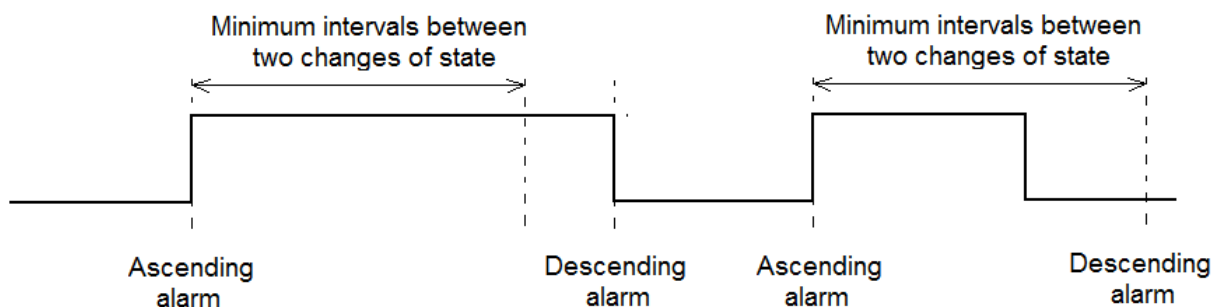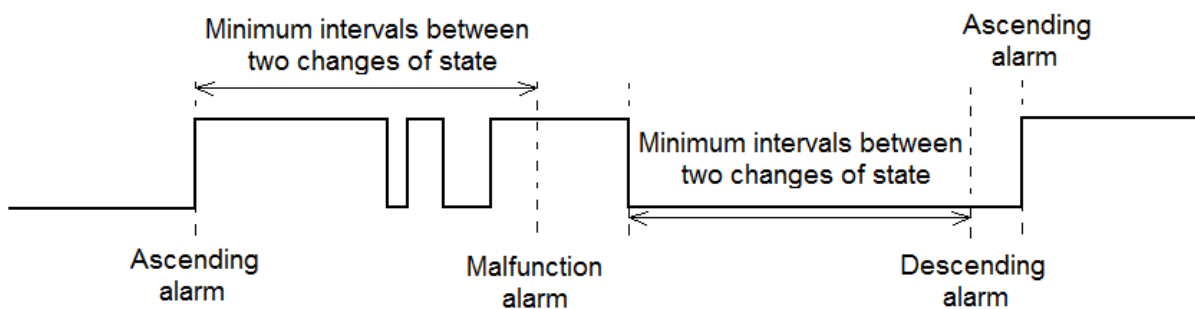

Case no. 1

- **Case of alarm malfunction:** After the sensor is activated, an ascending alarm is sent at the first change of state detected, but if at least two changes of state are detected during the minimum interval between two changes of state, an ascending malfunction alarm is sent at the end of this interval. In this case of malfunction, the descending alarm is filtered. This means that a descending alarm is sent at the end of a second minimum interval between two changes of state. This second interval begins either when the malfunction alarm is sent if the state has returned before the end of the first interval (case no. 3) or at the next change of state after this first interval (case no. 2) .

   On the other hand, at the end of the minimum interval between two changes of state, if the alarm is maintained (case no. 4) or if it is still in malfunction (case no. 5), no new alarm is issued.

CAUTION:
- There is no descending malfunction alarm provided by this sensor.
- In the event of a malfunction, the filtered descending alarm will not return in real time. It will be sent at the end of the minimum interval between two changes of state.
- In the case of a malfunction, there is no filtering on the signal in the high state. Filtering is performed only on the descending alarm.
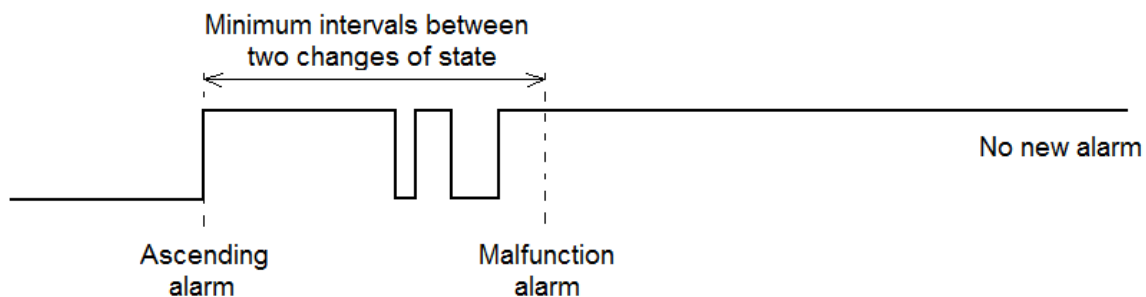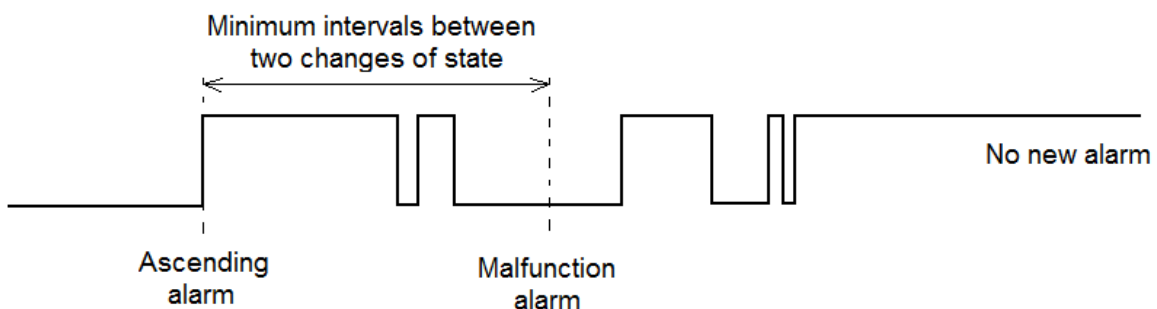

Case no. 2
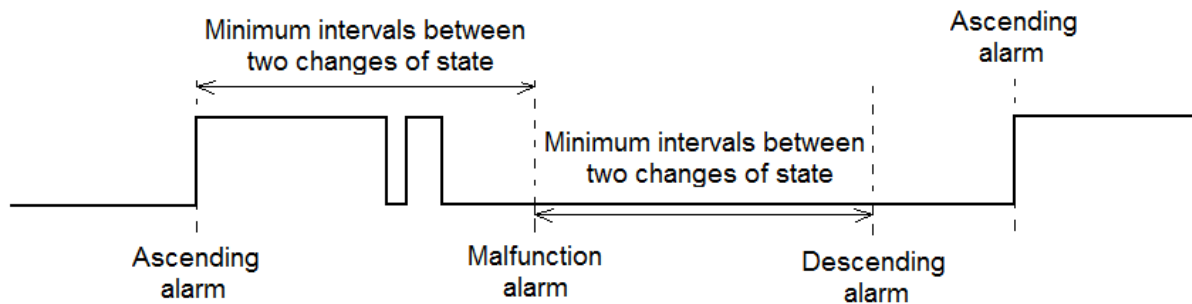
Case no. 3

Case no. 4

Case no. 5

Summary: in the event of a malfunction, the ascending alarm is always active as long as the system has not returned to normal operation with detection of the filtered descending alarm.

5.6 Microcontroller

A Flash memory inside the microcontroller supports:
- the software: the sensor is supplied with the current version of the software (later versions will allow local updates via a micro SD card).
- the configuration settings for the operating profile (later versions will allow local updates via a micro SD card).

5.7 NFC tag

An NFC tag attached to the sensors (inside the enclosure) includes a product type, as well as a unique internal identification code 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 (reed switch) activated by a magnet 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 (reed switch). When the sensor is stopped, it also transmits a stop "alarm".

"Low battery" alerts are sent during the period of radio transmission of information that follows their detection, if this function is activated.

6.2 Information transfer period and reference date

The information transfer rate (battery voltage, number of radio transmissions, software and configuration versions and subversions) of the SigFox alarms transfer 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 information structure of this sensor is specified in the document "50-09_SigFox_SPDL_Sensor.pdf".

6.3 Alarm for a change of state of the equipment's alarms transfer contact

The observed changes of state of the equipment's alarms transfer contact are transmitted in the form of an immediate alarm (almost in real-time) to the SigFox network.

6.4 Alarm data

Important: between two measurements, the sensor goes into standby mode. No alarm shall be detected (e.g. low battery voltage). It is not until the next measurement that a possible alarm will be detected and sent immediately.

The different types of alarms are:
- Product activation/deactivation alarms
- Power supply alarms (low battery)
- Alarm for a change of state of the equipment's alarms transfer contact.
- Device malfunction alarm (detection of change(s) of state during the minimum interval between two changes of state).

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.

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A functional check is performed by a test software embedded in each SigFox alarms transfer 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 (50-09-046-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 alarms transfer 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

Operating range comprised between -20°C and +50°C.

9.2 Storage temperature

Storage range comprised between -10°C and +30°C (limited by the battery).

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

Measures are taken during wiring to prevent the tool used (e.g. screwdriver) from tearing off a component if it slips.

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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 Pricing structure

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

11.3 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.

11.4 Maintenance

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

11.5 Product documentation requirements

Customer's responsibility.

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