D731D: Insafe+Origin Lora

Technical Guide

03/02/2021

www.nexelec.fr

1. Product overview

1.1. Introduction to the product

Smoke, Temperature / Humidity sensors and Indoor Air Quality Monitor

INSAFE+Origin is a new generation connected smoke sensor that also includes a temperature/humidity sensor.

Thanks to its « Edge Computing » architecture and its IZIAIR embedded algorithm, INSAFE+Origin calculates an indoor air quality index to help you take appropriate actions.

It is an ideal product for connected homes, residential or tertiary buildings and public establishments (schools, nurseries, leisure centers, retirement homes, etc.).

Product benefits:
> 4-in-1 product: Smoke, temperature, humidity sensors, Indoor Air Quality monitor
> IZIAIR Indoor Air Quality Indicator functional for the temperature range from 15 °C to 30°C
> Wireless sensor for easy and fast installation
> 10-year battery life for the product and wireless connection
> Elegantly designed detector

Applications:
> Control of smoke presence in residential premises and public places
> Control of indoor air quality in residential premises and public places
> Maintenance optimization
> Improvement of building energy efficiency
> Development of new services: home care assistance, well-being, heating cost savings, etc.

**Basic functions:**
> Alarm
> Low battery notification
> Functional manual test of the detector
> Measurement of temperature and humidity every 10 minutes

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Advanced features:
> Functional self-test (every 45 seconds)
> Product end of life notification
> Residual battery life
> Alarm pause function (9 minutes)
> Low battery alarm pause function
> IZIAIR indoor air quality index (5 levels)
> Reconfigurable product configuration via downlink
> Optimized message transmission: alert management on thresholds, keepalive, datalogging etc.

1.2   Product scheme
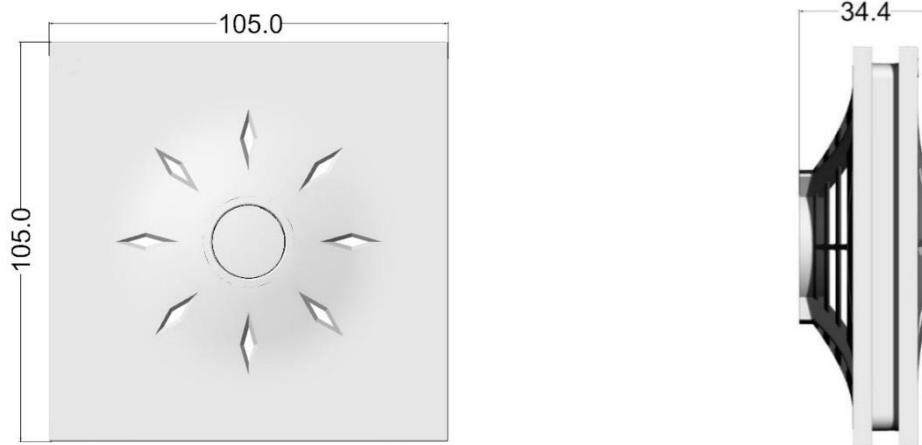
1.3   Detailed specifications

Product terms of use

> Indoor household environment

> Temperature: 4°C to + 45°C
Note: The detector has a lifespan of 10 years in a standard domestic environment (temperature between 15 ° C and 30 ° C). The detector can be used in an exceptional domestic environment (temperature between 4°C and 45°C). Recurring and / or prolonged use in this exceptional environment can reduce battery life and therefore detector autonomy. Residual battery estimation may also be wrong outside standard domestic environment.

> Relative humidity: from 0 to 95% RH (non-condensing)

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Sensors and measurements:

		Temperature	Humidity
Accuracy	Typical	±0.3 °C	±2 %RH
	Max	±0.4 °C	±3 %RH
Resolution		0.1 °C	0.5 %RH
Measuring range		0 – 50 °C	0 – 100 %RH
Measuring period		10 min	10 min

Certifications

The product is compatible with the following directives and standards:

Directives

- Radio Equipment Directive (RED) 2014/53/EU
- 2011/65/EU (RoHS) Directive

Standards :

- EN 62368-1
- EN 301 489-1 V2.2.0
- EN 301 489-3 V2.1.1
- EN 300 220-2 V3.2.1
- EN 62311 : 2008
- EN 14604 : 2005
- EN 14604 : 2005/AC : 2008

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2. Product operation

2.1. Smoke detection

Product is working locally as a standalone smoke alarm by activating its sounder and LED when smoke is detected.

A "Smoke Alarm" message (Refer to section 4.4 Smoke alarm status) is sent twice at 10 seconds intervals after the smoke alarm activation occurs. Then, the message is sent once every minute until smoke alarm deactivation. This event will also trigger a message sent twice at 10 seconds intervals.
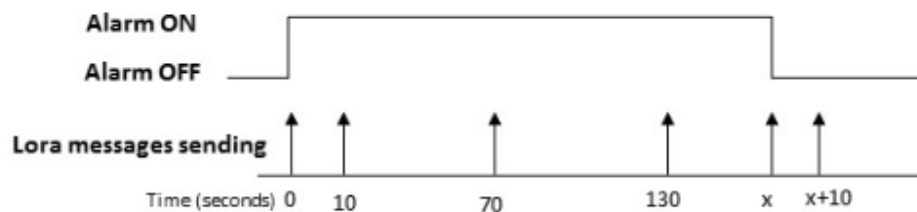
2.2. Push button

Short press to stop or pause your product

Short press is used for pausing or stopping the smoke alarm. Pausing the alarm helps to control a pending false alarm in advance (e.g.: smoke or steam when cooking, use of candles or incense, cigarette smoking, etc.). After 9 minutes, your product automatically resumes normal operation.

Long press to test your product

To test your alarm, press the button (> 3 seconds) until the alarm sounds then release. If the test does not work, the detector probably detected an operating defect.

A "Smoke alarm" message is sent to indicate the beginning and the end of the test (Refer to section 4.4 Smoke alarm status). "Real Time" message containing temperature, humidity and air quality is also generated (Refer to section 4.6 Real Time Data).

Multiple press

A multiple press (3 times) generates an OTAA join request.

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2.3. Air quality analysis

Insafe+Origin embeds a temperature/humidity sensor that enables air quality analysis. Depending on the uses-cases, you can select the appropriate function to get temperature / humidity and air quality data. These functions can be activated, deactivated and configured via downlink (Refer to section 4.10 Reconfiguration via downlink message).

Daily air quality

This function measures temperature, humidity and air quality every 10 minutes.

Every 24h, it provides:

- o Minimal, maximal and average temperature and humidity over last 24h
- o IZIair air quality information

Temperature/Humidity datalog

This function enables to gather several temperature/humidity measurements into a single LoRa message. The period between the measurements can be configured between 10 minutes and 150 minutes.

Every 6 hours, it provides the last temperature/humidity data (between 2 and 36 data depending on the configuration) (Refer to section 4.7 Datalog Temperature and 4.8 Datalog Humidity).

Example 1 –
Period between measurements
configured to 60 minutes
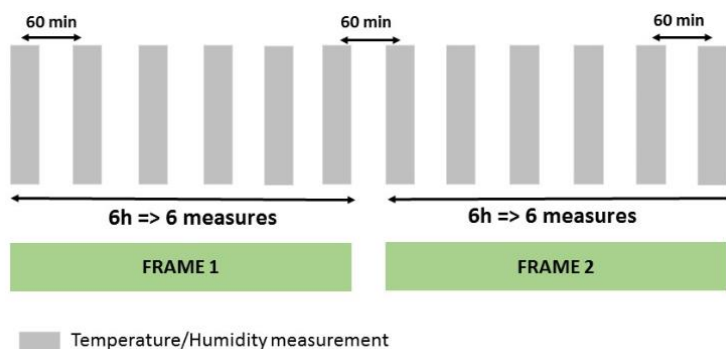
Example 2 –
Period between measurements
configured to 30 minutes

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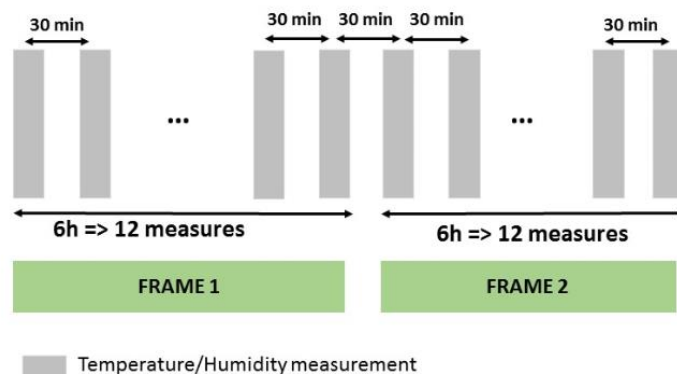
Note: The period between the measurements affects the product consumption and therefore the product autonomy. Refer to section 6 Product lifetime for autonomy impact.

Temperature alerts

This function enables to send a message when the temperature crosses one of the two configurable alert thresholds. A hysteresis (typical value of 0.5°C) is applied below each threshold to avoid too many messages.

Example of operation:
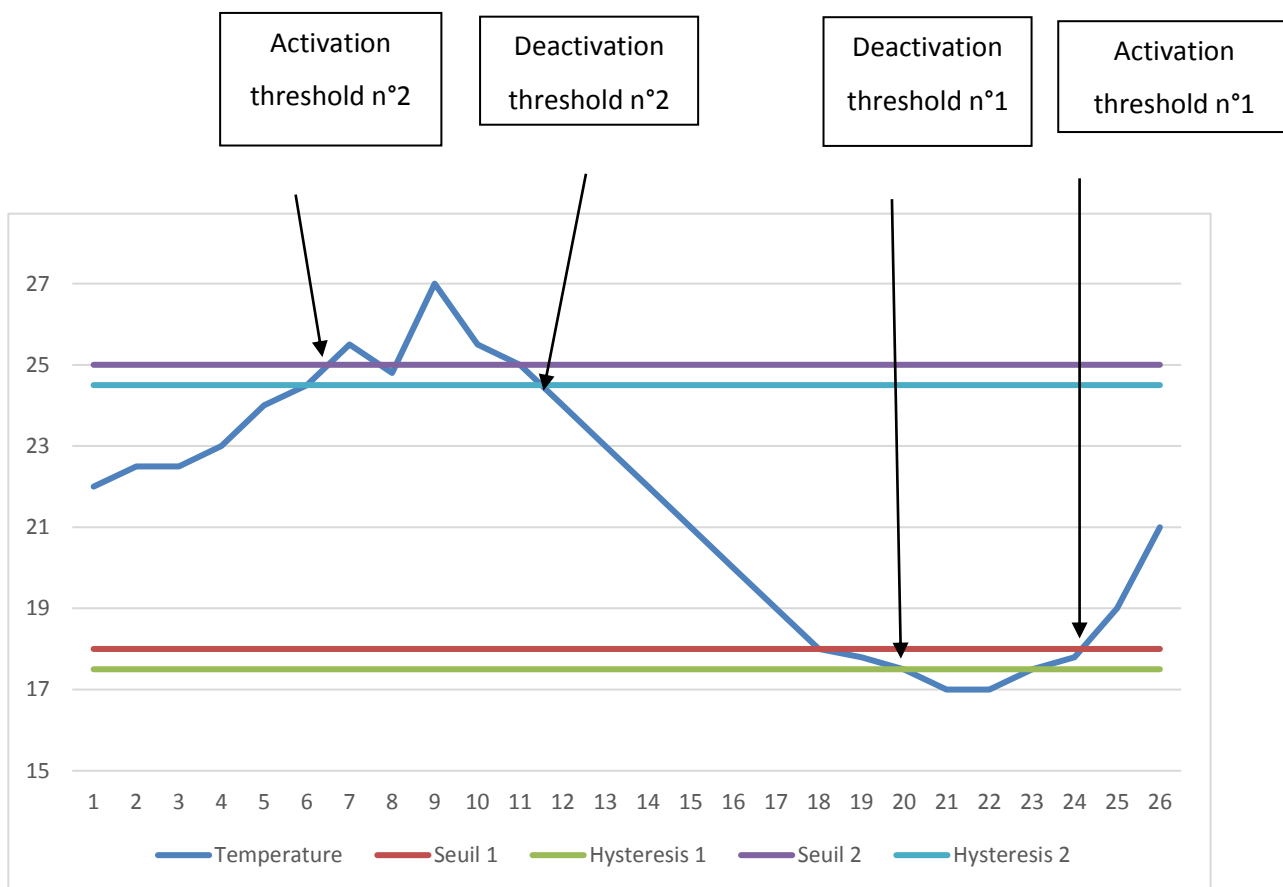
2.4.   Keepalive

A message is sent by the product on a regular basis to check its correct functioning. By default, the sending period of this message is set to 24h but this parameter can be reconfigured via downlink.

2.5.   Remaining lifetime forecast

As agreed with the certification EN 14604, the product lifetime is 10 years. A countdown indicating the remaining time until product end of life is given in the product status frame (Refer to Section 4.1. Product Status, Remaining product lifetime byte).

The connectivity autonomy part depends on the number of messages sent per days and the network coverage. The standard configuration of the product ensures a product lifetime of 10 years (Refer to section 5. Standard configuration). It's possible to reconfigure your product to decrease the period between measurements or to activate alerts for example. This is likely to reduce the product lifetime. A simulation of the product lifetime according to the actual use and the quality of the network helps to anticipate the actions to increase the lifetime.

Each 7 days, the predictive lifespan is re-calculated and is available in the product status frame (Refer to section 4.1.Product Status).

Example of use cases:

Consider a building manager configuring his products as follows:

- Temperature and Humidity datalog activated with a decimation factor = 1 (i.e a measurement each 10 minutes)

This configuration leads to more sending of messages and may not ensure a lifetime of 10 years for all types of network (Refer to section 6.Product lifetime). It's quite difficult to anticipate the quality of the network before deploying the products. Below, 2 examples of solutions to increase product lifetime.

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1) Add a gateway

A typical use case is when the quality of the network is not so good. By adding a new gateway, the network coverage will be better and therefore the product will work longer.

Building configuration

Network Quality

Lifetime = **90 months**

Building configuration

Network Quality

Lifetime = **120 months**
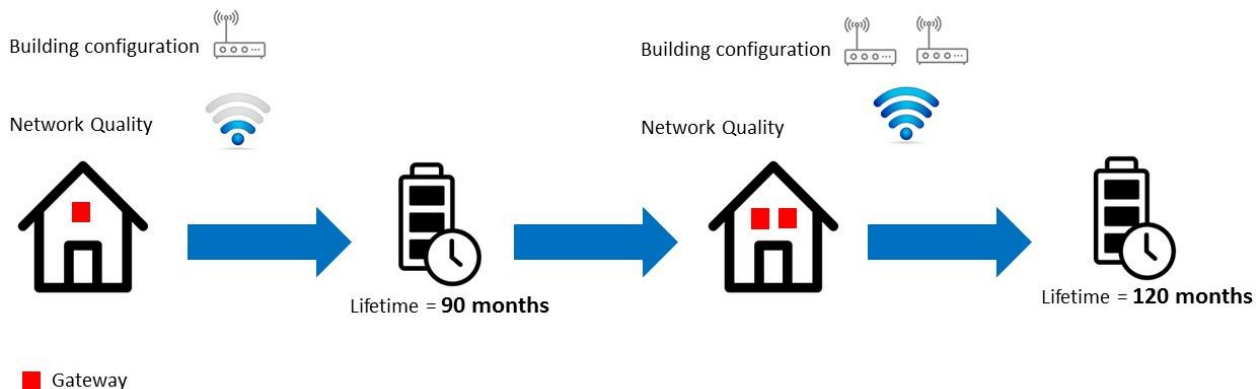
■ Gateway

2) Change product configuration

An alternative of adding a new gateway is to change the product configuration by another one that uses less energy and therefore enables a longer product lifetime.

Product configuration

Datalog period

10 min

10 min

Product configuration

Datalog period

10 min

OFF

Lifetime = **90 months**

Lifetime = **120 months**
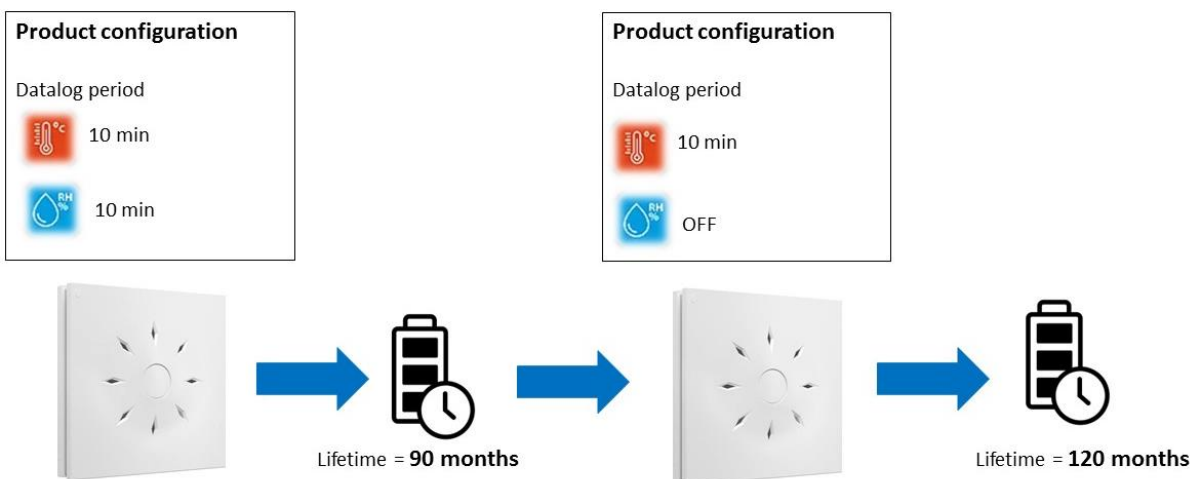
3. Installation

3.1.   Installation locations

Depending on the layout and the surface area of the dwelling, several smoke detectors may be required to ensure minimum protection and guarantee efficient detection, the range of the alarm and quick evacuation of the dwelling.
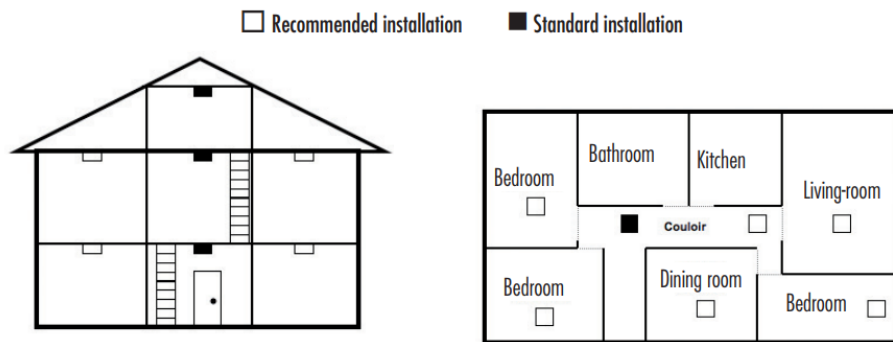
Standard installation

- On each floor

- In hallways and/or stairwells

- Between rest areas (bedrooms), the possible ignition sources (garage, area with a high electrical system, etc.) and exits leading outside of your home (door, window)

Recommended installation
Place a detector:

- On each floor, every 7 m

- In each stairwell per level

- In each room (1 for 50 m²), except in the kitchen and the bathroom (refer to paragraph below: «Places to be avoided»)

 It is recommended to install smoke detectors:

- less than 7 m from possible ignition sources

 - less than 7 m from rest areas (3 m if the doors are closed)

- less than 7 m from exits

Locate the detector in line with the current building standards.

Ceiling mounting

Install the detector to the ceiling in the center of the room, minimum 30 cm from corners, walls, beams or any other obstacles.

Wall mounting

Install the detector to the wall at a distance ranging between 30 cm and 60 cm from the ceiling.
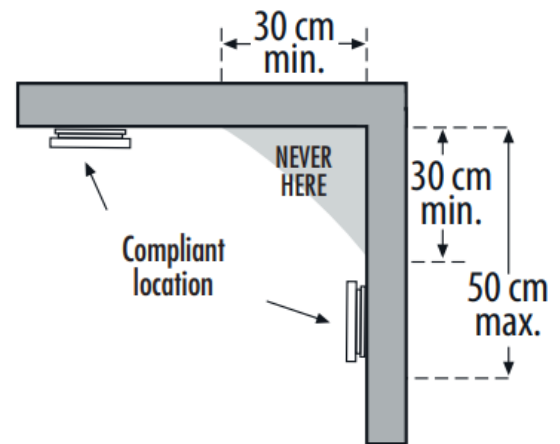
Mounting on a sloped ceiling

Install the detector at a distance ranging between 30 cm and 60 cm vertically from the highest point of the ceiling.
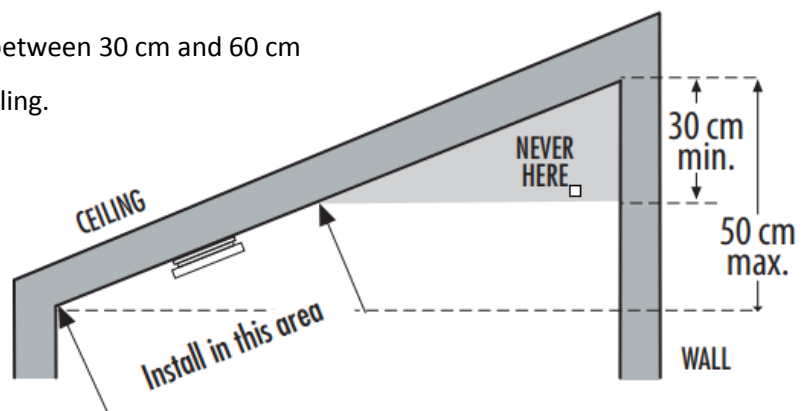
CAUTION: INSAFE+ Origin detector is wall-mounted only. It can not be located on the ceiling.

Places to be avoided

Do not install the smoke detector:

- Outside

- In a place where the alarm will be difficult to hear (room with closed door)

- In a place where the detector will be difficult to reach, in particular to perform tests

- In a place where the temperature is lower than 4°C or higher than 45°C

- In a place where humidity is less than 10% or exceeds 95% (bathroom, kitchen, laundry room, etc.)

- In a place subject to high and/or rapid temperature, pressure or humidity variations

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- In a place where the sunlight hits directly on the detector

- In a dusty or dirty area (garage, workshop, etc.)

- In a place where there are a lot of insects

- In a place where spurious smoke may disturb the smoke detector: kitchen, chimney, garage (exhaust gas), furnaces, boiler rooms, combustion radiators, etc.

- Close to heating appliances, windows, ventilation ducts, air conditioners, fans or any other item of equipment that may produce air flows

- Close to an area that is hotter or cooler than the rest of the room (non-insulated walls, hatches, etc.)

- Less than 1.5 m from obstacles preventing the smoke from accessing the detector (decorative objects, walls, doors, plants, chandeliers, curtains, etc.)

- Less than 1.5 m from lighting appliances (ceiling light, incandescent lamps, halogen or fluorescent lamps, etc.)

- Less than 1.5 m from electrical appliances or their wiring

3.2. Description of mountings

Mounting base for wall-mounted

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3.3. Mounting and bracket

Attaching the detector to a wall

Use the mounting base and the screws and wall plugs provided with the detector.
The product can also be mounted using the adhesive attachments (sold separately).
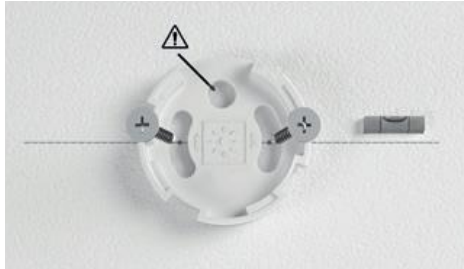
Comply with the following procedure:

> Select an appropriate location to secure the detector to the wall
> Remove the mounting base from the detector
> Mark the preferred location of screw holes on the wall using a pencil. The drawing inside the base shows the final position of the detector when attached. (3)
> Insert the nylon wall plugs provided and screw on the mounting base (4)
> Place your detector on the mounting base and then rotate a quarter turn to the right to secure. You should hear a «click», indicating that your detector is secured in its mounting base (5)
> Check that your detector is securely fitted to the wall

3.4. Activation and commissioning process

Activation

To commission your monitor, activate the single-use switch (1)

Initial commissioning

The orange LED will blink slowly during the join process (max 25 seconds). If

the process has been successful, the orange led will remain on during the

initializing period that may last up to 1 minute. In case of failure, the orange led will blink rapidly during

5 seconds.

(1)
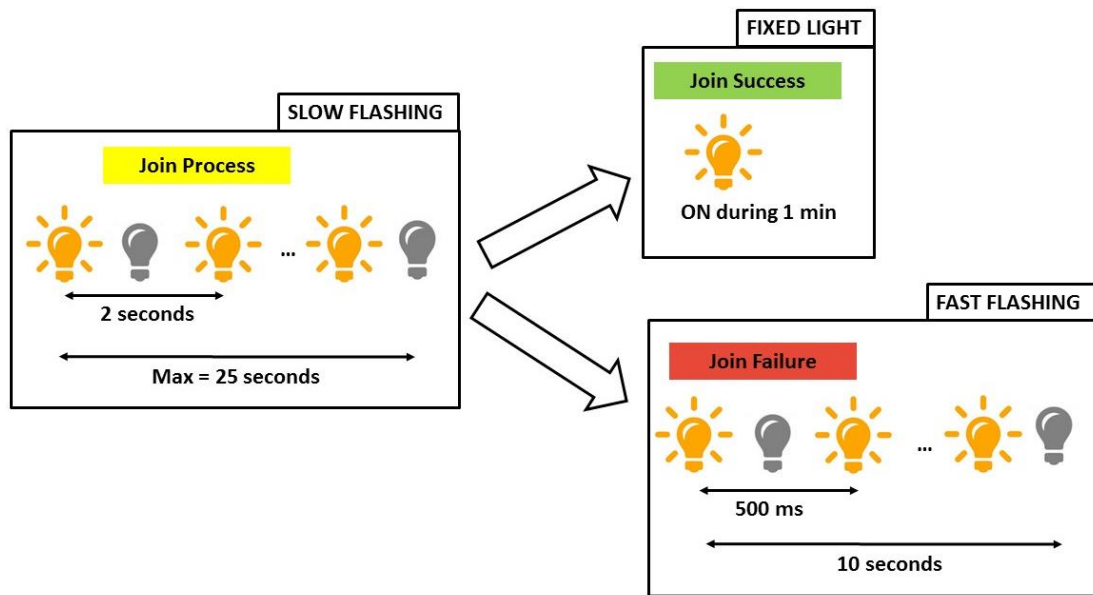
If the initial commissioning failed, the product will automatically retry once. In case of failure, the product will then follow the commissioning strategy described below (Refer to section Commissioning strategy in case of initial failure).

Product configuration and coverage analysis process

If the commissioning process is successful, the product will send its status (refer to section 4.1 Product Status), its configuration (Refer to section 4.10.Configuration of product function) and between 6 and 10 keepalive frames with about 10 seconds between each frame. This process intends to provide enough data for radio coverage analysis. The end of this initializing period is represented by the extinction of the orange led.

Commissioning strategy in case of initial failure

If the initial commissioning process failed, the product will automatically try to join the network with an increasing period between each try:

1st retry will occur 20 minutes after initial commissioning.

2nd retry will occur 40 minutes after 1st try.

3rd retry will occur 80 minutes after 2nd try.

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In case of failure, the product will then try to join the network every 24h.

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Schedule a recommissioning

You can schedule a join request. The typical use case is when you want to switch from a server to another. This function is available through downlink command. A confirmation message is sent to confirm the activation of the scheduling (Product status message, join request pending bit).

4. Description of Lora payload

4.1. General description

Insafe+ Origin is a configurable smoke alarm including following functions.

ID Message	Details of the function	Transmission of message	Can be deactivated	Configurable
0	Product Status	On event + Periodic	No	No
1	Product Function Configuration	On event	No	No
2	Keepalive	Periodic	Yes	Yes
3	Smoke Alarm status	On event + Periodic	No	No
4	Daily air quality	Periodic	Yes	Yes
5	Real time Data	On event	No	No
6	Datalog Temperature	Periodic	Yes	Yes
7	Datalog Humidity	Periodic	Yes	Yes
8	Temperature alerts	On event	Yes	Yes

4.1 Product Status

This message is sent when product is powered on, every 7 days or when one of this information changes:

- Battery level indication is defined using 4 levels:
  - High level: More than 50% remaining battery capacity
  - Medium level: 20-50% remaining battery capacity
  - Low level: 1-10% remaining battery capacity
  - Critical level: Less than 1% remaining battery capacity
- Product HW status: Smoke sensor status, Temperature/Humidity sensor status

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Offset	Size (bit)	Bit-range	Data	Description	Valid Range	Scale	Unit
0	8	DB0.7 – DB0.0	Type of product	Insafe+ Origin Lora	0xA2		
8	8	DB1.7 – DB1.0	Type of message	Product Status	0x00		
16	8	DB2.7 – DB2.0	HW revision	Hardware revision (enum)	0: C027A		
24	8	DB3.7 – DB3.0	SW revision	Software revision (enum)	0: S077A		
32	8	DB4.7 – DB4.0	Remaining product lifetime	Countdown time in months until product end of life	0-120	0-120	Month
40	1	DB5.7	Smoke sensor status	Status of the smoke sensor	0: OK 1: Smoke sensor fault		
41	1	DB5.6	Temperature / humidity sensor status	Status of the temperature / humidity sensor	0: OK 1: T°/humidity Sensor fault		
42	6	DB5.5 – DB5.0	Reserved	Reserved for future used	Reserved for future used		
48	8	DB6.7 – DB6.0	Battery 1 voltage	Battery 1 voltage, 5 mV step	0 - 250	2000 - 3250	mV
56	8	DB7.7 – DB7.0	Battery 2 voltage	Battery 2 voltage, 5 mV step	0 - 250	2000 - 3250	mV
64	2	DB8.7 – DB8.6	Energy status	Battery Level	0: high 1: Medium 2: Low 3: Critical		
66	1	DB8.5	Pending join	Join request scheduled	0: No join request scheduled 1: Join request scheduled		
67	5	DB8.4 – DB8.0	Not Used	Not Used	Not Used		
72	16	DB9.7 – DB10.0	Sent frames counter	Number of frames sent	0 - 65535	0- 655350	Frames
88	6	DB11.7 – DB11.2	Product date	Year (since 2000)	0-63	0-63	Year

94	4	DB11.1 – DB12.6	Product date	Month	1-12	1-12	Month
98	5	DB12.5 – DB12.1	Product date	Day	1-31	1-31	Day
103	5	DB12.0 – DB13.4	Product date	Hour	0-23	0-23	Hour
108	6	DB13.3 – DB14.6	Product date	Minute	0-59	0-59	Minute
114	6	DB14.5 – DB14.0	Product date	Second	0-59	0-59	Second
120	8	DB15.7 – DB15.0	Remaining connectivity duration	Countdown time in months until battery is empty	0-240	0-240	Months
					255	Not available	
128	16	DB16.7 – DB17.0	Reserved NEXELEC	Reserved NEXELEC	Reserved NEXELEC		
144	8	DB18.7 – DB18.0	Reserved for future use	Reserved for future use	Reserved for future use		

Example:

Raw Frame: A20000006400C8B400001452E697AD78000000

Decoded frame:

- Type of product: 0xA2 -> Insafe+Origin Lora
- Type of message: 0x00 -> Product status
- HW revision: 0x00 -> C027A
- SW revision: 0x00 -> S077A
- Remaining product lifetime: 0x64 -> 100 months
- Smoke sensor status: 0x0 -> Smoke sensor OK
- Temperature/humidity sensor status: 0x0 -> Temperature/humidity sensor OK
- Battery1 voltage: 0xC8 -> 3000 mV

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- Battery2 voltage: 0xB4 -> 2900 mV
- Energy status: 0x0 -> High
- Pending Join: 0x0 -> No join request scheduled
- Sent Frames counter: 0x14 -> 200 frames already sent
- Product date year: 0x14 -> 2020
- Product date month: 0xB -> November
- Product date day: 0x13 -> 19
- Product date hour: 0x9 -> 9h
- Product date minute:0x1E -> 9h30 min
- Product date second: 0x2D -> 9h30min45sec
- Remaining connectivity duration: 0x78 => 120 months

4.2   Configuration of product function

At the start-up product phase or during each reconfiguration, a message is sent to indicate the configuration of the product.

Offset	Size (bit)	Bit-range	Data	Description	Valid Range	Scale	Unit
0	8	DB0.7 DB0.0	Type of product	Insafe+Origin Lora	0xA2		
8	8	DB1.7 DB1.0	Type of message	Product general Configuration	0x01		
16	1	DB2.7	Temperature datalog enable	Temperature datalog function activated?	0: Non-active; 1: Active		
17	1	DB2.6	Humidity datalog enable	Humidity datalog function activated?	0: Non-active; 1: Active		
18	1	DB2.5	Daily air quality data enable	Daily air quality data function activated?	0: Non-active; 1: Active		
19	1	DB2.4	Temperature alert enable	Temperature alert function activated?	0: Non-active; 1: Active		
20	1	DB2.3	Keepalive enable	Keepalive function activated?	0: Non-active; 1: Active		
21	11	DB2.2 DB3.0	Reserved for future use	Reserved for future use	Reserved for future use		
32	8	DB4.7 DB4.0	Keepalive	Keepalive Period (h)	0 - 99	0 - 99	hours
40	16	DB5.7 DB6.0	Reserved for future use	Reserved for future use	Reserved for future use		

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56	8	DB7.7 DB7.0	Meas. Period	Period between two measurements (temperature, humidity)	0 - 250	0 - 250	min.
					255	Error	
64	4	DB8.7 DB8.4	Temperature Datalog decimation	Datalog decimation factor (keep only 1 measurement among x)	0 - 15	0 - 15	NA
68	9	DB8.3 DB9.3	Reserved for future use	Reserved for future use	Reserved for future use		
77	4	DB9.2 DB10.7	Humidity Datalog decimation	Datalog decimation factor (keep only 1 measurement among x)	0 - 15	0 - 15	NA
81	9	DB10.6 DB11.6	Reserved for future use	Reserved for future use	Reserved for future use		
90	9	DB11.5 DB12.5	Temperature alert threshold n°1	Temperature (linear), increment = 0.1°C	0-500	0°C +50°C	°C
					511	Error	
99	9	DB12.4 DB13.4	Temperature alert threshold n°2	Temperature (linear), increment = 0.1°C	0-500	0°C +50°C	°C
					511	Error	
108	68	DB13.3 DB21.0	Reserved for future use	Reserved for future use	Reserved for future use		

Example:

Raw Frame: A201D8001800000A30018017CD200000000000000000

Decoded frame:

- Type of product: 0xA2 -> Insafe+Origin Lora
- Type of message: 0x01 -> Product configuration
- Temperature Datalog enable: 0x1 -> Active
- Humidity Datalog enable: 0x1 -> Active
- Daily Air quality data enable: 0x0 -> Non-active
- Temperature Alert enable: 0x1 -> Active
- Keepalive enable: 0x1 -> Active
- Keepalive period: 0x18 ->24h
- Measuring period: 0x0A -> 10 minutes between 2 measurements
- Temperature datalog decimation: 0x3 -> Keep only 1 measurement among 3
- Humidity datalog decimation: 0x3 -> Keep only 1 measurement among 3

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- Temperature Alert Threshold n°1: 0xBE -> 19°C
- Temperature Alert Threshold n°2: 0xD2 -> 21°C

4.3   Keepalive

Data are sent in the following format:

Offset	Size (bit)	Bit-range	Data	Description	Valid Range	Scale	Unit
0	8	DB0.7 DB0.0	Type of product	Insafe+Origin Lora	0xA2		
8	8	DB1.7 DB1.0	Type of message	Keepalive Message	0x02		

4.4   Smoke alarm status

This message is sent when one of this information changes:

- Smoke alarm status
- Time since last maintenance (in terms of week)
- Smoke test running

Data are sent in the following format:

Offset	Size (bit)	Bit-range	Data	Description	Valid Range	Scale	Unit
0	8	DB0.7 – DB0.0	Type of product	Insafe+ Origin Lora	0xA2		
8	8	DB1.7 – DB1.0	Type of message	Smoke Alarm message	0x03		
16	1	DB2.7	Smoke Alarm status	Status of smoke detection	0: Smoke Alarm non- activated 1: Smoke Alarm activated		
17	1	DB2.6	Smoke Alarm Hush	Smoke Alarm Hush	0: Smoke alarm stopped because no smoke anymore 1: Smoke alarm stopped following central button press		
18	1	DB2.5	Smoke Test	Flag indicating if a smoke test is running	0: Smoke test Off 1: Smoke test is running		

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19	1	DB2.4	Smoke Alarm Condition analysis: Maintenance	Define if alarm may be due to lack of maintenance	0: Maintenance OK 1: Maintenance not done		
20	1	DB2.3	Smoke Alarm Condition analysis: Humidity	Define if alarm may be due to humidity level	0: Humidity range OK 1: Humidity range NOK		
21	1	DB2.2	Smoke Alarm Condition analysis: Temperature	Define if alarm may be due to temperature level	0: Temperature range OK 1: Temperature range NOK		
22	2	DB2.1 - DB2.0	Not Used	Not Used	Not Used		
24	8	DB3.7 DB3.0	Time since last maintenance	Time since last maintenance	0-255	0-255	Week
32	3	DB4.7 – DB4.5	Frame index	Frame Index is a loop counter to check if a frame has been lost	0–7		
35	5	DB4.4 – DB4.0	Not Used	Not Used	Not Used		

Example:

Raw Frame: A203800200

Decoded frame:

- Type of product: 0xA2 -> Insafe+Origin Lora
- Type of message: 0x03 -> Smoke Alarm status
- Smoke Alarm Status: 0x1 -> Smoke alarm activated
- Smoke alarm hush: 0x0 -> Smoke alarm stopped because no smoke anymore
- Smoke test: 0x0 -> Smoke test off
- Smoke alarm condition analysis (maintenance): 0x0 -> Maintenance OK
- Smoke alarm condition analysis (humidity): 0x0 ->Humidity range OK
- Smoke alarm condition analysis (Temperature): 0x0 ->Temperature range OK

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- Time since last maintenance: 0x02 -> 2 weeks
- Frame index: 0x4: Frame n°0

4.5   Daily air quality

Data are sent in the following format:

Offset	Size (bit)	Bit-range	Data	Description	Valid Range	Scale	Unit
0	8	DB0.7 – DB0.0	Type of product	Insafe+ Origin Lora	0xA2		
8	8	DB1.7 – DB1.0	Type of message	Air quality message	0x04		
16	3	DB2.7 – DB2.5	Indoor Air Quality level (IAQ_GLOBAL)	Air quality level	0: Excellent 1: Good 2: Fair 3: Poor 4: Bad 5-6: Not used 7: Error		
19	4	DB2.4 – DB2.1	Indoor Air Quality source (IAQ_SOURCE)	Main cause of the current IAQ level	0: All 1: Dryness indicator 2: Mould indicator 3: Dust mites indicator 4: CO 5: CO2 6..14: Reserved for future use 15: Error		
23	1	DB2.0	Not Used	Not Used	Not Used		
24	8	DB3.7 DB3.0	Temperature min.	Temperature (linear), 0,2°C step	0-250	0°C / +50°C	°C
32	8	DB4.7 DB4.0	Temperature max.	Temperature (linear), 0,2°C step	0-250	0°C / +50°C	°C
40	8	DB5.7 DB5.0	Temperature average.	Temperature (linear), 0,2°C step	0-250	0°C / +50°C	°C

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48	8	DB6.7 DB6.0	Relative Humidity min.	Relative Humidity (linear), 0.5%RH step	0-200	0-100	% RH
56	8	DB7.7 DB7.0	Relative Humidity max.	Relative Humidity (linear), 0.5%RH step	0-200	0-100	% RH
64	8	DB8.7 DB8.0	Relative Humidity average	Relative Humidity (linear), 0.5%RH step	0-200	0-100	% RH
72	3	DB9.7 DB9.5	Frame index	Frame Index is a loop counter to check if a frame has been lost	0–7		
75	5	DB9.4 - DB9.0	Not Used	Not Used	Not Used		

Example:

Raw Frame: A20420647D6E64827280

Decoded frame:

- Type of product: 0xA2 -> Insafe+Origin Lora
- Type of message: 0x03 -> Daily Air quality
- Indoor air quality level: 0x1 -> Good
- Indoor Air Quality source: 0x0 -> All
- Temperature min: 0x64 -> 20°C
- Temperature max: 0x7D -> 25°C
- Temperature average: 0x6E -> 22°C
- Humidity min: 0x64 -> 50%RH
- Humidity max: 0x82 -> 65% RH
- Humidity average: 0x72 -> 57%RH
- Frame index: 0x4 -> Frame n°4

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4.6   Real Time Data

Data are sent in the following format:

Offset	Size (bit)	Bit-range	Data	Description	Valid Range	Scale	Unit
0	8	DB0.7 DB0.0	Product Type	Insafe+Origin Lora	0xA2		
8	8	DB1.7 DB1.0	Type of message	Real Time data	0x05		
16	3	DB2.7 DB2.5	IAQ_GLOBAL	IZIAIR global air quality index	0: Excellent 1: Good 2: Fair 3: Poor 4: Bad 5…6: Reserved 7: Error		
19	4	DB2.4 DB2.1	IAQ_SRC	IZIAIR Data source	0:All 1:Drought Index 2:Mold Index 3:Mite Index 4:CO 5:CO2 … 15:Error		
23	3	DB2.0 DB3.6	IAQ_DRY	Drought Index Air Quality	0: Excellent 1: Good 2: Fair 3: Poor 4: Bad 5…6: Reserved 7: Error		
26	3	DB3.5 DB3.3	IAQ_MOULD	Mold Index Air Quality	0: Excellent 1: Good 2: Fair 3: Poor 4: Bad 5…6: Reserved 7: Error		
29	3	DB3.2 DB3.0	IAQ_DM	Mite Index Air Quality	0: Excellent 1: Good 2: Fair 3: Poor 4: Bad 5…6: Reserved 7: Error		
32	9	DB4.7 DB5.7	Temperature	Temperature (linear), increment = 0,1°C	0-500	0°C / +50°C	°C
41	8	DB5.6 DB6.7	Relative Humidity	Relative humidity (linear), increment = 0.5%RH	0-200	0-100	% RH
49	3	DB6.6 DB6.4	Frame index	Frame Index is a loop counter to check if a frame has been lost	0–7		

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52	4	DB6.3 DB6.0	Not used	Not used	Not used

Example:

Raw Frame: A2050000703790

Decoded frame:

- Type of product: 0xA2 -> Insafe+Origin Lora
- Type of message: 0x05 -> Real Time
- IAQ_Global: 0x0 -> Excellent
- IAQ_Source: 0x0 -> All
- IAQ_Dry: 0x0 -> Excellent
- IAQ_Mould: 0x0 -> Excellent
- IAQ_Dust_Mites: 0x0 -> Excellent
- Temperature : 0xE0 -> 22.4°C
- Relative Humidity : 0x6F -> 55.5 %RH
- Frame index: 0x1 -> Frame index 1

4.7 Datalog Temperature

The oldest data are referred to [n-x-1], … ,[n-2], [n-1] then [n] (x refer to the number of data contained in the frame). The data [n] corresponds to current data.

Example: in the case of a configuration with a 30-minute period between the measurements:
If the message is received at noon, the corresponding hours are the following:

- Measurement [n-11]: 6h30
- Measurement [n-10]: 7h
- Measurement [n-9]: 7h30
- Measurement [n-8]: 8h
- Measurement [n-7]: 8h30
- Measurement [n-6]: 9h
- Measurement [n-5]: 9h30
- Measurement [n-4]: 10h
- Measurement [n-3]: 10h30
- Measurement [n-2]: 11h
- Measurement [n-1]: 11h30
- Measurement [n]: 12h

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Data are sent in the following format:

Offset	Size (bit)	Bit-range	Data	Description	Valid Range	Scale	Unit
0	8	DB0.7 DB0.0	Type of product	Insafe+Origin Lora	0xA2		
8	8	DB1.7- DB1.0	Type of message	Temperature Message datalog	0x06		
16	8	DB2.7 DB2.0	Number of measurements	Number of data contained in this frame	2-36 measures		
24	4	DB3.7 DB3.4	Time between the measurements	Time with 10-minute increments between the measurement n and n+1	0 - 15	0–150	min
28	1	DB3.3	Reserved	Reserved	Reserved		
29	3	DB3.2 DB3.0	Frame index	Frame Index is a loop counter to check if a frame has been lost	0–7		
32	9	DB4.7 DB5.7	Temperature [n-x-1]	Temperature (linear), increment = 0,1°C X refer to the number of data contained in this frame	0-500	0°C / +50°C	°C
…	…	…	…	…	…	…	…
…	9	DB.. DB..	Temperature [n-2]	Temperature (linear), increment = 0,1°C	0-500	0°C / +50°C	°C
…	9	DB.. DB..	Temperature [n-1]	Temperature (linear), increment = 0,1°C	0-500	0°C / +50°C	°C
…	9	DB.. DB..	Temperature [n]	Temperature (linear), increment = 0,1°C	0-500	0°C / +50°C	°C
…	…	DB.. DB..	Not used	Not used	Not used		

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Example:

Raw Frame: A2060C31643218EC7633198CC562B158AC40

Decoded frame:

- Type of product: 0xA2 -> Insafe+Origin Lora
- Type of message: 0x06 -> Temperature Datalog
- Number of measurements: 0x0C -> 12 measurements
- Time between the measurements: 0x3 -> 30 minutes
- Frame index: 0x1 -> Frame index n°1
- Temperature[n-11]: 0xC8 -> 20°C
- Temperature[n-10]: 0xC8 -> 20°C
- Temperature[n-9]: 0xC7 -> 19.9°C
- Temperature[n-8]: 0xC7 -> 19.9°C
- Temperature[n-7]: 0xC6 ->19.8°C
- Temperature[n-6]: 0xC6 ->19.8°C
- Temperature[n-5]: 0xC6 ->19.8°C
- Temperature[n-4]: 0xC5 -> 19.7°C
- Temperature[n-3]: 0xC5 -> 19.7°C
- Temperature[n-2]: 0xC5 -> 19.7°C
- Temperature[n-1]: 0xC5 -> 19.7°C
- Temperature[n]: 0xC4 -> 19.6°C

4.8   Datalog Humidity

The structure of this message is identical to datalog temperature message. Refer to section 4.7 for details.

Data are sent in the following format:

Offset	Size (bit)	Bit-range	Data	Description	Valid Range	Scale	Unit
0	8	DB0.7 DB0.0	Type of product	Insafe+Origin Lora	0xA2		
8	8	DB1.7- DB1.0	Type of message	Humidity Message datalog	0x07		
16	8	DB2.7 DB2.0	Number of measurements	Number of data contained in this frame	2-36 measures		
24	4	DB3.7 DB3.4	Time between the measurements	Time with 10-minute increments between the measurement n and n+1	0 - 15	0–150	min
28	1	DB3.3	Reserved	Reserved	Reserved		

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29	3	DB3.2 DB3.0	Frame index	Frame Index is a loop counter to check if a frame has been lost	0–7		
32	8	DB4.7 DB4.0	Relative humidity [n-x-1]	Relative Humidity (linear), increment = 0.5%RH X refer to the number of data contained in this frame	0-200	0-100	% RH
…	…	…	…	…	…		
…	8	DB.. DB..	Relative humidity [n-2]	Relative Humidity (linear), increment = 0.5%RH	0-200	0-100	% RH
…	8	DB.. DB..	Relative humidity [n-1]	Relative Humidity (linear), increment = 0.5%RH	0-200	0-100	% RH
…	8	DB.. DB..	Relative humidity [n]	Relative Humidity (linear), increment = 0.5%RH	0-200	0-100	% RH

Example:

Raw Frame: A2070C357879797A7B7B7B7C7C7C7C7C
Decoded frame:

- Type of product: 0xA2 -> Insafe+Origin Lora
- Type of message: 0x07 -> Humidity Datalog
- Number of measurements: 0x0C -> 12 measurements
- Time between the measurements: 0x3 -> 30 minutes
- Frame index: 0x5 -> Frame index n°5
- Humidity[n-11]: 0x78 -> 60%RH
- Humidity[n-10]: 0x79 -> 60,5 %RH
- Humidity[n-9]: 0x79 -> 60,5 %RH
- Humidity[n-8]: 0x7A -> 61%RH
- Humidity[n-7]: 0x7B -> 61.5 %RH
- Humidity[n-6]: 0x7B -> 61.5 %RH
- Humidity[n-5]: 0x7B -> 61.5 %RH
- Humidity[n-4]: 0x7C -> 62%RH
- Humidity[n-3]: 0x7C -> 62%RH
- Humidity[n-2]: 0x7C -> 62%RH
- Humidity[n-1]: 0x7C -> 62%RH
- Humidity[n]: 0x7C -> 62%RH

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4.9　Temperature alerts

Data are sent in the following format:

Offset	Size (bit)	Bit-range	Data	Description	Valid Range	Scale	Unit
0	8	DB0.7 DB0.0	Type of product	Insafe+Origin Lora	0xA2		
8	8	DB1.7 DB1.0	Type of message	Temperature alert	0x08		
16	9	DB2.7 DB3.7	Temperature	Temperature (linear), increment = 0,1°C	0-500	0°C / +50°C	°C
					255	Error	
25	1	DB3.6	T_TH1	Temperature threshold n°1	0: threshold 1 not reached 1: threshold 1 reached		
26	1	DB3.5	T_TH2	Temperature threshold n°2	0: threshold 2 not reached 1: threshold 2 reached		
27	3	DB3.4 DB3.2	Frame index	Frame Index is a loop counter to check if a frame has been lost	0–7		
30	2	DB3.1 DB3.0	Not Used	Not Used	Not Used		

Example:

　　　Raw Frame: A20866C4

Decoded frame:

- Type of product: 0xA2 -> Insafe+Origin Lora
- Type of message: 0x08 -> Temperature alerts
- Temperature (°C): 0xCD -> 20.5°C
- Temperature Threshold n°1: 0x1 -> Temperature Threshold n°1 reached
- Temperature Threshold n°2: 0x0 -> Temperature Threshold n°2 non reached
- Frame index: 0x1 -> Frame index n°1

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4.10 Reconfiguration via downlink message

Product can be reconfigured via downlink message in response to any uplink message. The downlink message must be sent on port 0x56.

Reconfiguration acknowledgement

After reconfiguration, the product will send a message with its updated configuration (Refer to section 4.2 Configuration of product function).

Downlink message structure

First byte is the header: 0x55.

Then the following bytes can be used to reconfigure the product with respect to the format: Command ID and DATA.

Note: Downlink functionalities will certainly progress in the future. To ensure backwards-compatibility, Nexelec recommends sending the IDs from the lowest to the highest value.

A tool is available in the support tab of nexelec website, to easily calculate the payloads.

ID	Data length (byte)	Range	Scale	Description
0	-	-	-	No change, can be used for padding (Sigfox for example)
1	0	-	-	Ask for general configuration of the product (message Configuration of product functions)
…	-	-	-	Reserved
7	1	0 / 1	0 : disabled 1 : enabled	Temperature Alert enable
8	-	-	-	Reserved
9	1	0 / 1	0 : disabled 1 : enabled	Keepalive enable
…	-	-	-	Reserved
12	2	0 - 500	0 – 50°C	Temperature alert: Threshold 1 Temperature by step of 0.1°C

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13	2	0 - 500	0 – 50°C	Temperature alert: Threshold 2 Temperature by step of 0.1°C
…	-	-	-	Reserved
17	1	1 – 99	1 – 99h	Keepalive period (hours)
…				Reserved
23[1]	6	See description below		RTC configuration (product will reboot after configuration)
	Byte 0	0 - 100	2000 – 2100	year, starting from 2000 (value = 0)
	Byte 1	1 – 12	1 – 12	month, starting from January (value = 1)
	Byte 2	1 - 31	1 – 31	day of the month
	Byte 3	0 – 23	0 – 23	Hours
	Byte 4	0 – 59	0 – 59	Minutes
	Byte 5	0 - 59	0 - 59	Seconds
…	-	-	-	Reserved
28	2	1 - 1008	10 – 10080 minutes	Schedule a join request in x minutes
…	-	-	-	Reserved
40	1	0/1	0 : disabled 1 : enabled	Temperature datalog enable
41	1	0/1	0 : disabled 1 : enabled	Humidity datalog enable
42	1	0/1	0 : disabled 1 : enabled	Daily air quality enable
43	1	1 - 15	10 – 150 minutes	Temperature datalog decimation factor
44	1	1 - 15	10 – 150 minutes	Humidity datalog decimation factor

Note 1: product will reboot after configuration

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Example:

- Activate Temperature datalog

- Temperature decimation factor = 1

- Deactivate Humidity datalog

Frame structure from LSB to MSB:

Byte	Value	Info
0	0x55	Header for 1- message reconfiguration
1	0x28	ID Temperature datalog enable
2	0x01	Value to enable temperature datalog
3	0x29	ID Humidity datalog enable
4	0x00	Value to disable humidity datalog
5	0x2B	ID for temperature datalog decimation factor
6	0x01	Value for decimation factor = 1

5   Standard configuration

When the product is delivered, the standard configuration is the following:

Function	Status
Temperature Datalog	Activated with following parameters: Period between measurements = 30min
Humidity Datalog	Activated with following parameters: Period between measurements = 30min
Daily air quality	Deactivated
Temperature alert	Deactivated
Keepalive	Activated with following parameters: Period: 24h

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6   Product lifetime

The product is powered by a non-chargeable and non-replaceable battery.
When the battery is empty, the product must be replaced.

The table below shows the product autonomy <u>in years</u> according to the datalog decimation factor and LoRa Spreading factor (SF7/SF12).
✓ means the function is activated, ✗ means the function is deactivated.

	10 min	30 min	60 min
Temperature Datalog ✓ **Humidity Datalog** ✗	10 / 10	10 / 10	10 / 10
Temperature Datalog ✓ **Humidity Datalog** ✓	10 / 9	10 / 10	10 / 10

Autonomy for Insafe+Origin with SF7 / SF12

7   Revision history

7.1   Technical guide changelog

Document revision	Details	Date
A	Created	23/11/2020
B	Add reconfigurable functions	15/12/2020
C	Add product configuration frame structure	06/01/2021
D	Add information about downlink Add information about product lifetime	03/02/2021