

D679H: Insafe+ Pilot LoRa

Technical Guide

21/10/2021

www.nexelec.fr



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1. Presentation

1.1.Introduction to the product



INSAFE+ PILOT

Temperature / Humidity Sensor and Indoor Air Quality Monitor

INSAFE+Pilot is not simply a temperature and humidity sensor. Thanks to its « Edge Computing » architecture and its IZIAIR embedded algorithm, INSAFE+Pilot calculates an indoor air quality index to help you take appropriate actions.

INSAFE+Pilot is also a connected physical button that you can program with two different actions (short or long press) and an intuitive light feedback.

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: temperature, humidity, Indoor Air Quality monitor and push button
- > IZIAIR Indoor Air Quality Indicator
- > Wireless sensor for easy and fast installation
- > 10-year battery life for the product and wireless connection
- > Elegantly designed detector

Applications:

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

Basic functions:

- > Measurement of temperature and humidity every 10 minutes
- > Programmable push button

Advanced features:

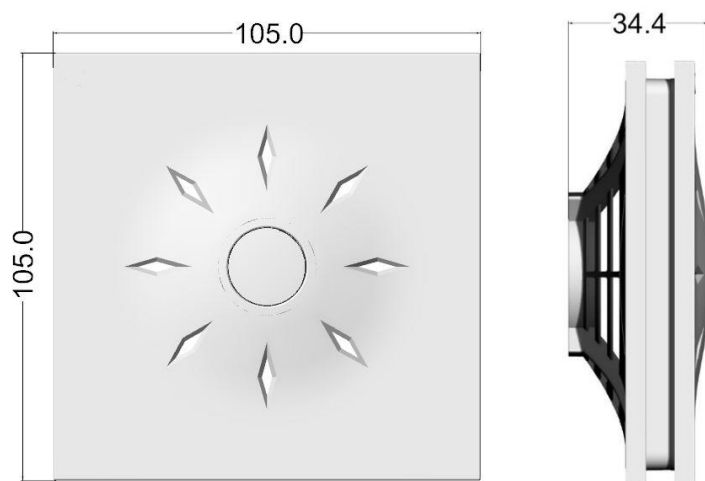
- > Reconfigurable Product via NFC with NFC Configuration Tool application
- > IZIAIR indoor air quality index (5 levels)
- > Residual battery life
- > Functional self-test (every 10 min.)
- > Optimized message transmission: alert management on thresholds, keepalive, datalogging, etc.

FAQ and support

More information on our website www.nexelec.fr/support

If you need help, contact us by email at support@nexelec.fr

1.2.Product scheme



1.3.Detailed specifications

Product terms of use

- > Indoor household environment
- > Temperature: 0°C to + 50°C
- > Relative humidity: from 0 to 95% RH (non-condensing)

Sensors and measurements:

		Temperature	Humidity
Accuracy	Typical	±0.3 °C	±2 %RH
	Max	±0.4 °C	±3 %RH
Resolution		0.2 °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

2. Installation

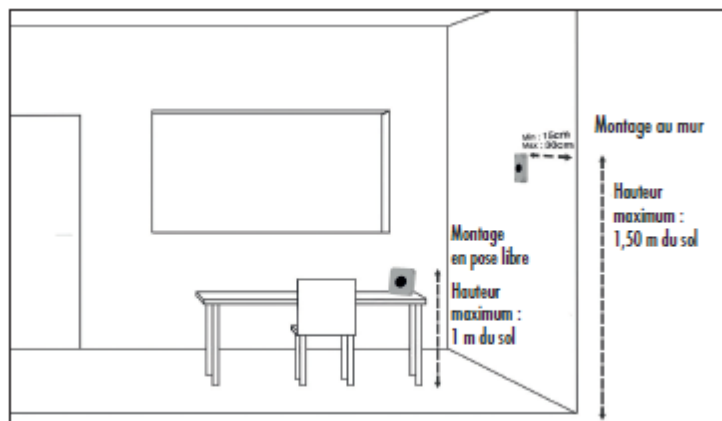
2.1.Installation locations

Recommended locations in a domestic or tertiary environment

It is recommended to install the detector:

- Less than 1.5 meters above the ground if the detector is wall mounted (attached with screws and wall plugs)

In order to obtain accurate and reliable data, we suggest you to follow recommended locations.



Locations to avoid

Do not install the indoor air quality monitor:

- Less than 30 cm from the ceiling
- Outdoors
- In a location where the temperature is less than 0°C or more than 50°C
- In a location where humidity levels is more than 95% (bathroom, kitchen, laundry room, etc.)
- In a dusty or dirty location (garage, workshop, etc.)
- Less than 1 m from doors and windows, heating, cooling or air vents
- In a narrow area where the detector could be damaged
- In a contained location (e.g. in a cupboard or behind a curtain)
- In a location where the detector could be blocked (e.g. by furniture)

2.2. Description of mountings



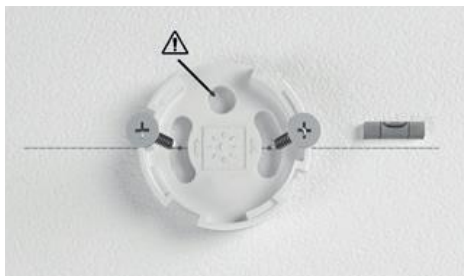
Mounting base for wall-mounted

2.3. 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.



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

2.4.Activation and commissioning process

Activation

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

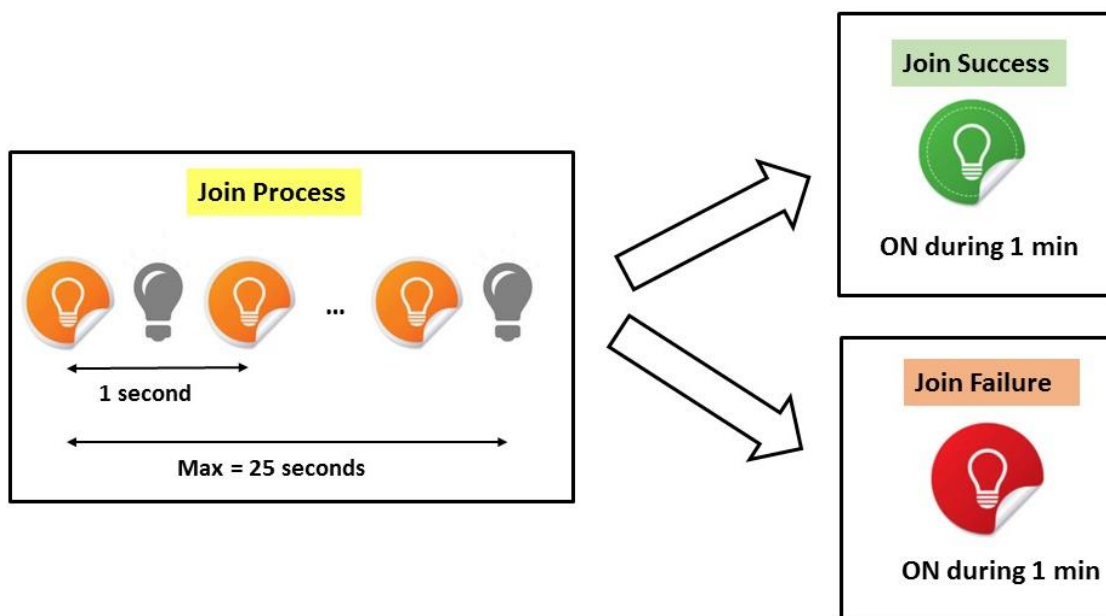


(1)

Initial commissioning

The orange LED will blink during the join process (max 25 seconds). The green LED will remain ON during the initializing period (maximum 1 minute) if the process has been successful, in red otherwise.

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 Commissioning strategy in case of initial failure).



Product configuration and coverage analysis process

If the commissioning process is successful, the product will send its configuration (refer to section 4.5 Configuration of product functions), its status (Refer to section 4.2 Product status) and 9 keepalive frames with about 10 seconds between each frame. This process intends to provide enough data for radio coverage analysis.

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.

....

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

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).

Commissioning strategy in case of network cut-off

In the event of network cut-off, the product will automatically try to rejoin the network 3 days after the disconnection. If this recommissioning process failed, the product will automatically try to join the network with an increasing period (as described in the “Commissioning strategy in case of initial failure” section).

3. Programmable push button

INSAFE+ Pilot has a programmable push button that enables to launch scenarios (heating, ventilation, presence, etc.) when the product is integrated into a connected ecosystem.

After a **short press** (< 1 second), green led is ON during 3 seconds to indicate that the press has been considered. A message is sent containing the type of button press and generating the triggering of appropriate actions (see section Push button message).

After a **long press** (> 2 second), red-orange-green LED flashes to indicate that the press has been considered. A full measurement is done (temperature + humidity) and sent (see section Real Time Data).

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

4. Description of payload

4.1.General description

Insafe+ Pilot is a configurable product to measure temperature, humidity and to analyze indoor air quality. Insafe+ Pilot includes advanced features such as real time measurement, datalogging, alert management, etc.

In order to optimize battery life, management of messages and subscriber fees on network, the functions can be activated, deactivated and configured.

ID Message	Details of the function	Transmission of message	Can be deactivated	Configurable
0	Product status	On event	No	No
1	Real time data	On event	Yes	Yes
2	Datalog Data	Periodic	Yes	Yes
3	Product Function Configuration	On event	No	No
4	Button press	On event	Yes	No
5	Temperature Alerts	On event	Yes	Yes
6	Keepalive	Periodic	Yes	Yes

4.2.Product status

This message is sent every 7 days or when one of this information changes:

- Battery level indication is defined using 4 levels:
 - o High level: More than 40% remaining battery capacity
 - o Medium level: 10-40% remaining battery capacity
 - o Low level: 5-10% remaining battery capacity
 - o Critical level: Less than 5% remaining battery capacity
- Product Hardware status (HW)
- Join request pending status

Data are sent in the following format:

Offset	Size (bit)	Bit-range	Data	Description	Valid Range	Scale	Unit
0	4	DB0.7 – DB0.4	Type of product	Insafe+Pilot LoRa	0x6		
4	4	DB0.3 – DB0.0	Type of message	Product Status message	0x0		
8	2	DB1.7 – DB1.6	Energy status	Battery level	0: High 1: Medium 2: Low 3: Critical		
10	1	DB1.5	Product HW status	Status of HW	0: HW working correctly 1: HW fault detected		
11	3	DB1.4 – DB1.2	Frame index	Frame Index is a loop counter to check if a frame has been lost	0–7		
14	1	DB1.1	Pending Join	Join request scheduled	0: No join request scheduled 1: Join request scheduled		
15	1	DB1.0	Not Used	Not Used	Not Used		

4.3.Real Time Data

The real-time function is very convenient to know the instant temperature and humidity values while preserving the autonomy of the product.

The product measures environmental data every 10 minutes and a real-time message containing the last temperature and humidity data is sent at least every 120 minutes. If one of the measurements (temperature, humidity) changes significantly within period of 120 minutes, a message is immediately sent by the device.

The default values of significant change, called “**delta**” are the following:

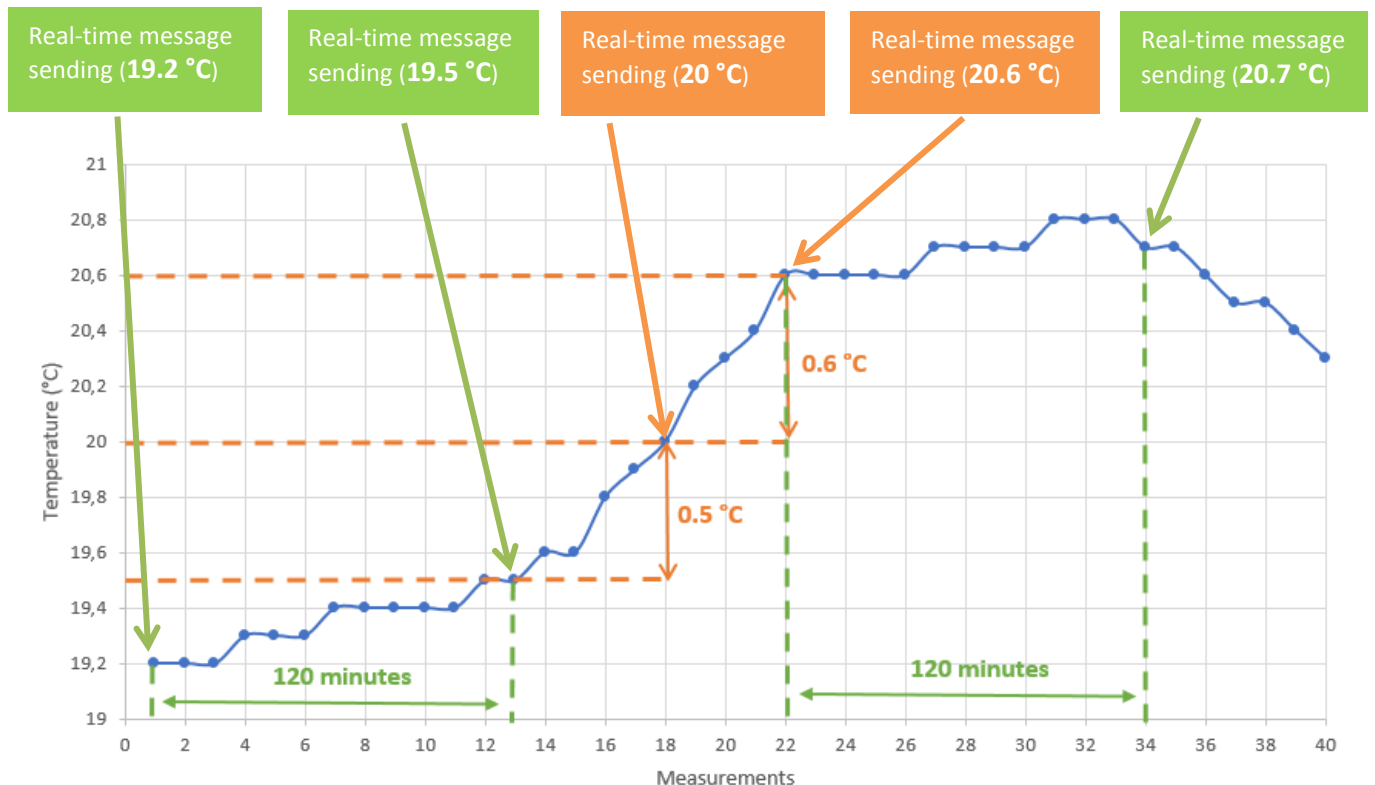
- Delta Temperature: 0.5°C
- Delta Humidity: 5.0%RH

Example

The chart below shows the evolution of the temperature data and the associated sending of message.

Configuration:

- Delta Temperature = 0.5 °C
- Sending period = 120 minutes



The sending period and also the different delta (CO2 / temperature / humidity) can be reconfigured separately via NFC (See section 5 Reconfiguration via NFC) or downlink (See section 4.9 Reconfiguration via downlink message).

Data are sent in the following format:

Offset	Size (bit)	Bit-range	Data	Description	Valid Range	Scale	Unit
0	4	DB0.7 DB0.4	Type of product	Insafe+Pilot LoRa	0x6		
4	4	DB0.3 DB0.0	Type of message	Real Time data	0x1		
8	8	DB1.7 DB1.0	Temperature	Temperature (linear), increment = 0.2°C	0-250	0°C / +50°C	°C
16	8	DB2.7 DB2.0	Relative Humidity	Relative humidity (linear), increment = 0.5%RH	0-200	0-100	% RH
24	3	DB3.7 DB3.5	IAQ_GLOBAL	IZIAIR global air quality index	0: Excellent 1: Good 2: Fair 3: Poor 4: Bad 5...6: Reserved 7: Error		
27	4	DB3.4 DB3.1	IAQ_SRC	IZIAIR Data source	0:All 1:Drought Index 2:Mold Index 3:Mite Index 4:CO 5:CO2 ... 15:Error		
31	3	DB3.0 DB4.6	IAQ_DRY	Drought Index Air Quality	0: Excellent 1: Good 2: Fair 3: Poor 4: Bad 5...6: Reserved 7: Error		
34	3	DB4.5 DB4.3	IAQ_MOULD	Mold Index Air Quality	0: Excellent 1: Good 2: Fair 3: Poor 4: Bad 5...6: Reserved 7: Error		
37	3	DB4.2 DB4.0	IAQ_DM	Mite Index Air Quality	0: Excellent 1: Good 2: Fair 3: Poor 4: Bad 5...6: Reserved 7: Error		
40	2	DB5.7 DB5.6	HCI	Hygrothermal comfort Index	0: Good 1: Fair 2: Poor 3: Error		
42	3	DB5.5 DB5.3	Frame index	Frame index is a loop counter to check if a frame has been lost	0-7		
45	3	DB5.2 DB5.0	Not used	Not used	Not used		

Example:

Raw Frame: 617259000008

Decoded Frame

- Product Type: 0x6 → Insafe+ Pilot LoRa
- Type of message: 0x1 → Real Time Data
- Temperature: 0x72 → 22.8°C
- Relative Humidity: 0x59 → 44.5 %RH
- IZIAIR Index: 0x0 → Excellent
- IZIAIR Source: 0x0 → All
- IAQ DRY : 0x0 → Excellent
- IAQ_MOULD : 0x0 → Excellent
- IAQ DM : 0x0 → Excellent
- HCI : 0x0 → Good
- Frame index : 0x1 → Frame n°1

4.4.Datalog Data

The Datalog function enables to gather 5 measurements into a single message. This function is very convenient to have periodic data while preserving the autonomy of the product.

You can set up the period between the measurements (10 / 30 / 60 minutes) via the NFC application (see section 5 Reconfiguration via NFC) or via downlink (see section 4.9 Reconfiguration via downlink message).

The oldest data are referred to [n-4], [n-3], [n-2], [n-1] then [n]. The data [n] correspond to current data.

Example: in the case of a configuration with a 60-minute period between the measurements:

If the message is received at noon, the corresponding hours are the following:

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

Data are sent in the following format:

Offset	Size (bit)	Bit-range	Data	Description	Valid Range	Scale	Unit
0	4	DB0.7 DB0.4	Type of product	Insafe+Pilot LoRa	0x6		
4	4	DB0.3 DB0.0	Type of message	Message datalog	0x2		
8	8	DB1.7 DB1.0	Temperature [n-4]	Temperature (linear), increment = 0,2°C	0-250	0°C / +50°C	°C
16	8	DB2.7 DB2.0	Relative Humidity [n-4]	Relative Humidity (linear), increment = 0.5%RH	0-200	0-100	% RH
24	8	DB3.7 DB3.0	Temperature [n-3]	Temperature (linear), increment = 0,2°C	0-250	0°C / +50°C	°C
32	8	DB4.7 DB4.0	Relative Humidity [n-3]	Relative Humidity (linear), increment = 0.5%RH	0-200	0-100	% RH
40	8	DB5.7 DB5.0	Temperature [n-2]	Temperature (linear), increment = 0,2°C	0-250	0°C / +50°C	°C
48	8	DB6.7 DB6.0	Relative Humidity [n-2]	Relative Humidity (linear), increment = 0.5%RH	0-200	0-100	% RH
56	8	DB7.7 DB7.0	Temperature [n-1]	Temperature (linear), increment = 0,2°C	0-250	0°C / +50°C	°C
64	8	DB8.7 DB8.0	Relative Humidity [n-1]	Relative Humidity (linear), increment = 0.5%RH	0-200	0-100	% RH
72	8	DB9.7 DB9.0	Temperature [n]	Temperature (linear), increment = 0,2°C	0-250	0°C / +50°C	°C
80	8	DB10.7 DB10.0	Relative Humidity [n]	Relative Humidity (linear), increment = 0.5%RH	0-200	0-100	% RH
88	4	DB11.7 DB11.4	Time between the measurements	Time with 10-minute increments between the measurement n and n+1	0 - 15	0-150	min
92	3	DB11.3 - DB11.1	Frame index	Frame Index is a loop counter to check if a frame has been lost	0-7		
95	1	DB11.0	Not used	Not used	Not used		

Example :

Raw Frame: 6263676266616760675f6768

Decoded frame:

- Type of product: 0x6 → Insafe+ Pilot LoRa
- Type of message: 0x2 → Message datalog
- Temperature [n-4] :0x63 → 19.8°C
- Relative Humidity [n-4] : 0x67 → 51.5 %RH
- Temperature [n-3] :0x62 → 19.6°C
- Relative Humidity [n-3] : 0x66 → 51.0 %RH
- Temperature [n-2] :0x61 → 19.4°C
- Relative Humidity [n-2] : 0x67 → 51.5 %RH
- Temperature [n-1] :0x60 → 19.2°C
- Relative Humidity [n-1] : 0x67 → 51.5 %RH
- Temperature [n] :0x5F → 19.0°C
- Relative Humidity [n] : 0x67 → 51.5 %RH
- Time between the measurements: 0x6 → 60 minutes
- Frame index : 0x4 → Frame n°4

4.5.Configuration of product functions

At the start-up product phase or during each reconfiguration (see section 4.9.Reconfiguration via downlink message and section 5.Reconfiguration via NFC) a message is sent to indicate the configuration of the product.

Data are sent in the following format:

Offset	Size (bit)	Bit-range	Data	Description	Valid Range	Scale	Unit
0	4	DB0.7 DB0.4	Type of product	Insafe+Pilot LoRa	0x6		
4	4	DB0.3 DB0.0	Type of message	General configuration information	0x3		
8	1	DB1.7	LED blink enable	LED blink function activated?	0: Non-active; 1: Active		
9	1	DB1.6	Button notif. enable	Push button notification activated?	0: Non-active; 1: Active		
10	1	DB1.5	Real-time data enable	Real-time data function activated?	0: Non-active; 1: Active		
11	1	DB1.4	Datalog enable	Datalog function activated?	0: Non-active; 1: Active		
12	1	DB1.3	Temperature alert enable	Temperature alert function activated?	0: Non-active; 1: Active		

13	1	DB1.2	Keepalive activated	Keepalive function activated?	0: Non-active; 1: Active		
14	2	DB1.1 DB1.0	Not Used	Not Used	Not Used		
16	8	DB2.7 DB2.0	Meas. Period	Period between measurements (temperature, humidity)	0 - 250	0 - 250	min.
					255	Error	
24	8	DB3.7 DB3.0	Datalog decimation	Datalog decimation factor (record only 1 on x samples)	0 - 255	0 - 255	NA
32	8	DB4.7 DB4.0	Temperature alert threshold 1	Temperature (linear), 0,2°C step	0-250	0°C +50°C	°C
					255	Error	
40	8	DB5.7 DB5.0	Temperature alert threshold 2	Temperature (linear), 0,2°C step	0-250	0°C +50°C	°C
					255	Error	
48	8	DB6.7 DB6.0	Delta_Temp	Temperature change leading to a real-time message transmission	0-250	0°C +25°C	°C
					255	Error	
56	8	DB7.7 DB7.0	Delta_Hum	Relative humidity change leading to a real-time message transmission	0-200	0-100	% RH
					255	Error	
64	8	DB8.7 DB8.0	Keepalive	Keepalive period (h)	0 - 250	0 - 250	hours
72	8	DB9.7 DB9.0	SW Version	Software version of the product	0 - 255	0 - 255	-
80	2	DB10.7 DB10.6	NFC status	Status of NFC configuration interface	0: Discoverable 1: Not discoverable 2..3: RFU		
82	6	DB10.5 DB10.0	Real-time message sending period	Maximum time between two real-time messages sending	1 - 63	10 - 630	Min.

Example:

Raw Frame: 636c0a065a73050a181506

Decoded frame:

- Type of product 0x6 → Insafe+ Pilot LoRa
- Type of message: 0x3 → Product General Configuration
- Button Notif.: 0x1 → Active function
- Real Time Data: 0x1 → Active function
- Datalog: 0x0 → Function not active
- Temperature alerts: 0x1 → Active function
- Keepalive: 0x1 → Active function

- Meas. period: 0x0A → 10 minutes
- Datalog decimation: 06 → 1 measurement kept out of 6 = equivalent to a datalog period of 1h
- Temperature alert: threshold n°1: 0x5A → 18.0°C
- Temperature alert: threshold n°2: 0x73 → 23.0°C
- Temp. Delta: 0x05 → 0.5°C
- Hum. Delta: 0x0A → 5% RH
- Keepalive : 0x18 → 24h
- SW Version : 0x15 → Version 2.1
- NFC status : 0x00 → Discoverable
- Real-time message sending period: 0x0C → 120 minutes

4.6.Push button message

If this function has been activated, (see section 5 Reconfiguration via NFC) a message is sent at each

Short button press

Data are sent in the following format:

Offset	Size (bit)	Bit-range	Data	Description	Valid Range	Scale	Unit
0	4	DB0.7 DB0.4	Type of product	Insafe+Pilot LoRa	0x6		
4	4	DB0.3 DB0.0	Type of message	Button press	0x4		
8	3	DB1.7 DB1.5	Button press	Type of button press	0: short press 1: Reserved for Nexelec 2: Reserved for Nexelec 3: Reserved for Nexelec 4..7: Reserved		
11	3	DB1.4 DB1.2	Frame index	Frame Index is a loop counter to check if a frame has been lost	0-7		
14	2	DB1.1 DB1.0	Not Used	Not Used	Not Used		

Example :

Raw frame: 6400

Decoded frame :

- Type of product: 0x6 → Insafe+ Pilot LoRa
- Type of message: 0x4 → Button press
- Type of button press: 0x0 → Short press
- Frame index : 0x0 → Frame n°0

4.7. Temperature alerts

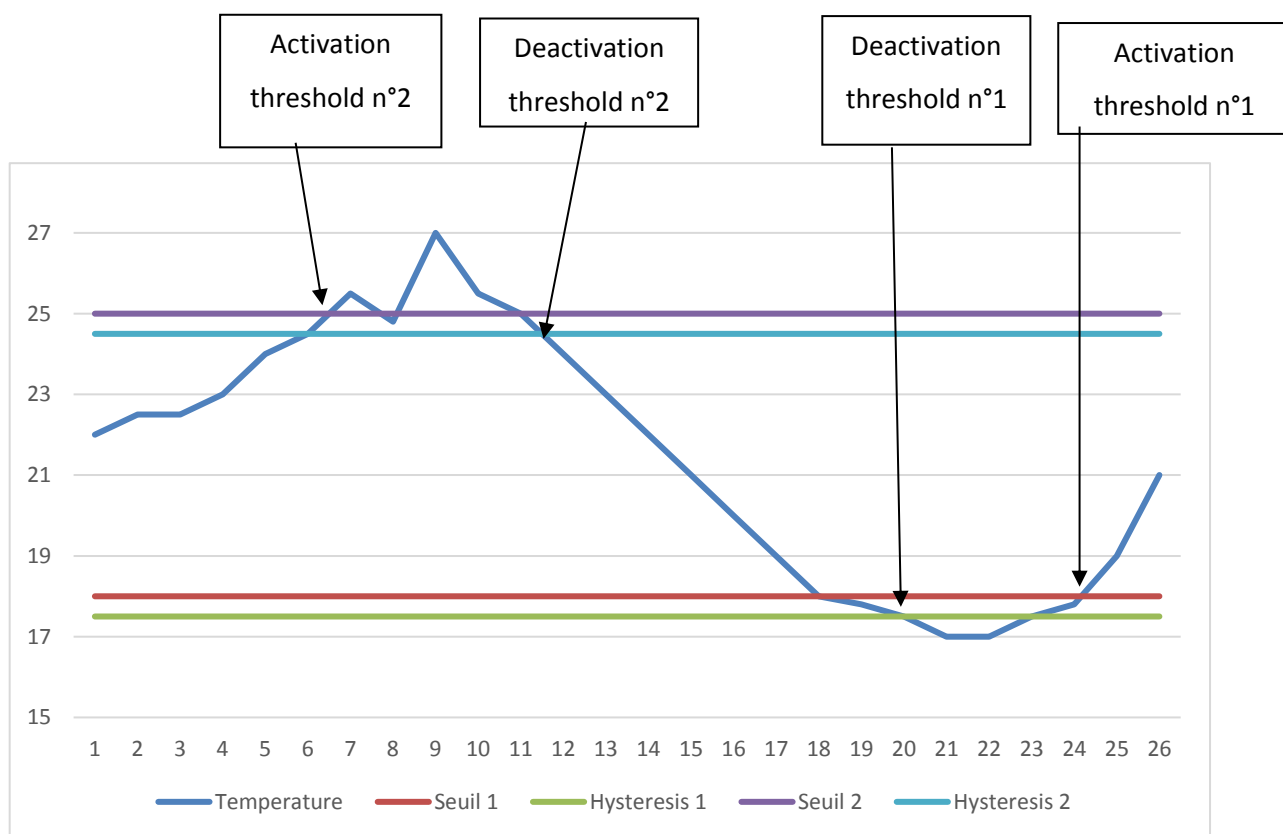
This function enables to send a message when the temperature reaches one of the two configurable alert thresholds (see section 4.9.Reconfiguration via downlink message and section 5.Reconfiguration via NFC). A hysteresis (typical value of 0.5°C) is applied below each threshold to avoid too many messages.

An activation message is sent when the temperature measured is higher than the threshold set.

A deactivation message is sent when the temperature measured dropped by 0.5°C below the threshold

At the start-up product phase, a message is sent with thresholds (activation / deactivation) current state.

Example of operation:



Data are sent in the following format:

Offset	Size (bit)	Bit-range	Data	Description	Valid Range	Scale	Unit
0	4	DB0.7 DB0.4	Type of product	Insafe+Pilot LoRa	0x6		
4	4	DB0.3 DB0.0	Type of message	Temperature alert	0x5		
8	8	DB1.7 DB1.0	Temperature	Temperature (linear), increment = 0.2°C	0-250	0°C / +50°C	°C
					255	Error	
16	1	DB2.7	T_TH1	Temperature threshold n°1	0: threshold 1 not reached 1: threshold 1 reached		
17	1	DB2.6	T_TH2	Temperature threshold n°2	0: threshold 2 not reached 1: threshold 2 reached		
18	3	DB2.5 DB2.3	Frame index	Frame Index is a loop counter to check if a frame has been lost	0-7		
21	3	DB2.2 DB2.0	Not Used	Not Used	Not Used		

Raw Frame: 6573c0

Decoded frame:

- Type of product: 0x3 → Insafe+Pilot LoRa
- Type of message: 0x5 → Temperature alert
- Temperature :0x73 → 23.0°C
- T_TH1 : threshold 1 reached
- T_TH2 : threshold 2 reached
- Frame index : 0x0 → Frame n°0

4.8.Keepalive

This message is sent by the product on a regular basis to check its correct functioning. The sending period of this message is configurable (see section 5 Reconfiguration via NFC).

Data are sent in the following format:

Offset	Size (bit)	Bit-range	Data	Description	Valid Range	Scale	Unit
0	4	DB0.7 DB0.4	Type of product	Insafe+Pilot LoRa	0x6		
4	4	DB0.3 DB0.0	Type of message	Keepalive Message	0x6		

4.9.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 (Configuration of product functions).

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.

ID	Data length (byte)	Range	Scale	Description
0x00	-	-	-	No change, can be used for padding (Sigfox for example)
0x01	0	-	-	Ask for general configuration of the product (message Configuration of product functions)
0x02				Reserved
0x03	1	0 / 1	0 : disabled 1 : enabled	LED enable
0x04	1	0 / 1	0 : disabled 1 : enabled	Button enable
0x05	1	0 / 1	0 : disabled 1 : enabled	Real Time Value enable
0x06	1	0 / 1	0 : disabled 1 : enabled	Datalog enable
0x07	1	0 / 1	0 : disabled 1 : enabled	Temperature Alert enable
0x08	-	-	-	Reserved
0x09	1	0 / 1	0 : disabled 1 : enabled	Keepalive enable
0x0A	1	0/1	0 : disabled 1 : enabled	NFC interface enable
0x0B	1	1 - 9	1 – 9	Datalog decimation factor
0x0C	2	0 - 500	0 – 50°C	Temperature alert: Threshold 1 Temperature by step of 0.1°C
0x0D	2	0 - 500	0 – 50°C	Temperature alert: Threshold 2 Temperature by step of 0.1°C

0x0E	1	0 - 99	0 – 9.9°C	Temperature Delta generating the transmission of a «real time» message
0x0F	1	0 - 19	0 – 9.5%RH	Humidity Delta generating the transmission of a «real time» message
0x10	-	-	-	Reserved
0x11	1	1 – 99	1 – 99h	Keepalive period (hours)
0x12	-	-	-	Reserved
0x13	-	-	-	Reserved
0x14	3	See description below		Smart Period n°1 config
	Byte 0.7 MSB	0 / 1	0 : disabled 1 : enabled	Smart period On/Off
	Byte 0.6	0 / 1	0 : disabled 1 : enabled	Monday On / Off
	Byte 0.5	0 / 1	0 : disabled 1 : enabled	Tuesday On / Off
	Byte 0.4	0 / 1	0 : disabled 1 : enabled	Wednesday On / Off
	Byte 0.3	0 / 1	0 : disabled 1 : enabled	Thursday On / Off
	Byte 0.2	0 / 1	0 : disabled 1 : enabled	Friday On / Off
	Byte 0.1	0 / 1	0 : disabled 1 : enabled	Saturday On / Off
	Byte 0.0 LSB	0 / 1	0 : disabled 1 : enabled	Sunday On / Off
	Byte 1	0 – 47	0 – 23h30	Starting time of the period in 30 minutes step
	Byte 2	0 - 48	0 – 24h	Duration of the period in 30 minutes step
0x15	3	Same as above		Smart Period n°2 config
0x16	-	-	-	Reserved
0x17 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
0x18 ¹	2	See description below		Relative clock configuration (product will reboot after configuration)
	Byte 0	0 / 1	0: Backward time slot increasing 1: Forward time slot increasing	Backward/forward RTC time slot increasing
	Byte 1	0 - 250	0 – 250 minutes	Number of minutes to add/remove to the current RTC date
...				Reserved
0x1C	2	1 - 1008	10 – 10080 minutes	Schedule a join request in x minutes
...				
0x49	1	1 - 63	10 – 630 minutes	Maximum time between two “real-time” messages sending

...				Reserved
0xFF				Reserved

Note 1: product will reboot after configuration

Example 1:

- Activate Real time values
- Delta temperature = 0.5°C
- Delta Humidity = 9.5%RH

Frame structure, from LSB to MSB:

Byte	Value	Info
0	0x55	Header for 1- message reconfiguration
1	0x05	ID Real time value enable
2	0x01	Value to enable real time message
3	0x0E	ID for delta temperature
4	0x05	Value for 0.5°C
5	0x0F	ID for delta humidity
6	0x13	Value for 9.5%RH

Example 2:

- Activate Smart Period n°1:
 - o Monday, Tuesday, Thursday, Friday
 - o From 8.30am to 4.30pm (duration = 8 hours)

Frame structure, from LSB to MSB:

Byte	Value	Info
0	0x55	Header for 1- message reconfiguration
1	0x14	ID Smart Period n°1
2	0xEC	Select the appropriate days and enable function
3	0x11	Starting time (8.30am = 17 steps of 30 minutes)
4	0x10	Duration (8 hours = 16 steps of 30 minutes)

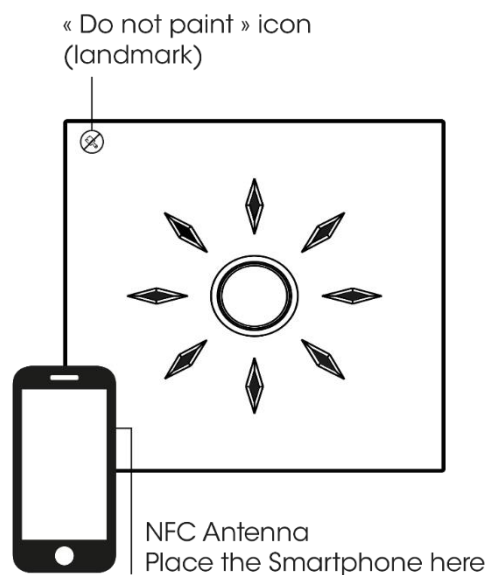
5. Reconfiguration via NFC

The NFC interface can be deactivated via downlink message. By this way, the NFC memory is no more discoverable and placing the product in the face of the product has no effect. A deactivation of the NFC memory avoids a reconfiguration of the product once deployed.

After being deactivated, the NFC interface can be re-activated again via downlink message.

5.1.NFC antenna location

In the face of the product, place the “do not paint” icon at the top left (standard position when mounting the product in accordance with the instructions given previously).



5.2.Presentation of the application

The « Nexelec Config Tool » product reconfiguration application is available in Android for devices (mobile, tablet) equipped with NFC interface.



Nexelec Config Tool

NEXELEC R&D

Outils

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5.3.Presentation of reconfigurable data

Following parameters are configurable:

- Button: enabled / disabled
- Real Time values: delta Temperature / delta humidity / sending period
- Datalog: measuring period
- Temperature alerts: Temperature thresholds 1 and 2, Temperature hysteresis
- Smart Period
- Keepalive

6. Standard configuration

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

Function	Status
Button	Activated
Real time data	Activated with following parameters: Delta Temperature: 0.5°C Delta Humidity: 5.0%RH Sending period: 120 minutes
Datalog	Deactivated
Temperature alert	Deactivated
Smart Periods	Deactivated
Keepalive	Activated with following parameters: Period: 24h

7. Product autonomy

The product is powered by a non-chargeable and non-replaceable battery. When the battery is empty, the green LED blinks every 10 seconds indicating the product must be replaced.

The product autonomy depends on the number of messages sent.

The table below helps you evaluate the number of messages sent based on the functions that have been activated in the product:

Function	Average number of messages sent per day
Product Status	0.15
Keepalive 6h	4
Keepalive 12h	2
Keepalive 24h	1
Datalog 10min	29
Datalog 30min	10
Datalog 60min	5
Real-time data	The product measures environmental data every 10 minutes. If the value (T° or humidity) has changed significantly, a message will be sent. The number of de messages depends on the product environment (see note 1)
Temperature alert	The product sends a message each time the temperature reaches a defined threshold. The number of de messages depends on the product environment (see note 1)

Note 1: These functions depend on environmental conditions. The table below gives an example of the number of messages in office conditions.

Function	Number of messages per day
Real time data Temperature delta: 0.5°C Humidity delta: 5% RH Sending period = 120 minutes	20
Real time data Temperature delta: 1.0°C Humidity delta: 5% RH Sending period = 120 minutes	15
Temperature Alerts	4

In LoRaWan, the network can define parameters like datarate and output power to optimize the device battery power consumption (See Adaptive Data Rate description in LoRaWan specification).

Two tables are built to show the best case and the worst case depending on the network:

- Best case: Output power = 2dBm, Spreading factor: SF7
- Worst case: Output power = 14dBm, Spreading factor: SF12

The table below shows the product autonomy according to the number of messages sent per day.

Number of messages / day	Autonomy (year)
0	10
10	10
20	10
35	10
50	10
140	4

Autonomy for Insafe+Pilot with SF12, 14dBm output power (Worst case)

Number of messages / day	Autonomy (year)
0	10
10	10
20	10
35	10
50	10
140	10

Autonomy for Insafe+Pilot with SF7, 2dBm output power (Best case)

You can increase the autonomy of your product by switching off the communications during specific periods of the week (LED functions and/or Smart Period : see section 5.3 Presentation of reconfigurable data).

8. Traceability and marking

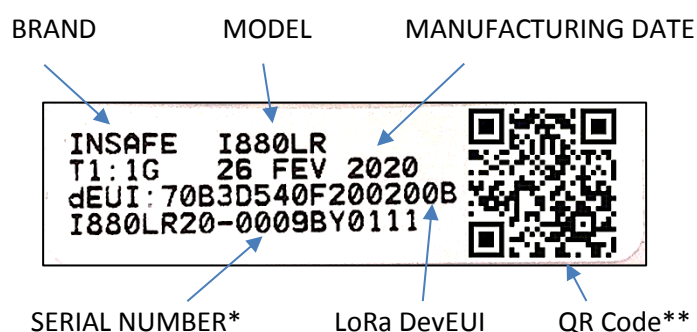
Three labels and a QR Code are located at the back of the product.



Labels at the back of the product

8.1. Tracking label

This label is placed both at the back of the product and on the packaging.



*Serial number format:

I880LR	20	-	00	09	BY	0111
Model	Year		Reserved	Week of production	Batch	Number in batch

**QR Code:

Format: Serial number; Testbench; Date; LoRa DevEUI

Example: I880LR20-0009BY0111;1G;260220;70B3D540F200200B

8.2. LoRaWAN QR Code

A QRCode compatible with the LoRa Alliance standard (LoRaWAN® Device Identification QR Code) is placed both at the back center of the product and on the packaging.

Example :



Device Schema version : D0
 AppEUI: 70B3D540F9A1E389
 DevEUI: 70B3D540F351A9E2
 Owner Token: FFFF0880
 Serial number: SI880LR21-0509DK0482

9. Maintenance and failures

9.1.Clock setting

The product has a clock allowing the operation of the Smart Period. This clock drifts very slightly (about 5 minutes/year) in domestic conditions (20-25°C). When it is run for the first time, this clock is synchronized with UTC+2 time zone.

Product clock can be reconfigured via downlink (See 4.9 Reconfiguration via downlink message) or using « Nexelec Config Tool » application (See “Reconfiguration via NFC” section of this documentation for general information on NFC).

- >Launch “Nexelec Config Tool” NFC application
- >Select “Product Info” tab and then press on « Sync. Date »
- >Bring the product closer to synchronize the phone clock
- >The product automatically restarts and takes into account this new clock.

10.Revision History

10.1.Technical guide changelog

Document revision	Details	Date
A	Created	17/05/2019
B	Add information about standard configuration	23/10/2019
C	Add information relative to product autonomy	13/11/2019
D	Add information on Activation and commissioning process Update information on temperature and humidity accuracy	27/02/2020
E	Add information about Tracking label	11/03/2020
F	Add reconfiguration via downlink commands	31/08/2020
G	Add new functions: - Activation/Deactivation of NFC interface - Relative clock configuration	04/03/2021
H	- Improved battery management: green led blinks every 10 seconds when battery is empty - Automatically Join after 3 days without network connection - Add periodic transmission configuration on Real-time messages	21/10/2021

10.2.Associated product batch number

Use the table below to know the functionalities implemented in your product. To understand better the serial number format, refer to section Tracking label.

Technical guide revision	Product Code	Revision starting from serial number
A..E	/	I880LRxx-xxxxAAxxxx
F	/	I880LRxx-xxxxCCxxxx
G	00	I880LRxx-00xxCOxxxx
	05	I880LRxx-05xxDPxxxx
H	00	I880LRxx-00xxDAxxxx
	05	I880LRxx-05xxFZxxxx