

**D948B\_Technical guide**  
**SIGN RISE FEEL MOVE**  
**LoRaWAN**

<b>I. PRODUCT OVERVIEW</b>	<b>4</b>
1. Main functions .....	4
2. Product diagram .....	6
3. Kit description .....	6
4. Operating environment and certifications .....	7
5. Support and integration tools .....	7
<b>II. PRODUCT INSTALLATION</b>	<b>8</b>
1. Installation sites .....	8
2. Detector mounting .....	9
3. Anti-theft mounting .....	12
4. Anti-tear detection .....	13
5. Product commissioning .....	13
- 01. Product power supply .....	13
- 02. Automatic network connection .....	14
- 03. Product time setting .....	14
<b>III. MAIN BUTTON AND LED</b>	<b>15</b>
<b>IV. BUTTON AND SECONDARY LED</b>	<b>16</b>
<b>V. ENVIRONMENTAL MEASURES</b>	<b>17</b>
<b>VI. CO2 MEASUREMENT</b>	<b>19</b>
<b>VII. MOTION DETECTION (PIR)</b>	<b>20</b>
<b>VIII. LED INDICATOR FOR CO2</b>	<b>20</b>
<b>IX. BUZZER</b>	<b>21</b>
<b>X. IZIAIR</b>	<b>21</b>
<b>XI. ACCESS TO MEASUREMENTS VIA NFC</b>	<b>22</b>
<b>XII. RECORDING MEASUREMENTS ON SD CARD</b>	<b>23</b>
1. File creation.....	23
2. Collect and analyze measurements.....	23
3. Troubleshooting : .....	24
<b>XIII.AUTONOMY</b>	<b>25</b>
1. Estimate the autonomy of my product .....	25

2.	Factors affecting product autonomy .....	25
3.	Typical use case .....	26
<b>XIV.</b>	<b>LORAWAN PARAMETERS</b>	<b>27</b>
1.	Recommended LoRaWAN parameters.....	27
2.	Network connection .....	27
3.	Description of data transmission modes .....	28
4.	General description of messages .....	30
5.	Region-specific messages .....	31
- 01.	Historical data (EU868 version)	31
- 02.	Periodic data (EU868)	32
- 03.	Product status (EU868)	35
- 04.	Product configuration (EU868)	37
<b>XV.</b>	<b>PRODUCT CONFIGURATION AND REMOTE CONTROL</b>	<b>40</b>
1.	Configurations for environmental measures .....	40
2.	Light and sound indicator settings .....	41
3.	Network and data transmission configurations.....	41
4.	Commands related to product maintenance, reliability and safety .....	42
<b>XVI.</b>	<b>REMOTE PRODUCT CONFIGURATION VIA A LORAWAN NETWORK</b>	<b>43</b>
<b>XVII.</b>	<b>PRODUCT CONFIGURATION VIA NFC</b>	<b>47</b>
1.	NFC antenna location .....	47
2.	Download mobile application .....	47
3.	Access to Android TOUCH documentation .....	47
<b>XVIII.</b>	<b>MARKINGS</b>	<b>48</b>
<b>XIX.</b>	<b>MONITORING DEVELOPMENTS</b>	<b>48</b>

# I. Product overview

## 1. Main functions

This document describes the technical operation of the 7-in-1 LoRaWAN-connected, battery- or USB-powered, NFC-configurable room sensors. The range comprises 4 products, depending on the sensors integrated: temperature, humidity, CO2, VOC, brightness, presence and noise.

MODELE	NOM	T°/HUM	CO2	VOCS	PIR	LUM.	MIC.	USB	SD	BUZZER	BATTERIES
<b>X580LS</b>	FEEL	●									1
<b>X520LS</b>	RISE	●	●						●	●	2
<b>X590LS</b>	MOVE	●			●	●	●				2
<b>X565LS</b>	SIGN	●	●	●	●	●	●	●	●	●	2



### iZiAiR assesses Air Quality

This on-board algorithm simplifies the interpretation of the numerous data measured by the sensors. A useful and effective decision-making aid for healthier air

### Detects and measures ambient light

The brightness sensor measures the amount of light in the room. Useful for controlling lighting or adjusting temperature more quickly according to sunshine levels.

### Sound under control

Measures noise and identifies noise pollution. Helps preserve a calm and peaceful environment

### Reliable data transmission

Transmission modes adapted to every need, with redundant transmissions for high availability of critical data

### Temperature & Humidity

For better indoor comfort. Measures ambient parameters in offices or homes

## FUNCTIONS



#### Signal tone

An audible signal notifies occupants if Indoor Air Quality deteriorates. Can be activated / deactivated locally or remotely



#### Saves measured data

Integrated microSD card. Up to 10 years of sensor measurements stored in memory. Useful in the event of a power cut



#### Anti-tear detection

Triggers an alert message if the product is removed from its mounting base



#### Measurement accuracy

No risk of measurement drift. Automatic weekly recalibration of CO2 sensor. Manual calibration possible



#### Easy to configure

Easy product adjustment via contactless NFC technology from a smartphone



#### Clearly visible indicator light

The Green / Orange / Red indicator changes with the CO2 level and alerts you when it's time to ventilate to renew the indoor air



#### Easy to install

Free-standing on desk, wall or flush-mounted box. Adhesive mounting included



#### Calibration certificate

Accuracy of CO2, temperature and humidity measurements validated by a COFRAC-accredited metrology laboratory



#### High-performance battery

Operates on replaceable lithium batteries. Up to 20 years(1) of autonomy



#### 270° Air

Numerous side openings for better ambient air analysis



#### Anti-theft protection

Lockable mounting base reduces risk of sensor removal



#### Enhanced cyber security

Data transmitted by the product is secured from end to end using double AES128 encryption



#### USB-C socket

Universal connector for quick and easy power supply



#### Instantaneous measurement

Easy to operate, thanks to a button on the front of the sensor. Useful for occupants or technicians (function can be deactivated)

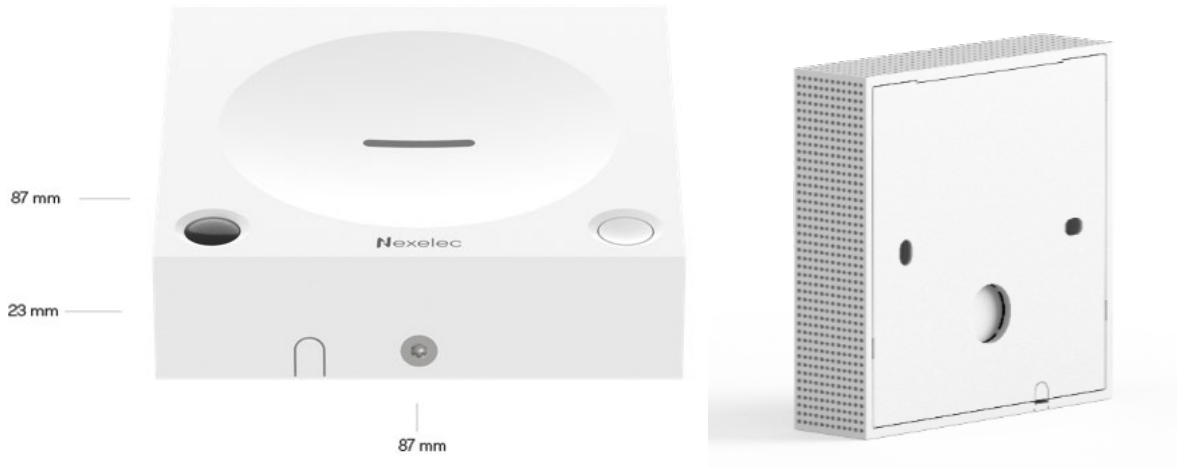


#### Regulatory compliance

Direct-reading sensor compliant with French standards for measuring CO2 concentration in indoor air

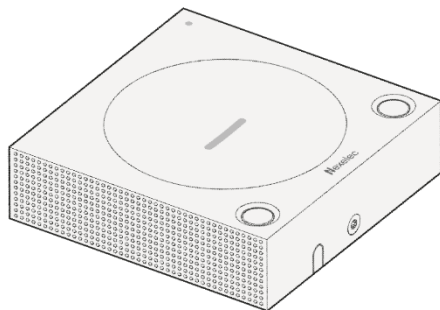
## 2. Product diagram

### DIMENSIONS & WEIGHT

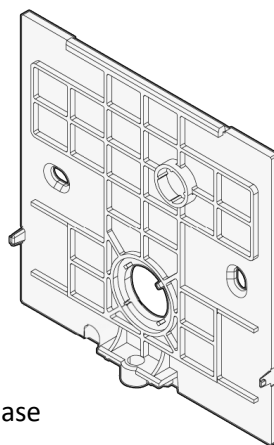


110 g including 2 batteries

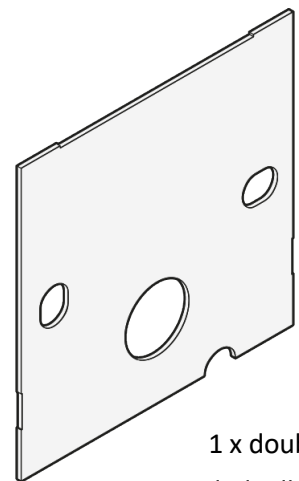
## 3. Kit description



1 x product



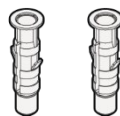
1 x base



1 x double-sided adhesive



1 or 2 x batteries



2 x screws & dowels



1 x microSD 256 MB

\* : Depending on model. See product configuration table

## 4. Operating environment and certifications

### CONDITIONS OF USE

- > Indoor environment
- > Temperature: -20°C to +50°C
- > Relative humidity: 0% to 99% RH (non-condensing)
- > Product life : Some sensors have a limited lifetime:
  - > VOC: 10 years of operation (SIGN)
  - > CO2: 15 years of operation (RISE & SIGN)

### CERTIFICATIONS

Applicable certifications and associated declarations of conformity are available on the Nexelec support website [support.nexelec.fr](http://support.nexelec.fr)

## 5. Support and integration tools

Documentation and tools for this product can be found on our website [support.nexelec.fr](http://support.nexelec.fr)  
Here you'll find :

- > CODEC, Javascript code for decoding LoRaWAN messages:  
<https://support.nexelec.fr/fr/support/solutions/folders/80000678871>
- > Online decoding tool for LoRaWAN messages :  
<https://nexelec-support.fr/n/decoder/>
- > Online downlink calculation tool for remote product reconfiguration: <https://nexelec-support.fr/n/downlink/>
- > VOTL: Online product autonomy calculator :  
<https://nexelec-support.fr/n/volt/>

If you have any questions, our support team can be contacted by e-mail at [support@nexelec.fr](mailto:support@nexelec.fr).

## II. Product installation

### 1. Installation sites

#### RECOMMENDED PLACES

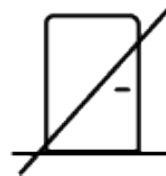
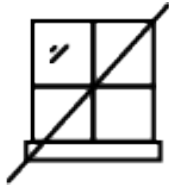
The equipment should be placed in a location representative of average exposure. Ideally, the product should be placed in a central area of the room, between 50cm and 2m high.

A CO2 collector covers about 100m<sup>2</sup>.

#### PLACES TO AVOID

To avoid distorting the measurements, try to position it away from exposed areas:

- > draughts (doors, windows, etc.)



- > close to heat sources (radiators, direct sunlight, etc.)





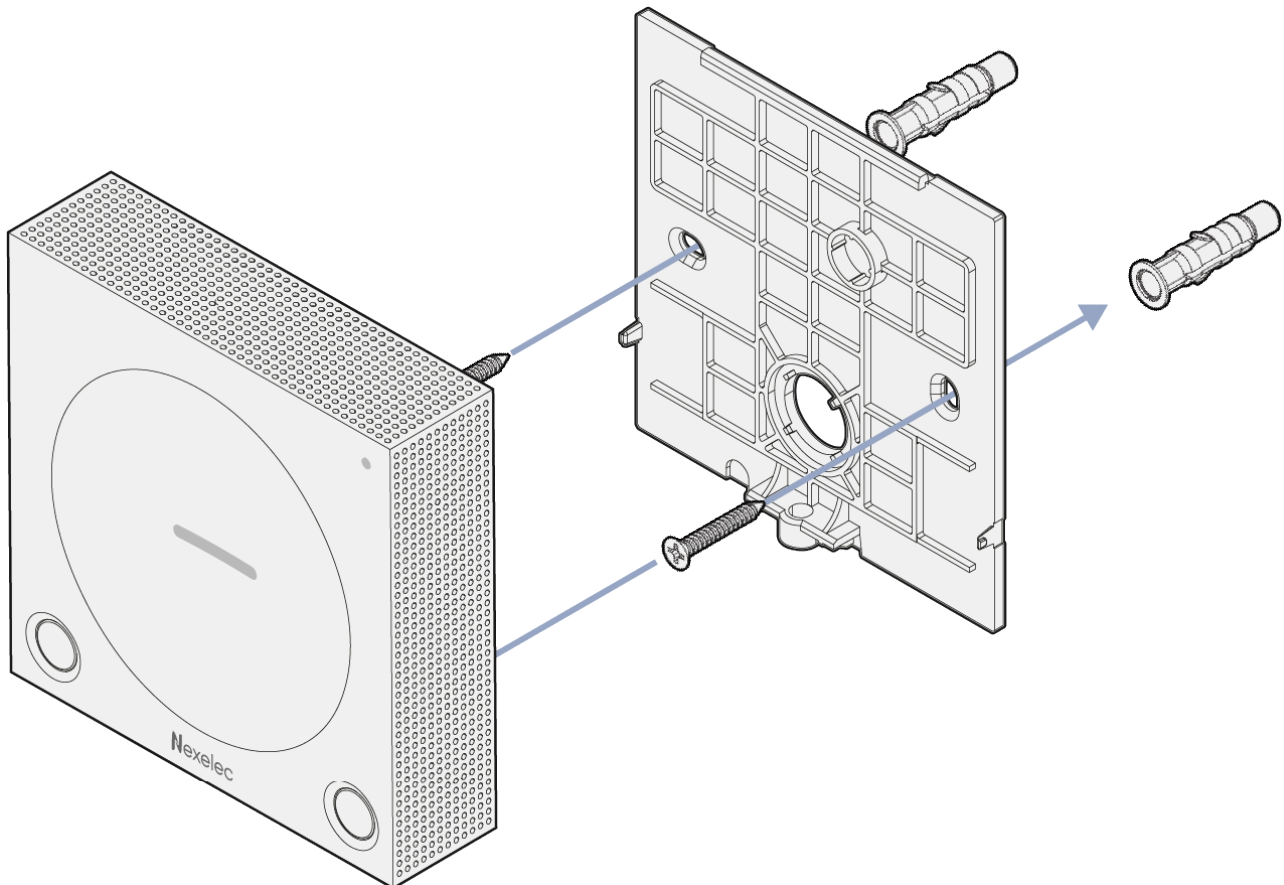
## 2. Detector mounting

### MOUNTING THE DETECTOR ON A WALL

The product can be wall-mounted either :

- > with screws and plugs, supplied with the product

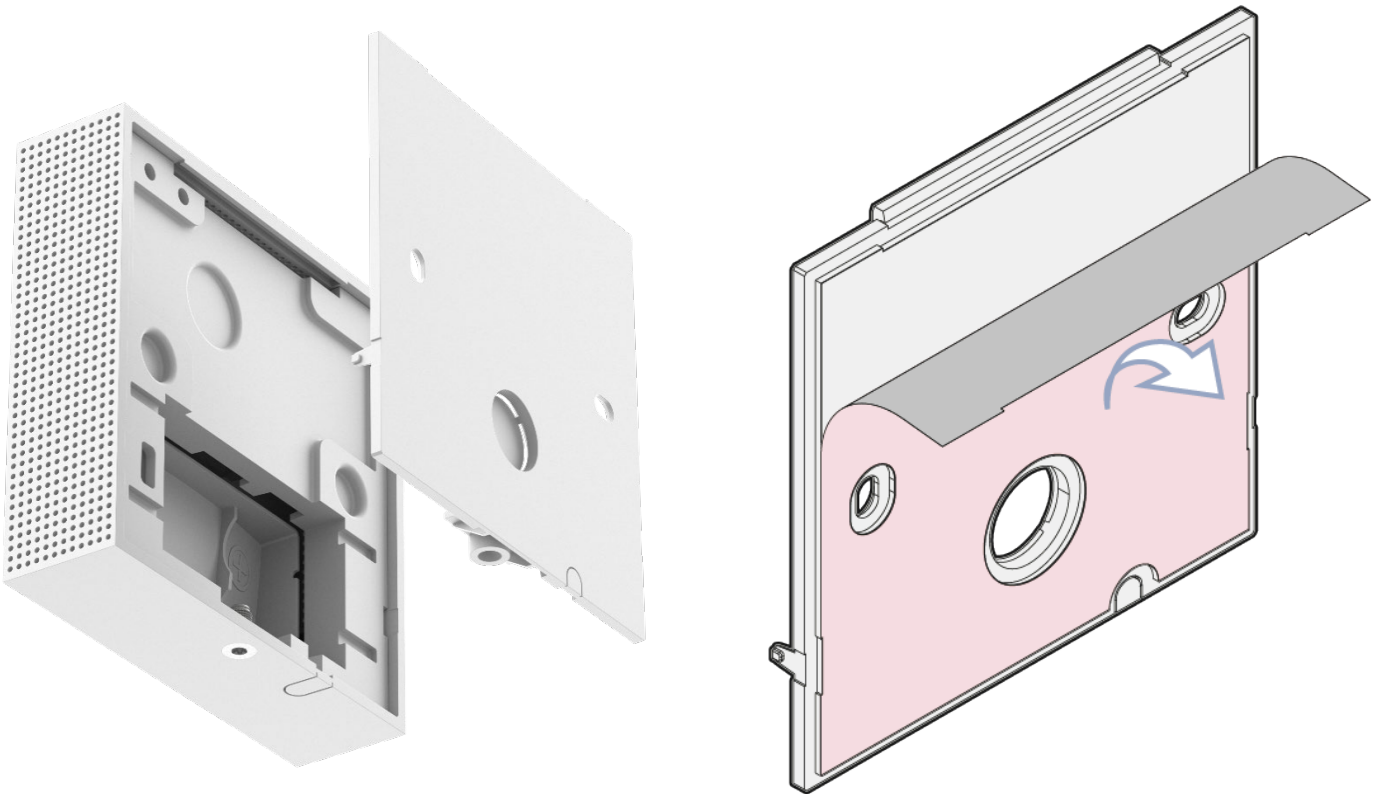
Follow the procedure below:



- > Choose a suitable location to mount the sensor on the wall
- > Remove the mounting base from the detector
- > Use a pencil to mark the desired position of the screw holes on the wall
- > Insert the supplied plugs and screw on the mounting base
- > Insert your product into the mounting base, and lock it in place using the screw on the bottom edge of the product.

- > by double-sided adhesive tape, supplied with the product:

Follow the procedure below:

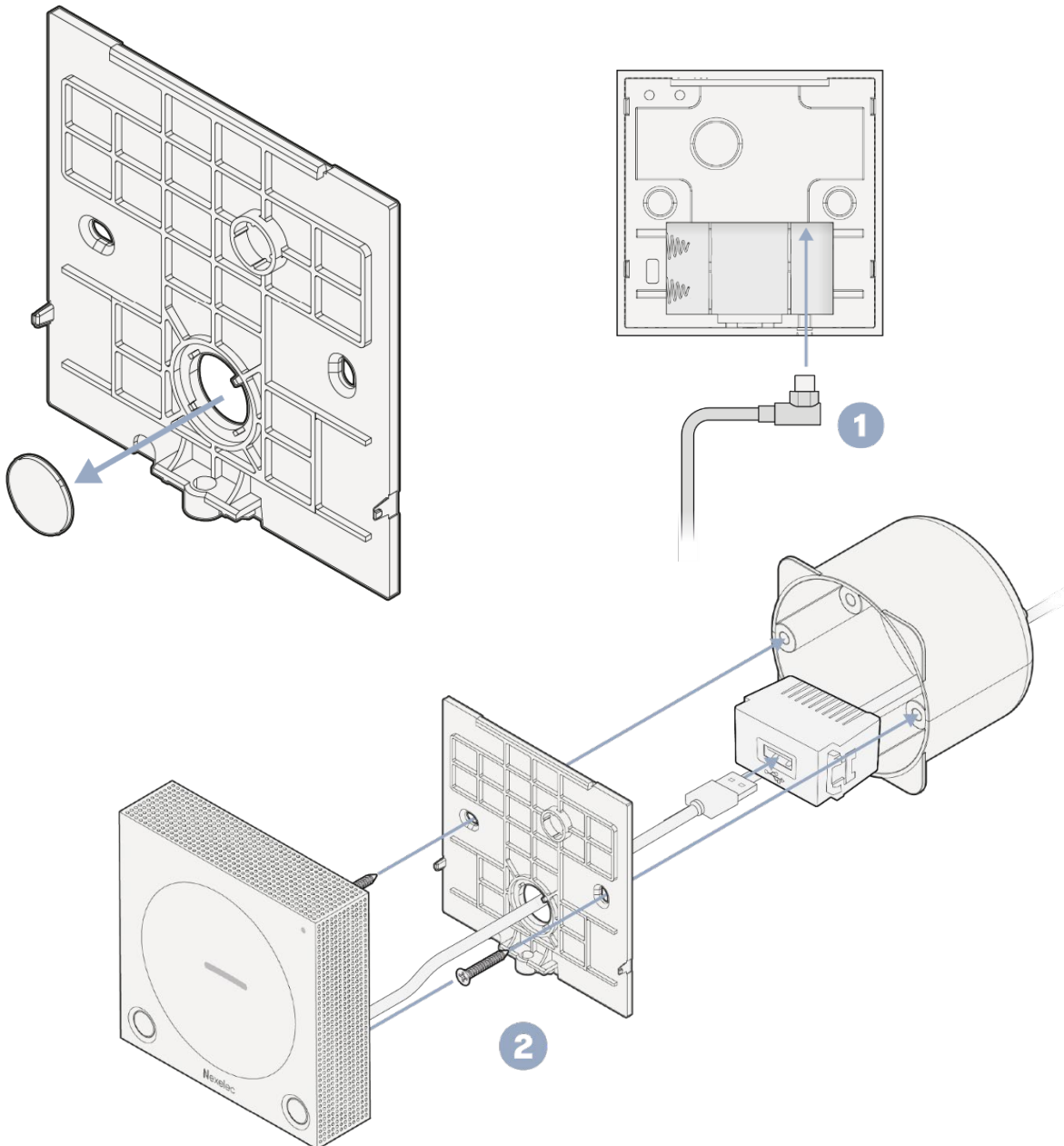


- > Choose a suitable location for wall-mounting the sensor
- > Remove the mounting base from the detector
- > Place the adhesive on the back of the base and press down for about ten seconds.
- > Remove the second film of adhesive, place the base on the wall and hold for ten seconds.
- > Insert the product into the mounting base, locking the assembly with the screw on the bottom edge of the product.

## MOUNTING ON A STANDARD ELECTRICAL FLUSH-MOUNTING BOX

A power supply kit is available in the Nexelec accessories list. It contains :

- > 220V to 5V USB transformer, can be integrated into flush-mounting boxes
- > A specially adapted USB cable (short length, angled end)



- > Break off the plastic plug to remove the power cable from your product
- > Connect the USB cable through the hole left by the plastic plug.
- > Screw wall bracket to flush-mounting box
- > Mount and screw your product onto the wall bracket

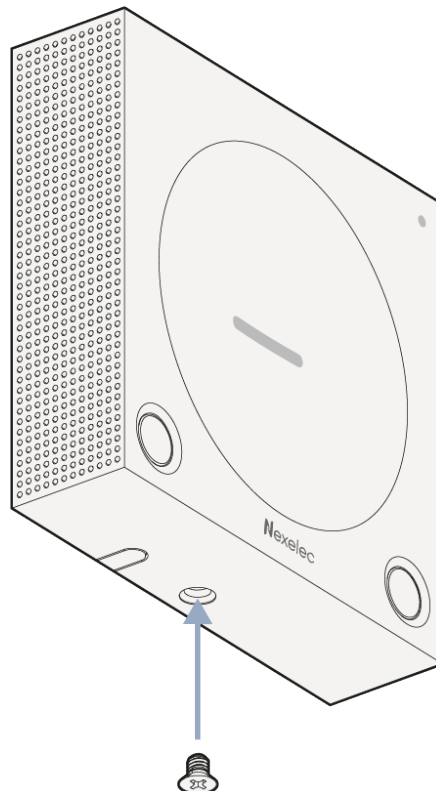
## FREE-STANDING

Simply place the detector on a piece of furniture or a shelf .



## 3. Anti-theft mounting

The product is supplied with an M3x8 screw to lock it to its mounting base. In this way, the product cannot be removed from its base without a special tool.



## 4. Anti-tear detection

The product is fitted with a magnet to check whether or not the product is installed on its mounting base. This function ensures that products have not been removed from their base. As soon as the product is inserted or removed from its base, a LoRaWAN "Product status" message is transmitted.

When the product is removed from the cradle, the front LED lights up red. If the SD card is active, data is copied to it and its status is updated in the NFC memory. Once these operations have been completed, the front LED flashes green three times and the product sends a network frame.

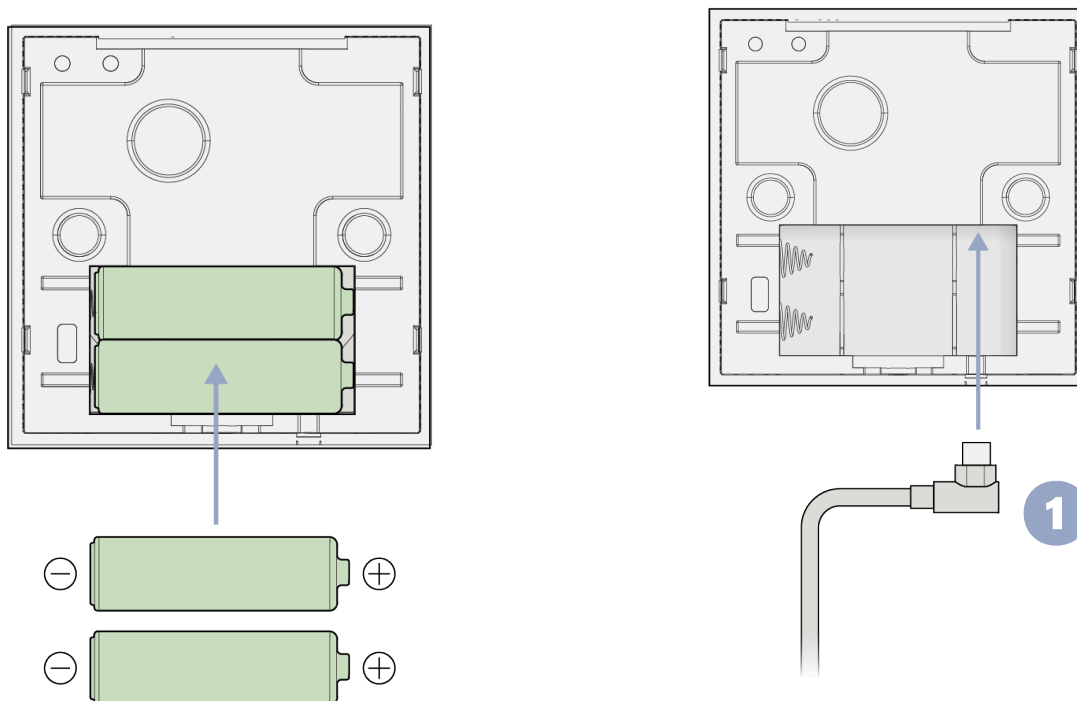
## 5. Product commissioning

### — 01. Product power supply

The product may be powered either by batteries or via the USB-C connector on the rear of the product.

The product is compatible with 3.6V AA non-rechargeable batteries. The product can be powered by one or two batteries, depending on the application and the desired autonomy. If powered by a single battery, it can be positioned in any of the slots.

To commission your product, power it via USB or insert the batteries\*. Batteries must be inserted in the direction indicated on the product.



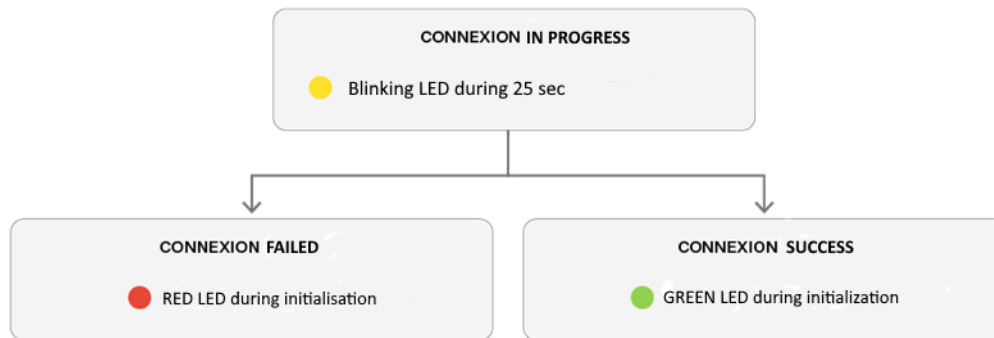
\*: Do not mix battery references of different brands. When replacing batteries, replace the entire set with new ones.

## — 02. Automatic network connection

Once powered, the :

- > Initializes for approx. 5 seconds: steady green LED
- > Automatically attempts to connect to the LoRaWAN network

The main LED and the secondary LED simultaneously display the stages of the product initialization and connection phase:



At the end of the connection phase (approx. 25 seconds), the product is ready for use. In the event of failure, the product will immediately attempt a second connection to the network, and then periodically (more information is available in section 15.2 Network connection.)

## — 03. Product time setting

The product time is used to time-stamp measurements stored on the SD card. The NFC interface is used to configure the product time. Refer to the NFC Touch application for detailed procedure.

Note that when the product is no longer powered (unplugged, battery change), it is necessary to set the product's time again using the NFC Touch application.

### III. Main buttons and LEDs I



Support type	Actions generated	Main LED
Short press	<ul style="list-style-type: none"> <li>Instant measurement and transmission</li> <li>Air quality indication</li> </ul>	<ul style="list-style-type: none"> <li>● : Low CO2 level</li> <li>● Average CO2 level</li> <li>● High CO2 level</li> </ul>
Long press	<ul style="list-style-type: none"> <li>Product status: network connection   product status</li> </ul>	<p>2 successive flashes of the LED :</p> <ul style="list-style-type: none"> <li>●● Network connection OK, Product OK</li> <li>●● Network connection OK, Battery low</li> <li>●● Network connection OK, Hardware problem*.</li> <li>●● : No network connection, Product OK</li> <li>●● No network connection, Battery low</li> <li>●● No network connection, Hardware problem*.</li> </ul>

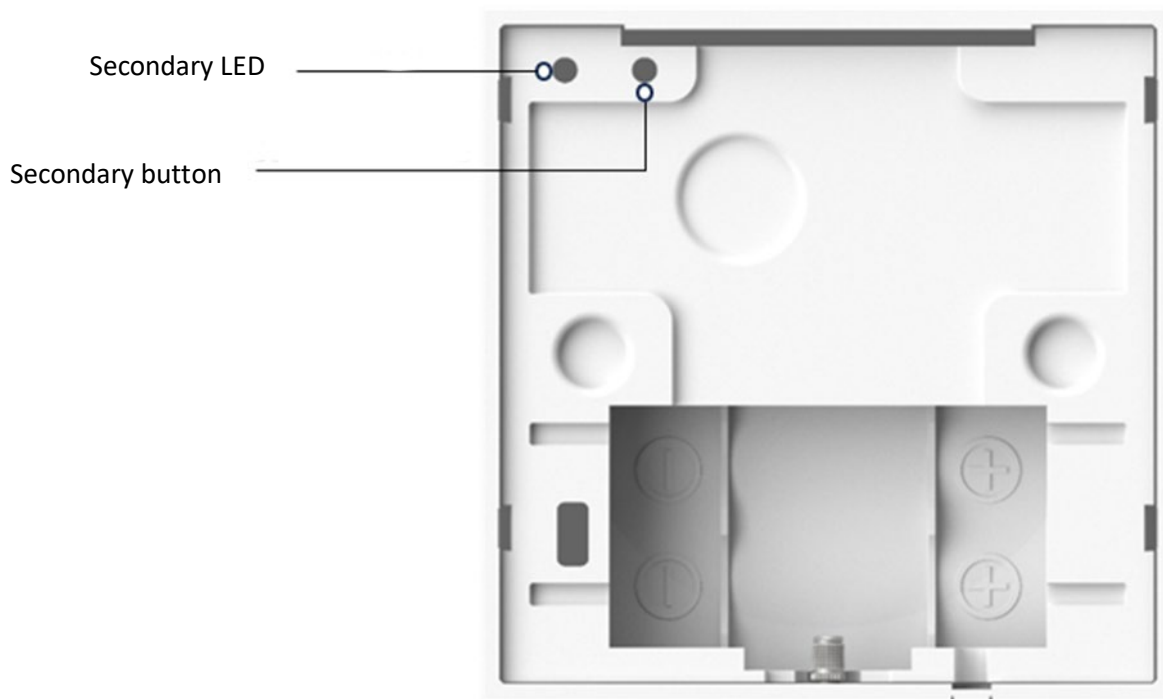
\*In the event of a hardware problem :

- > Reset the product by pressing the secondary button 3 times (see corresponding section).
- > If resetting the product has not solved the problem, remove the batteries from the product, wait 2 minutes and then insert the batteries back into the product. If the problem persists, contact support.

Note: Button-press messaging can be activated and deactivated via NFC or LoRa downlink.

## IV. Button and secondary LED

The secondary button is located on the back of the product. An object (pen, paper clip, etc.) is required to activate the button. The sequence of actions induced by the use of the secondary button can be observed on the product's secondary LED, located next to the secondary button.



Support type	Actions generated	Secondary LED
Short press	Manual attempt to connect to LoRaWAN network (join)	Flashing <span style="color: yellow;">●</span> : Connection attempt in progress <span style="color: green;">●</span> : Successful connection <span style="color: red;">●</span> : Failed connection
Double support	reserved for Nexelec	<span style="color: yellow;">█</span>
Triple support	Product reboot	Flashing <span style="color: yellow;">●</span> <span style="color: green;">●</span> <span style="color: red;">●</span> for 5 seconds
Long press > 3 seconds	Manual CO2 calibration	<span style="color: yellow;">●</span> CO2 calibration in progress <span style="color: green;">●</span> CO2 calibration successful <span style="color: red;">●</span> CO2 calibration failed



## V. Environmental measures

### PRECISION AND RESOLUTION

Type	Unit	range	Resolution	Precision	
				Typ.	Max.
CO2	ppm	0 - 5000	1	-	±(50 ppm ± 3% of value)
VOCS	µg/m <sup>3</sup>	0 - 15000	1	25%	-
Temperature	°C	-30 - +70	0.1	±0.2 °C	±0.4 °C
Humidity	%R.H.	0 - 100	0.5	±2%RH	±3%RH
Brightness	lux	0 - 5100	5	± 5lux	-
Noise level	dB	35 - 120	1	± 5dB	-
Presence	Rate / % of occupancy	0 - 100	1	-	-

\*Accuracy achieved after 3 weeks of VOC sensor operation.

## MEASUREMENT PERIOD

By default, the product measures every 10 minutes. The period can be configured via the LoRa or NFC downlink.

- > The following measurements are taken continuously between two transmissions:



The sound level is measured for 200 ms every 10 seconds. Average and maximum values are calculated between two transmissions.



The motion sensor continuously measures and analyzes the occupancy rate per 10-second period: if motion is observed during this 10-second period, an event is recorded. Before transmission, the product calculates the space occupancy rate, the ratio between the number of periods with motion detected and the total number of periods.



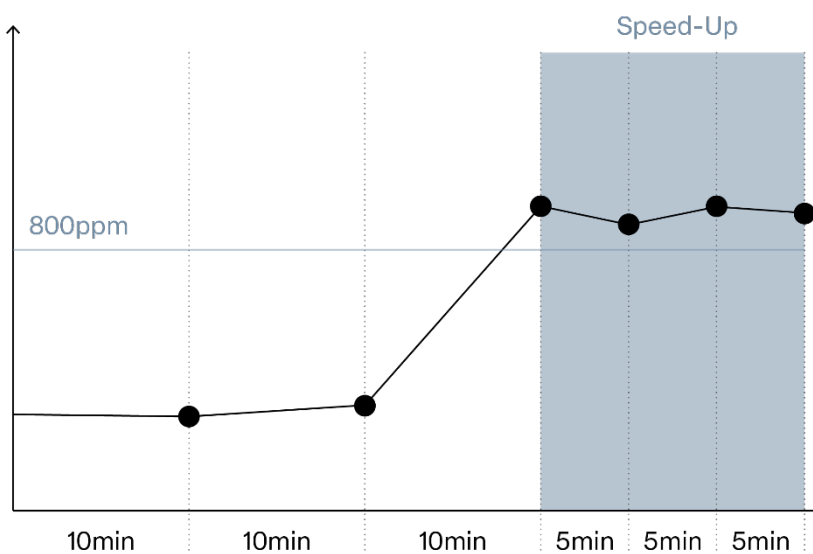
Volatile organic compounds are measured every 90 seconds. The average value between two messages is provided.

- > The following measurements are taken just before data transmission:



CO2, temperature, humidity and brightness are measured just before each transmission.

## CO2 SPEEDUP: AUTOMATIC ADJUSTMENT OF CO2 MEASUREMENT PERIOD



The product automatically adjusts the CO2 measurement period to optimize its responsiveness to the aeration instructions given via the LED and buzzer.

The product measures CO2 levels every 10 minutes. This period is reduced to 5 minutes as soon as the CO2 level reaches medium or high levels.

The measurement period automatically returns to its initial value (10 minutes by default) when the CO2 light turns green again. The transmission of LoRaWAN information and the measurement of other parameters is not affected by this system.

## VI. CO2 measurement

### TECHNOLOGY

The product features a CO2 sensor with NDIR non-dispersive infrared technology.

### AUTOMATIC CALIBRATION

CO2 is measured using NDIR infrared technology. This optical technology can cause the measurement to drift over time, which the product automatically compensates for using an ABC (Automatic Baseline Correction) method.

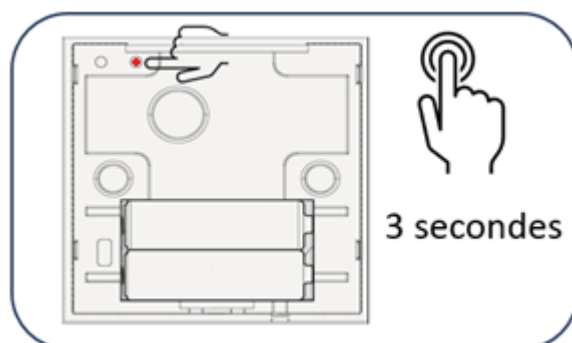
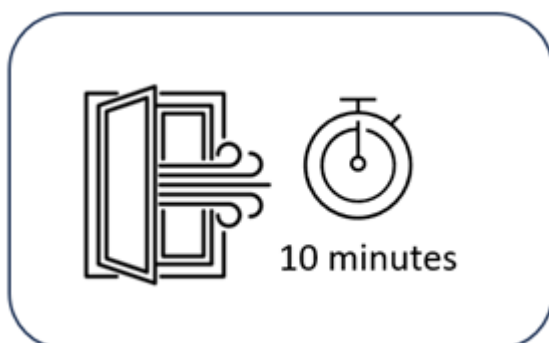
This method is particularly effective and reliable in an environment where the product is exposed to "fresh" air (CO2 levels close to 420ppm) at least every 8 days. This is often the case at night and weekends in public areas, and during the day in bedrooms. No maintenance is required. The reliability of CO2 measurements is guaranteed throughout the product's lifetime.

Note: Automatic calibration is not suitable for enclosed spaces where air renewal is rare or occupancy constant (e.g. hospital rooms, agricultural greenhouses). In these particular conditions, we advise you to deactivate automatic calibration.

### MANUAL PRODUCT CALIBRATION

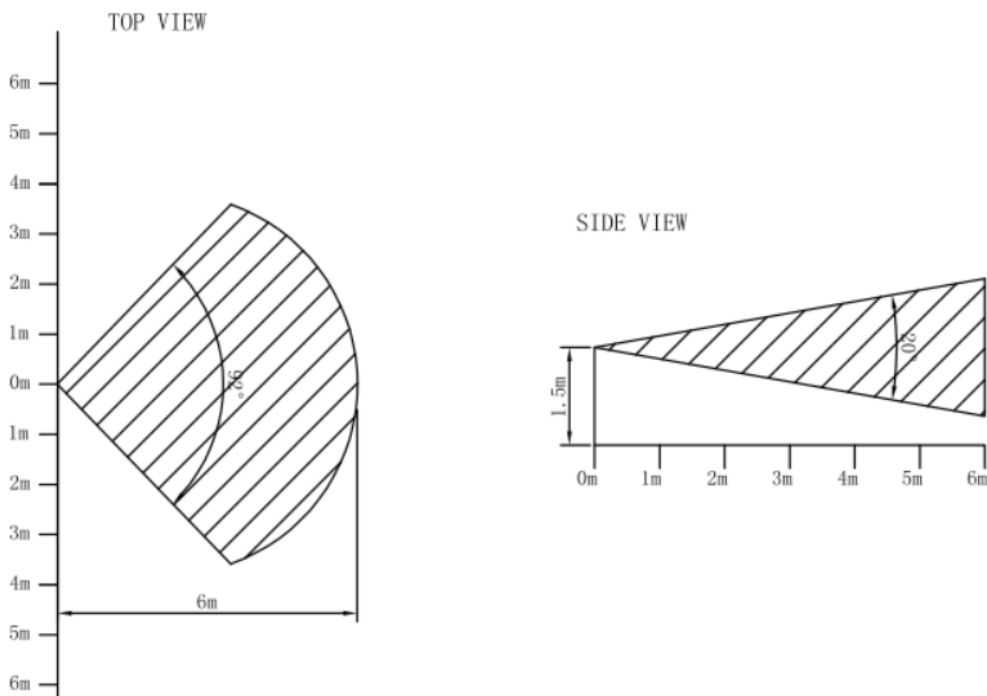
You can calibrate the CO2 sensor manually:

- > Place the product outdoors or near an open window for 10 minutes.
- > Long press on the secondary button on the back of the product
- > Secondary LED lights up during calibration process
- > The green LED lights up, indicating that manual product calibration has been successfully completed. If the red LED lights up, repeat the operation.



## VII. Motion detection (PIR)

The motion sensor detects up to 6m in front of the product, and at an angle of 92°.



## VIII. LED indicator for CO2

The air quality sensor operates autonomously and indicates air confinement via the product's main LED:

	BATTERY-POWERED	USB POWER SUPPLY
Good air quality	No flashing	● fixed
Medium containment, ventilation required	Flashing ●	● fixed
High containment, ventilation required	Flashing ●	● fixed

\*: short press on main button displays current air quality for 3 seconds

Configurable parameters on LED indicator :

- > Activation: ON | OFF
- > Show "green" and "red" levels only → Orange LED: ON | OFF
- > Parameter displayed: IZIAIR | CO2 level

## IX. Buzzer

The buzzer warns the user when a threshold is crossed, whether conditions are improving or deteriorating (CO<sub>2</sub> or iZiAIR, depending on product configuration). The buzzer continues to warn the user at regular intervals (with each measurement) as long as conditions remain poor (can be deactivated).

The buzzer is disabled by default. It can be activated via NFC or downlink.

Configurable buzzer parameters :

- > Activation: ON | OFF
- > Parameter: CO<sub>2</sub> | iZiAIR (configuration in conjunction with LED indicator)
- > Confirmation of poor air quality: ON | OFF

## X. iZiAIR

Nexelec has designed the iZiAir integrated algorithm to simplify indoor air quality assessment.

The algorithm adapts to the measurement data available, enabling rapid assessment of air quality levels. iZiAir can analyze up to 9 pollutants simultaneously. The algorithm measures the concentration of each of these pollutants, and prioritizes their hazardousness. This enables you to take action tailored to your environment.

This information can be displayed on the main LED, depending on its configuration.

- > Red: Caution
- > Orange: Medium
- > Green: Very good

The information linked to iZiAIR is calculated in the product and sent back in the message in the form of two main indicators:

- > iZiAIR Global: summarized air quality level (Very good, Fair, Warning)
- > iZiAIR Source: Main pollutant

Messages adapted to each situation are available from our support team or via our API service.

# XI. NFC access to measurements

The data measured by the product can be consulted via the NFC TOUCH application. This function is particularly useful for :

- > View current values of various environmental parameters :
  - Temperature
  - Relative humidity
  - CO2 concentration
  - VOC concentration
  - Brightness
  - Noise
- > History and advanced analysis of CO2 concentration :
  - 5-day history in 10-minute steps (720 last measurements)
  - Time spent in CO2 high, CO2 average (private)
  - CO2 calibration status :
    - Manual | Automatic
    - Time since last manual calibration
- > View product status information :
  - Status of sensors, battery, etc.
  - Software version, hardware version



To access data measured by the product via NFC :

- > Short press on the product's main button
- > Use the NFC TOUCH smartphone application

## XII. Recording measurements on SD card


Environmental measurements can be stored on the sensor's MicroSD card. This function is particularly suitable for analyzing all product measurements over a relatively long period, typically from several days to several months.

A file is created each month, and updated daily with the day's measurements.

The file on the SD card is also updated when the sensor is removed from its holder.

### 1. File creation

Files are identified by the devEUI, year and month of creation:

 70B3D57ED8000D73\_2023-03.csv

Each line of the file is time-stamped and includes all measurements:

The headers and data format are as follows:

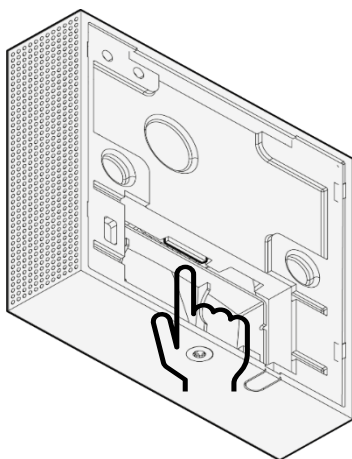
devEUI	timestamp_s	temperature	humidity	pressure	luminosity	formaldehyde	covt	co_concentration	concentration_PM1	concentration_PM10	concentration_PM2_5
String	Date	Int	Float	Float	Float	Float	Float	Float	Float	Float	Float

### 2. Collect and analyze measurements.

#### REMOVE THE SD CARD FROM YOUR PRODUCT

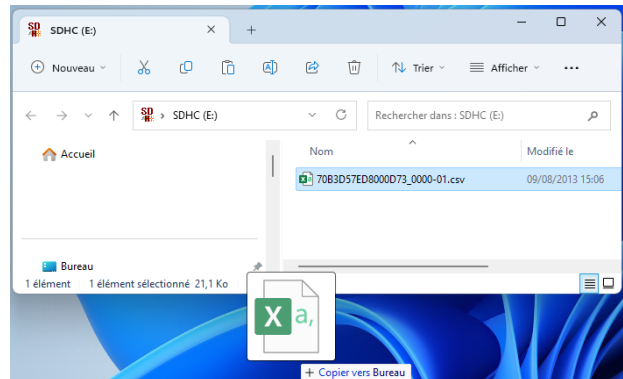
Unscrew the anti-theft screw and remove the product from its base to access the SD card.

The main LED indicates the status of operations between the SD card and the product.



SD STATUS	LED STATUS FRONT
Operation in progress Do not remove SD card	<span style="color: red;">●</span> fixed
Operation completed You can remove the SD card	3 flashes <span style="color: green;">●</span>

## COPY FILES TO YOUR COMPUTER



## REPLACING THE SD CARD

Replace the SD card in the sensor, then the power supply (battery or USB).

Replace the sensor on its base and install the anti-theft screw.

## 3. Troubleshooting :

The date or time of recordings on the SD card is incorrect:

The product's time is automatically set by the phone when it starts recording measurements via the NFC TOUCH application. If the product's batteries are removed, the product's time must be reset using the NFC interface. Otherwise, the product will continue to record data, but the time stamp will be incorrect.



## XIII. Autonomy

### 1. Estimating my product's autonomy

An online calculation tool is available: <https://nexelec-support.fr/n/volt/>

It allows you to evaluate product autonomy according to transmission modes, network parameters, LED activation time, etc. You can also access it by scanning or clicking on the Qr Code :



### 2. Factors affecting product autonomy

Several factors influence product autonomy:

#### Sensor measurement period

The product consumes energy, particularly when the sensors are taking measurements. The shorter the period between measurements, the higher the overall consumption of the product, and therefore the shorter the autonomy.

#### LED and buzzer

When the LED flashes and the buzzer is activated, the battery is under greater strain. Product autonomy will be lower in environments where the LED and buzzer are regularly switched on.

#### Data transmission frequency

The product consumes energy when transmitting the data measured by the sensors. The lower the number of transmissions, the greater the product's autonomy. In particular, datalog mode increases the product's autonomy, while maintaining a very low measurement frequency.

#### LoRaWAN network coverage quality

LoRaWAN technology uses a mechanism called ADR, which adapts radio transmission parameters according to the level of network coverage. A product placed in an environment with very good radio coverage can consume up to 20 times less energy than a sensor placed in a less favorable environment! Your product's radio coverage is therefore a decisive factor in determining its autonomy.

### 3. Typical use case

The table below gives the autonomy of the product powered by 2 SAFT LS14500 batteries under standard conditions and configurations (LoRaWAN SF10).

	<b>CONFIGURATION</b>	<b>AUTONOMY</b>
<b>FEEL</b>	Periodic mode:30 minutes	22 years old
<b>FEEL</b>	Datalog, measure 30 minutes, send 3h, repeat transmission 3	38 years old
<b>RISE</b>	Periodic mode: 30 minutes	14.5 years
<b>RISE</b>	French regulations ICONE calculation: Datalog CO2, measurement 10 minutes, transmission 2h, repeat transmission 3	19 years old
<b>MOVE</b>	Periodic mode: 30 minutes	7 years
<b>SIGN</b>	Periodic mode:30 minutes	3.5 years

# XIV. LoRaWAN parameters

## 1. Recommended LoRaWAN parameters

LoRaWAN protocol version: Product compatible with versions 1.1.0 and 1.0.4

Regional parameters: Product compatible with parameters RP001 1.1 rev B and RP002 1.0.3

Profile: Class A (RX2SF9 or RX2SF12)

Available frequencies: EU868

Join type : OTAA

AppEUI: 0x70B3D540FCAD56DF

DevEUI: Unique identifier for each product. Information available on the label and supplied when the product is delivered.

AppKey: Security key unique to each product. Information supplied when the product is delivered.

Application port (uplink / downlink): 56

ADR : Yes

## 2. Network connection

### AUTOMATIC CONNECTION ON POWER-UP

When the device is switched on, two attempts are made to connect to the network. If the connection is successful, the product will send its configuration and status.

### COMMISSIONING STRATEGY IN THE EVENT OF INITIAL FAILURE

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

The first attempt will be made 20 minutes after initial commissioning.

The second attempt will take place 40 minutes after the first.

The third attempt will take place 80 minutes after the second attempt.

If this fails, the product will try to rejoin the network every 24 hours.

### PROGRAM A NEW REMOTE NETWORK CONNECTION

You can schedule a connection request via a downlink command. A typical use case is when you want to switch from one LoRaWAN network server to another . A configuration message is sent with the "Delayed network connection" field set to 1, meaning that the request has been taken into account by the product.

### PERIODIC CHECK OF NETWORK CONNECTION

The product checks its connection to the network every day by sending the "product status" message via the standardized LoRaWAN "LinkCheck" system. After 3 unanswered attempts from the network, the product

will automatically attempt to join the network as described in the section Commissioning strategy in the event of initial failure).

### 3. Description of data transmission modes

#### PERIODIC DATA

This mode enables periodic transmission of data measured by the product. The data transmission period is configurable. By default, it is 30 minutes.

Between these periodic messages, the product continues to measure the various parameters. If a significant change is observed, a message is sent immediately. The value of this significant change is configurable and called "delta". The default values are :

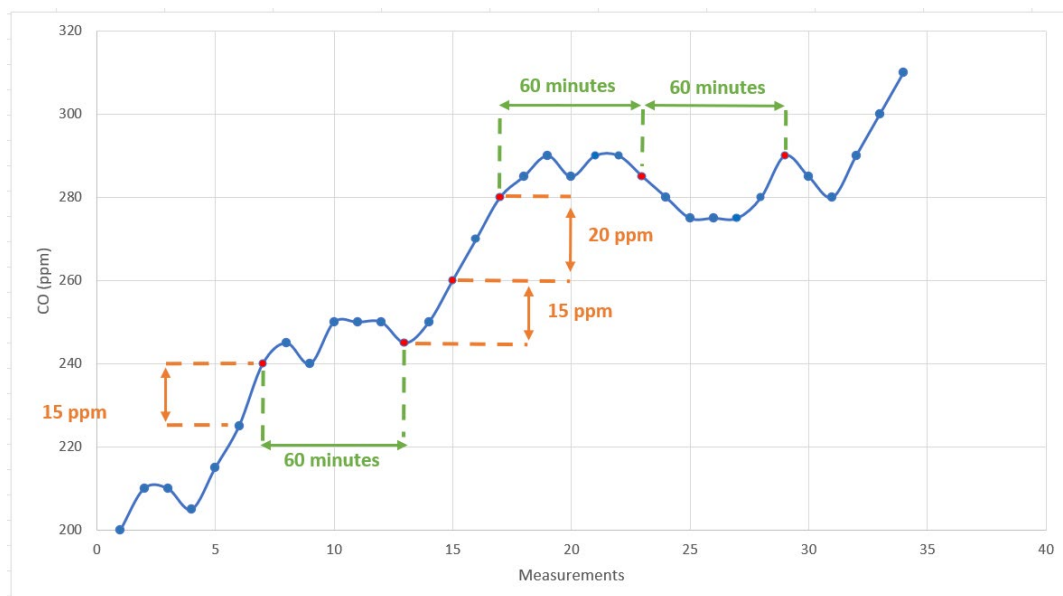
- > Delta CO2: 150 ppm
- > Delta Temperature: 0.5°C

This function makes it possible to set a relatively long sending period (e.g. 60 minutes), while ensuring that changes in values can be observed with a high degree of reactivity.

The following example illustrates this mode in the following configuration:

- > Periodic transmission every 60 minutes
- > Significant change leading to instant shipment: 15 ppm

Each blue dot corresponds to a measurement. Each red dot corresponds to the sending of a message.



## HISTORICAL DATA (DATALOG) AND REDUNDANCY

The data logging function (Datalog) enables multiple measurements to be combined in a single LoRa message. This function makes it possible to :

- > Reduce the number of messages sent by the product to increase autonomy
- > Send the same data several times to reduce potential message loss due to radio transmission.

Temperature and CO2 data can be transmitted in datalog mode. Each type of measurement is integrated into a specific message. So if both CO2 and temperature datalog modes are activated, the product will send two messages: one containing CO2 measurements, the other containing temperature measurements. The number of measurements included in the message, as well as the sending period, are configurable.

Datalog mode incorporates a "redundancy" function. This allows the transmission of the same measurement to be repeated in order to maximize the chances of the message being received.

The following parameters are used to configure datalog mode operation:

- > Number of new measures contained in a message
- > Message transmission period
- > Number of repetitions of the same value (redundancy)

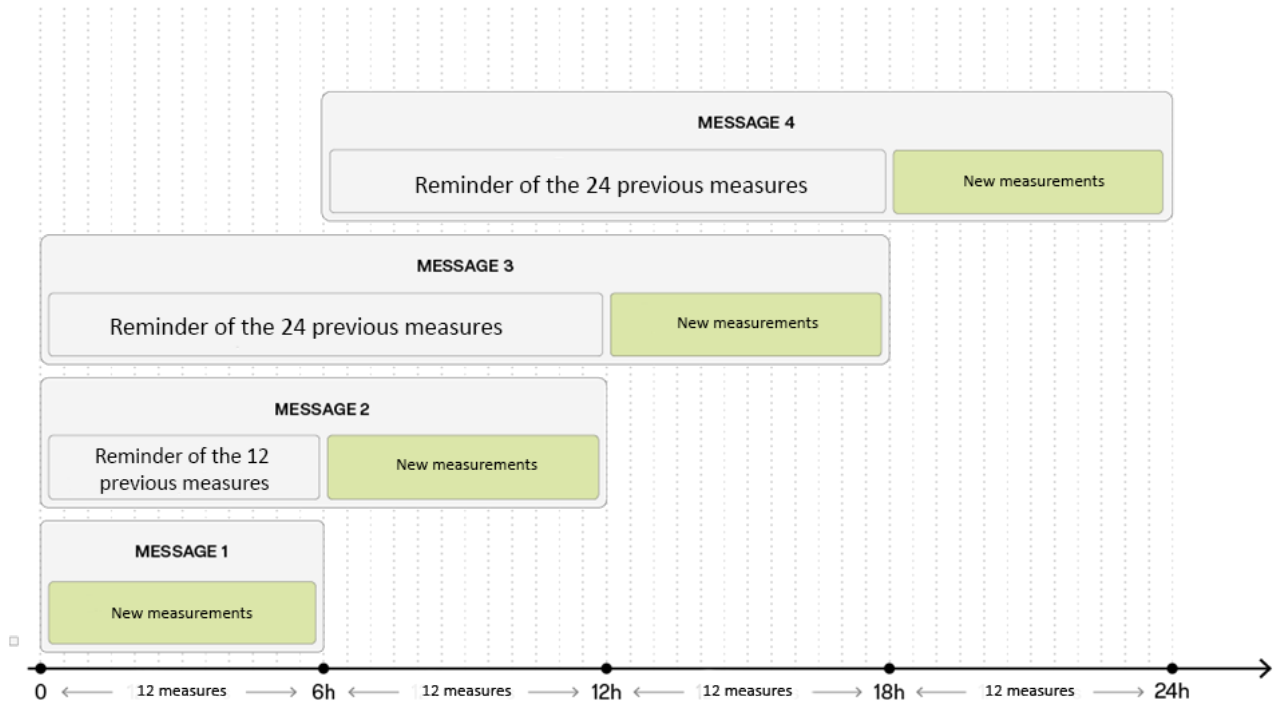
**Limit:** In Europe, the LoRaWAN standard limits the maximum message size. It's important not to exceed this limit, so make sure that the total number of bars contained in a **message doesn't exceed 36 bars**. This total number corresponds to :

$$\text{Total number of measurements} = \text{number of new measurements} * \text{number of repeat measurements}$$

**Example:** The image below illustrates datalog mode operation with the following parameters:

- > Number of new measures in a message: 12
- > Message transmission period: 6 hours
- > Number of repetitions of the same value: 3

This configuration tells the product to store measurements with a time step of 30 minutes (12 new measurements transmitted every 6 hours), and to send them every 6 hours, integrating the same measurement 3 times. The number of measurements per message will then be 36 measurements (12 new measurements \* 3).



## 4. Description general messages

The different types of messages are described below:

Function details	Message index	Message transmission	Can be deactivated	Configurable
<b>Periodic data</b>	0x01	Periodical and event-based	Yes	Yes
<b>Historical data (datalog)</b>	0x02: CO2 0x03: Temperature	Periodical	Yes	Yes
<b>Product status</b>	0x05	24-hour periodical and event-driven	No	No
<b>Product configuration</b>	0x06	Periodic 7J and On change	No	No

## 5. Region-specific messages

### — 01. Historical data (EU868 version)

Data is logged and sent at regular intervals. They are ordered from the most recent value to the oldest. The first value (index  $n$  in the message description) corresponds to the current value. The  $n-1$  value represents the previously measured value, and so on. The time between two measurements is indicated in each message to simplify decoding operations.

Historical data can be of CO2 or temperature type. They are represented as 10 bits in the following format:

Size (bit)	Data	Description	Valid range	Scale	Unit
10	Temperature	Temperature in °C, <b>offset 30°C</b> (e.g.: 0 = -30°C, 300 = 0°C, 1000 = 70°C)	0..1000	-30..70	°C
			1023 : Error		
10	CO2	CO2 in ppm, resolution 5ppm	0..1000	0..5000	ppm
			1023 : Error		

The data is organized in the message as follows:

Offset	Size (bit)	Data	Description	Valid range	Scale	Unit
0	8	Product type	Product model	FEEL : 0xA9 RISE: 0xAA MOVE : 0xAB SIGN : 0xAD		
8	8	Message type	Historical data containing : CO2   Temperature	0x02: CO2 historical data 0x03: Historical temperature data		
16	6	Number of measurements	Total number of measures in the message	1 - 36	1 - 36	N/A
22	8	Period between measurements	Time in minutes between measurements	5 - 30	5-30	min
30	6	Repeat	Number of repetitions of the same measurement	1 - 36	1 - 36	N/A
36	10	Measurement [n]	CO2 or temperature measurement	See table above		

46	10	Measurement [n-1]	CO2 or temperature measurement	See table above
...	...	...	...	...
...		Measurement [n-x]	CO2 or temperature measurement	See table above
...	...	Not used	Filling the message with 0s to obtain an integer number of bytes	0

## — 02. Data periodic (EU868)

The product measures and sends a message containing environmental data in the following format :

Offset	Size (bit)	Data	Description	Valid range	Scale	Unit
0	8	Product type	Product configuration	FEEL : 0xA9 RISE: 0xAA MOVE : 0xAB SIGN : 0xAD		
8	8	Message type	Periodic data	0x01		
16	10	Temperature	Temperature in °C, <b>offset 30°C</b> (e.g.: 0 = -30°C, 300 = 0°C, 1000 = 70°C)	0..1000 1023 : Error 1022 : Sensor not present 1021: Sensor deactivated	-30..70	°C
26	10	Humidity	Humidity in % RH	0.. 1000 1023 : Error 1022 : Sensor not present 1021: Sensor deactivated	0..100	%RH
36	14	CO2	Concentration in ppm	0-10000 16383: Error 16382: Sensor not present	0-10000	ppm



						16381: Sensor deactivated
50	14	VOCS	Concentration in µg/m3	0-15000	0-15000	µg/m3
						16383: Error
						16382: Sensor not present
						16381: Sensor deactivated
64	10	Brightness	Brightness in lux	0-1020	0-5100	lux
						1023 : Error
						1022 : Sensor not present
						1021: Sensor deactivated
74	1	Button	Button press detection	0: no button press detected		
						1: button press detected
75	7	Average noise	Average noise (dBA)	35-120	35-120	dB
						127 : Error
						126 Sensor not present
						125: Sensor deactivated
82	7	Noise peak	Maximum noise (dBA)	35-120	35-120	dB
						127 : Error
						126: Sensor not present
						125: Sensor deactivated
89	7	Occupancy rate	Occupancy rate (%)	0-100	0-100	%
						127 : Error
						126: Sensor not present
						125: Sensor deactivated
96	3	IAQ Global	iZiAIR level	0: Very good		
						1: Reserved
						2: Medium

- 3: Reserved
- 4: Attention
- 5..6: Reserved
- 7: Error

99	4	IAQ Source	Main pollutant iZiAIR	0: None
				1..4: Reserved
				5: CO2
				6: VOC
				7-14: Reserved
				15: Error

103	3	IAQ CO2	iZiAIR CO2 specific level	0: Very good
-----	---	---------	---------------------------	--------------

106	3	IAQ VOCs	iZiAIR VOC-specific level	1: Reserved
				2: Medium
				3: Reserved
				4: Attention
				5..6: Reserved
				7: Error

109		Padding	Padding	Padding
-----	--	---------	---------	---------

### — 03. Product status (EU868)

This message is sent when the product is switched on, repeated every day and sent instantly when any of the following information changes:

- > equipment condition (HW),
- > status of pending membership application.

Data is sent in the following format:

Offset	Size (bit)	Data	Description	Valid range	Scale	Unit
0	8	Product type	Product configuration	FEEL : 0xA9 RISE : 0xAA MOVE: 0xAB SIGN : 0xAD		
8	8	Message type	Product status	0x05		
16	8	Hardware version	Hardware version	0 - 250	0 - 250	-
24	8	Software version	Software version	0 - 250	0 - 250	-
32	2	Power supply	Main power source	0 : Battery 1 : 5V external 2: Reserved 3: Reserved		
34	10	Battery voltage	Battery voltage	0 - 1000 1022 : External power supply 1023 : Error	0 - 5000	mV
44	3	Battery level	Battery level	0: High (>50%) 1: Medium (10 - 50%) 2: Low (1-10%) 3: Critical (<1%)		

				4 : External power supply		
				5 - 7 : Reserved		
47	1	Overall product status	Product material status	0 : Hardware OK		
				1: Material defect		
48	3	Temp/Hum status	Sensor status (T°/Hum)	0 : Sensor OK		
				1: Sensor fault		
51	3	CO2 status	Sensor status (CO2)	2: Sensor not present		
54	3	VOC status	Sensor status (VOC)	3: Sensor deactivated		
57	3	PIR status	Sensor status (PIR)	4: Sensor at end of life		
60	3	Micro status	Sensor status (Microphone)			
63	3	Brightness status	Sensor status (Brightness)			
66	3	SD card status	SD card status	0 : SD card OK		
				1: Fault: Cannot mount drive.		
				2: Card missing.		
				3: Functionality disabled.		
				4: SD card at end of life		
69	10	Product activation time counter	Cumulative duration of product activation	0 - 1000	0 - 1000	Month
				1023: error		
79	8	Time since last manual calibration	Time in days since last manual calibration.	0 - 250	0 - 250	Days
87	1	Reserved				
88	8	Reserved				
96	2	Pull-out detection status	Anti-tear detection status	0: Base not detected		
				1: Base detected		

2: Sensor removed from base just now

3: Sensor installed on bracket just now

98      6      Reserved

#### — 04. Product configuration (EU868)

A message confirming the current product configuration is sent :

- > During the product start-up phase
- > During each reconfiguration
- > Every 7 days

Offset	Size (bit)	Data	Description	Valid range	Scale	Unit
0	8	Product type	Product configuration	FEEL : 0xA9 RISE : 0xAA MOVE: 0xAB SIGN : 0xAD		
8	8	Message type	Product status	0x06		
16	3	Reconfiguration source	Source of the reconfiguration process	0 : NFC 1: Application downlink 2: Product start-up 3: Network 4: GPS 5: Local 6-8 : Reserved		
19	2	Reconfiguration status	Results of the reconfiguration process: success or failure?	0: Total success 1: Partial success 2: Total failure 3: Reserved		

21	5	Measurement period	Time in minutes between two measurements	5 - 30	5 - 30	Min
	1	CO2 On / Off	Activating / deactivating CO2 measurements	0: measurements disabled 1: active measures		
	1	COV On / Off	Activation / deactivation of VOC measurements	0: measurements disabled 1: active measures		
	1	PIR On / Off	Activation / deactivation of PIR measurements	0: measurements disabled 1: active measures		
	1	Microphone On / Off	Activation / deactivation of microphone measurements	0: measurements disabled 1: active measures		
	1	Local storage On / Off	Activate / deactivate SD card measurement storage	0: storage disabled 1: active SD storage		
	1	Automatic CO2 calibration	Activate/deactivate automatic calibration of CO2 measurement	0: Automatic calibration disabled 1: Automatic calibration enabled		
	10	CO2 medium level	CO2 threshold between good and medium level	0..1000	0..5000	ppm
	10	CO2 high level	CO2 threshold between medium and high level	0..1000	0..5000	ppm
	1	LED CO2	CO2 LED on/off	0: Non-active; 1: Active		
	1	LED medium level	Activation/deactivation of LED indication for average CO2 level	0: Non-active; 1: Active		
	1	Buzzer	General activation/deactivation of buzzer notification	0: Non-active; 1: Active		
	1	Buzzer confirmation	Activate/deactivate buzzer notification confirmation	0: Non-active; 1: Active		
	2	Data used by LED and buzzer	Defines the data notified by the LED and buzzer	0 : CO2 1 : iZiAIR 2-3 : Reserved		
	1	Notif. button Activate	Notification of active button press?	0: Non-active; 1: Active		

4	LoRa region	Deployment region	0: EU868 1: US915 2: AS923 3: AU915 4: KR920 5 : IN865 6: RU864 7-15: Reserved		
1	Periodic data On / Off	Activate / Deactivate periodic data transmission	0: Non-active; 1: Active		
6	Periodic data transmission period	Periodic data transmission period in minutes	1 - 60	1 - 60	min
8	Delta CO2	CO2 evolution leading to instantaneous transmission	0 - 250 255 : Off	0 - 1000	ppm
7	Delta temperature	Temperature changes leading to instantaneous transmission	0 - 99 127 : Off	0 - 9.9	°C
1	Historical data CO2 On / Off	Enable / disable sending of historical CO2 measurements	0: Non-active; 1: Active		
1	Historical temperature data On / Off	Enable / disable sending of historical temperature readings	0: Non-active; 1: Active		
6	No. of new measures	Number of new measures contained in a datalog message	1 - 36	1 - 36	-
5	No. of transmissions	Number of times the same measurement is transmitted in the datalog function	1 - 24	1 - 24	-
8	Transmission period	Transmission period for historical measurements (datalog)	1 - 144	10 - 1440	minutes
			255: error		
1	Delayed network connection	Delayed network connection request pending	0: No request programmed 1: Programmed connection request		
2	NFC status	NFC configuration interface status	0 : Convertible 1: Non-discoverable		

			2-3 : Reserved		
6	Product date	Year (since 2000)	0-63	0-63	years
4	Product date	Month	01-12	1-12	month
5	Product date	Day	1-31	1-31	day
5	Product date	Time	0-23	0-23	h
6	Product date	Minute	0-59	0-59	min
1	Reserved				
16	Downlink Fcnt	Fcmt of downlink causing product reconfiguration			

## XV. Product configuration and remote control

An online downlink calculation tool is available: <https://nexelec-support.fr/n/downlink>

The product can be reconfigured to best suit each use case. This reconfiguration can be carried out :

- > locally, using a smartphone or tablet via the NFC TOUCH application;
- > or remotely, via the LoRaWAN connection interface.

### 1. Configurations for environmental measures

CONFIGURATION TYPE	DEFAULT VALUE	POSSIBLE CONFIGURATIONS
Configuration of measurement period	10 minutes*.	5 - 30 minutes
Sensor deactivation to optimize product autonomy	All sensors activated by default	Deactivation of each sensor individually
Local storage of measurements on SD card	Off	On   Off
Automatic calibration of CO2 measurement	Activated	On   Off

\* CO2 can be measured with twice the period: see section CO2 Speedup: Automatic adjustment of CO2 measurement period



## 2. Configurations for light and sound indicators

CONFIGURATION TYPE	DEFAULT VALUE	POSSIBLE CONFIGURATIONS
Orange" LED threshold configuration	800 ppm	0 - 5000 ppm
Red" LED threshold configuration	1500 ppm	0 - 5000 ppm
LED CO2 indicator light	Activated	On   Off
Orange" level notification CO2 LED	Activated	On   Off
Acoustic notification of CO2 level change	Off	On   Off
Audible confirmation of low CO2 level	Off	On   Off
Sound and visual indicator source	CO2	CO2   iZiAiR

## 3. Network and data transmission configurations

CONFIGURATION TYPE	DEFAULT VALUE	POSSIBLE CONFIGURATIONS
Network configuration		
Geographical area	EU868	EU868
Periodic send function		
Periodic data transmission	Activated	On   Off
Periodic data transmission	30 minutes	10 - 60 minutes
CO2 evolution leading to instantaneous transmission	150 ppm	0 - 1000 ppm
Temperature changes leading to instantaneous transmission	0.5°C	0 - 9.9°
Send a message by pressing a short button	Activated	On   Off
Historical data function (datalog)		
Sending datalog temperature data	Off	On   Off
Sending datalog CO2 data	Off	On   Off
Number of new measurements included in a datalog message	12	1 - 36

Datalog transmission period	3h	30 min - 24h
Number of transmissions of the same measure	3	1 - 24

## 4. Commands related to product maintenance, reliability and safety

ORDER TYPE	PARAMETER
NFC interface accessibility	Discoverable   Non-discoverable
Product restart	-
Network connection request	Delay before connection attempt 10 - 10080 minutes*

\* In NFC mode, this parameter is not reconfigurable and the network connection request is instantaneous.

## XVI. Remote product configuration via a LoRaWAN network

The product can be reconfigured by a downlink in response to a message. The downlink must be sent to port 56.

### ACKNOWLEDGEMENT OF RECONFIGURATION

After reconfiguration, the product will send a message with its updated configuration.

### DOWNLINK MESSAGE STRUCTURE

The first byte is the header: 0x55.

Next, the following bytes can be used to reconfigure the product format: Command ID and DATA.

Note: Downlink functionality will certainly evolve in the future. To ensure backward compatibility, Nexelec recommends sending IDs from the lowest to the highest value.

### LIST OF LORAWAN DOWNLINK COMMANDS

ID	Length (bytes)	Beach	Values	Description
0x01	0	-	-	Request forced upload of product configuration
0x03	1	0 / 1	0: disabled 1: activated	Activation / deactivation of LED CO2 indicator light
0x04	1	0 / 1	0: disabled 1: activated	Activation / deactivation of periodic data transmission at the touch of a button
0x05	1	0 / 1	0: disabled 1: activated	Activate / Deactivate periodic data transmission
0x08	1	0 - 99	0 - 9.9°C	Delta temperature: Temperature change leading to instantaneous transmission of a measurement, in 0.1°C steps.
0x0A	1	0/1	0: disabled 1: activated	Activate / Deactivate NFC interface

0x10	1	0 - 50	0 - 1000 ppm	Delta CO2: Evolution of CO2 leading to instantaneous transmission of a measurement, steps of 20ppm
0x12	1	0 - 250	0 - 5000 ppm	CO2 threshold, "orange" level CO2 level adjustable in 20 ppm steps
0x13	1	0 - 250	0 - 5000 ppm	CO2 threshold, "red" level CO2 level adjustable in 20 ppm steps
0x19	1	0 / 1	0: disabled 1: activated	Activation / deactivation of CO2 measurement
0x1C	2	1 - 1008	10 - 10080 minutes	Delayed network connection command Set time to connection in minutes
0x1D	2	0 - 5000	0 - 5000	Manual calibration of CO2 sensor according to value
0x28	1	0 / 1	0: disabled 1: activated	Enable / disable sending of historical temperature data
0x2D	1	0 - 3	0: CO2 1: IziAir 2..3: Reserved	Sound and visual indicator source
0x2E	1	0/1	0: disabled 1: activated	Activation / deactivation of "Orange" level notification LED CO2
0x2F	1	5 - 30	5 - 30 minutes	Period between two measurements
0x33				Nexelec reserved order
0x46				Nexelec reserved order
0x47				Nexelec reserved order
0x48				Nexelec reserved order
0x49	1	10 - 60	10 - 60 minutes	Periodic data transmission period
0x4A	1	1		Product restart command
0x4B	1	1		Restore factory settings command
0x4C				Nexelec reserved order
0x54	1	0 / 1	0: disabled	Motion sensor activation/deactivation (PIR)

			1: activated	
0x55	1	0 / 1	0: disabled	Activate/deactivate brightness measurement
			1: activated	
0x56	1	0 / 1	0: disabled	Activation/deactivation of sound level measurement (microphone)
			1: activated	
0x57	1	0 / 1	0: disabled	Activation / deactivation of VOC measurement
			1: activated	
0x58	1	0 / 1	0: disabled	Activate / deactivate local storage of measurements on SD card
			1: activated	
0x59	1	0 / 1	0: disabled	Activate/deactivate automatic calibration of CO2 measurement
			1: activated	
0x5A	1	0 / 1	0: disabled	Activate / deactivate buzzer notification level change
			1: activated	
0x5B	1	0 / 1	0: disabled	Enable / disable buzzer confirmation bad level
			1: activated	
0x5C	1	0 / 1	0: disabled	Activate / Deactivate sending of historical CO2 data
			1: activated	
0x5D	1	1 - 36	1 - 36	Number of new measures included in a datalog message
0x5E	1	3 - 144	30 - 1440min (24h)	Datalog transmission period
0x5F	1	1 - 24	1 - 24	Number of transmissions of the same measure

## Examples

## Example 1:

- > Activate LED
- > LED function = CO2 level
- > Deactivate average level indication

Frame structure, from LSB to MSB

Byte	Value	Info
0	0x55	Header for 1 message reconfiguration
1	0x03	Activation of LED ID
2	0x01	Value to activate LED
3	0x2D	Identification LED function
4	0x01	Value to activate the CO2 level for the LED function
5	0x2E	Activation of average IAQ/CO2 ID level indication
6	0x00	Value to disable LED display of average IAQ/CO2 level

## Example 2:

- > CO2 threshold 1 = 800 ppm
- > CO2 threshold 2 = 1,500 ppm

Frame structure, from LSB to MSB

Byte	Value	Info
0	0x55	Header for 1 message reconfiguration
1	0x12	ID CO2 threshold 1
2	0x28	Value for setting CO2 threshold 1 = 800 ppm
3	0x13	CO2 threshold ID 2
4	0x4D	Value for setting CO2 threshold 2 = 1500 ppm

# XVII. Product configuration via NFC

The product has an NFC interface enabling it to communicate with a smartphone equipped with the NFC TOUCH application. This interface enables :

- > Configure the product to suit your application,
- > Access the latest measured data,
- > Update product software.

The NFC interface can be remotely activated and deactivated via a LoRaWAN downlink message. In this way, NFC memory is no longer discoverable by a phone, preventing reconfiguration of the product once deployed.

## 1. Antenna location NFC

The NFC antenna is located in the center of the product. Place the phone's antenna opposite the product's antenna so that the connection can be made.



## 2. Download mobile application

The *TOUCH* product reconfiguration application is available on Android and iOS for devices (mobile, tablet) equipped with an NFC interface.

## 3. Access to TOUCH Android application documentation

Documentation for the Touch application is available on the support site.

Link: <https://support.nexelec.fr/fr/support/solutions/folders/80000680573>

## XVIII. Markings



## XIX. Tracking developments

Document revision	Details	Date
<b>A</b>	Created	<b>31/08/2023</b>
<b>B</b>	Minor modifications	<b>12/09/2023</b>