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Smartphone Application for EP5000-XX IAQ probe

Ver	Date	Change / Update
V1	Initial	Draft
V2	26/03/21	EnOcean Pairing
V3	09/04/21	EnOcean Pairing, input
V4	30/04/21	Minimum ventilation
V5	30/06/21	Ozone and NOx sensors setting added
V6	19/10/21	Slave Modbus dampers control + measures
V7	10/01/22	Indication of LED figures added + Modbus hydraulic valve control+ firmware management
V8	13/04/2022	New Enocean pairing interface. Limits of exemption
V9	20/10/2022	Measures written after reading NFC to improve tap reliability (FW < 6.3)

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Summary

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1. Presentation

The EP5000-XX probe has an NFC antenna in the front panel and can be configured using a smartphone application. This document presents the main settings.

2. Type of smartphone and settings

Make sure your Android smartphone has a built-in NFC function.
Enable NFC in the settings section.

3. Download the smartphone application

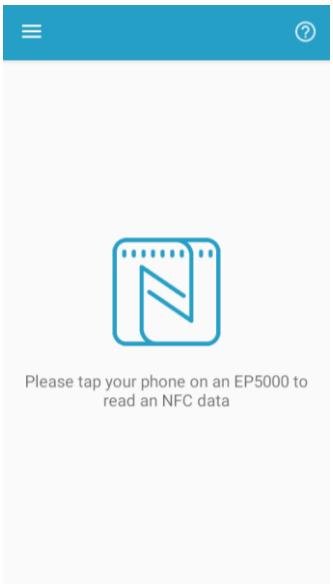
Go to the Play store and search for NanoSense. Download the EP5000 application.
Or directly:
https://play.google.com/store/apps/details?id=com.nanosense.nanosensev2

The following pictogram will appear on one of your tabs:

4. Configuration of the App

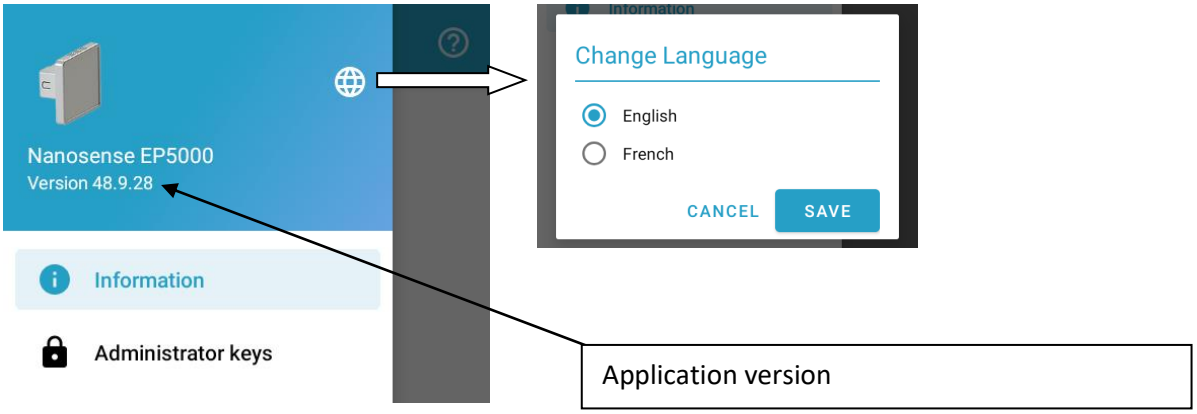
Launch the App first in case you have other Apps using NFC that could be launched automatically upon a tap.

At opening, the following screen is displayed with NFC logo and instructions.



Click on or slide the left tab to make it to appear

Click on the world map to select the language.



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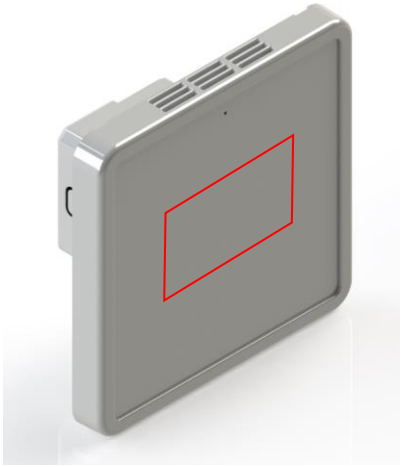
Reading of probe’s parameters

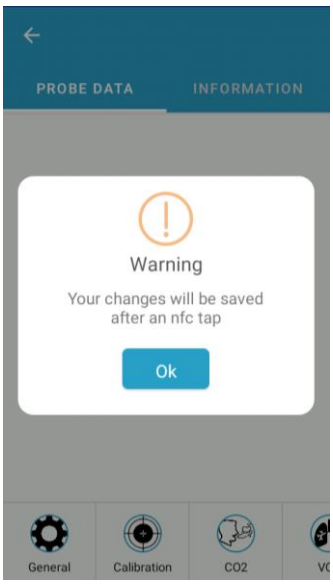
Tap the smartphone on the center of the front panel of the probe (the antenna is located in the center).
Setting by NFC does not require the unit to be powered and can therefore be carried out with the probe in its box. A symbol can appear on the box to indicate the location of the antenna.
In case of commissioning many probes the same way a copy paste feature can be used (but pairings).

When the probe's NFC antenna responds, you should hear a Beep on the smartphone.

In the process, the application loads the contents of the memory via NFC, and, at the end, opens an alert message indicating that all the parameter modifications will only be applied after a new NFC tap (writing the memory).



Location of NFC antenna



Memory being read, take the smartphone in hand and make the desired settings.

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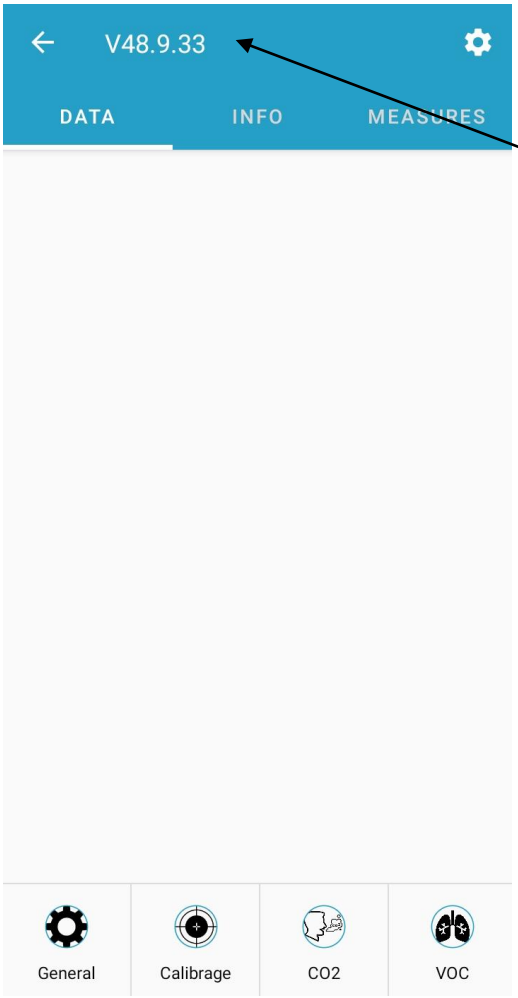
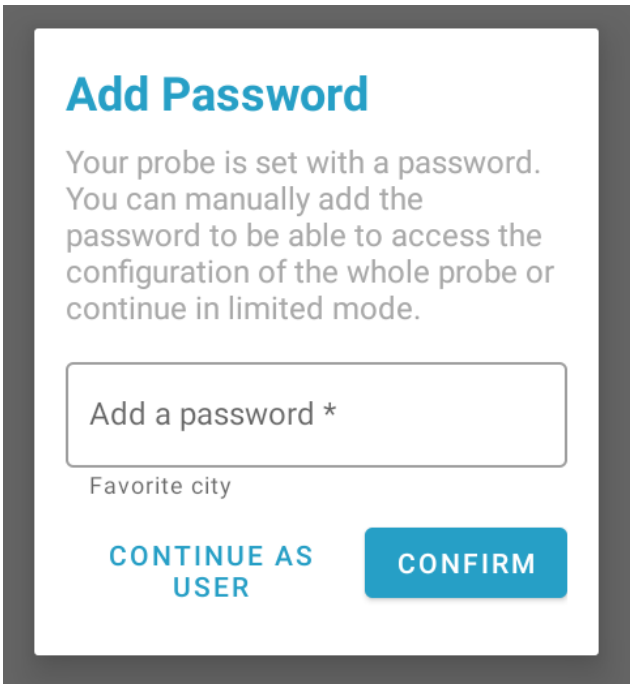
6. Access to data

If the probe has already been set and a password entered and recorded in the probe, the following screen appears:



Version of the sensor's NFC memory data configuration recorded at the factory.

If the probe has a password recorded in another smartphone, the following screen appears.



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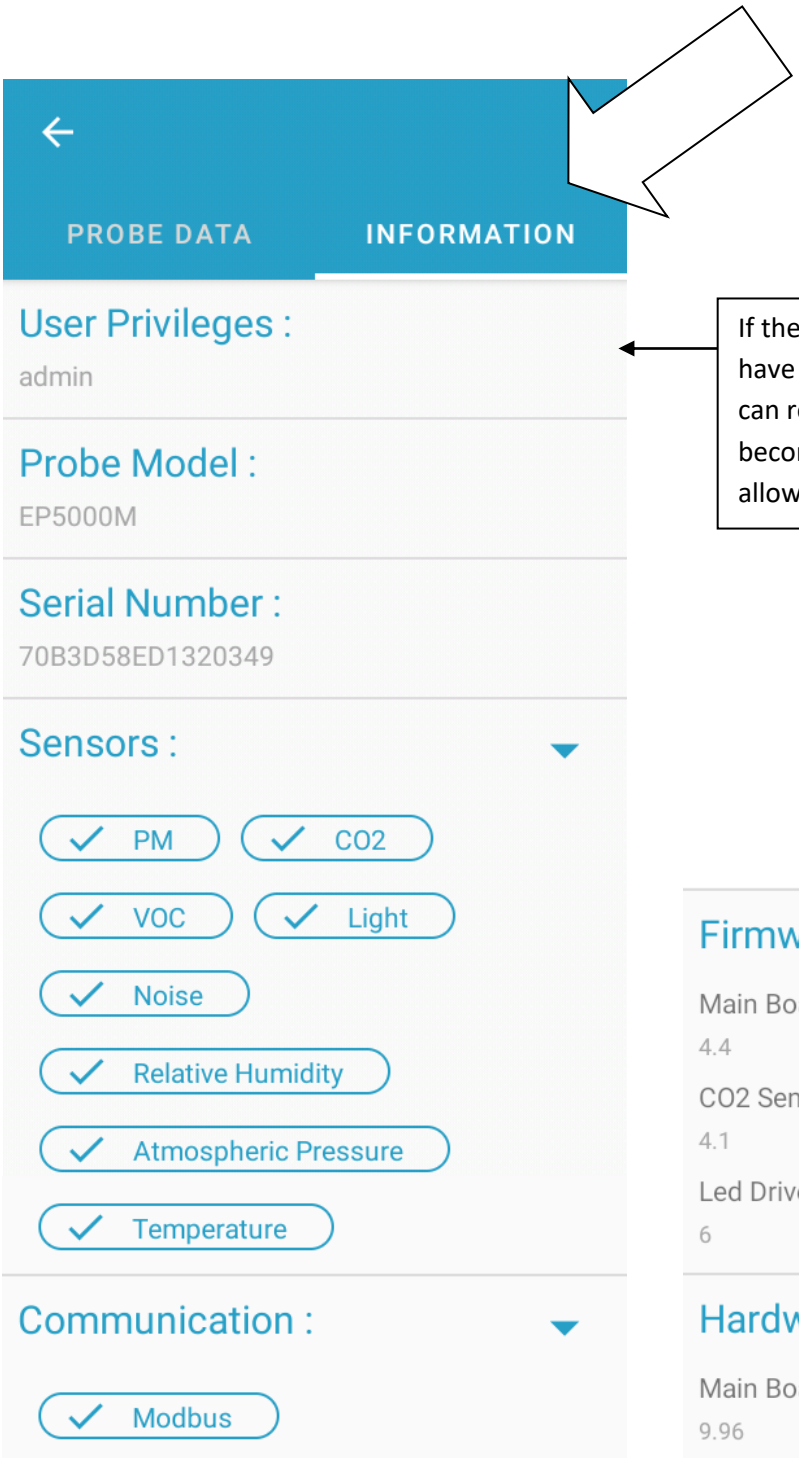
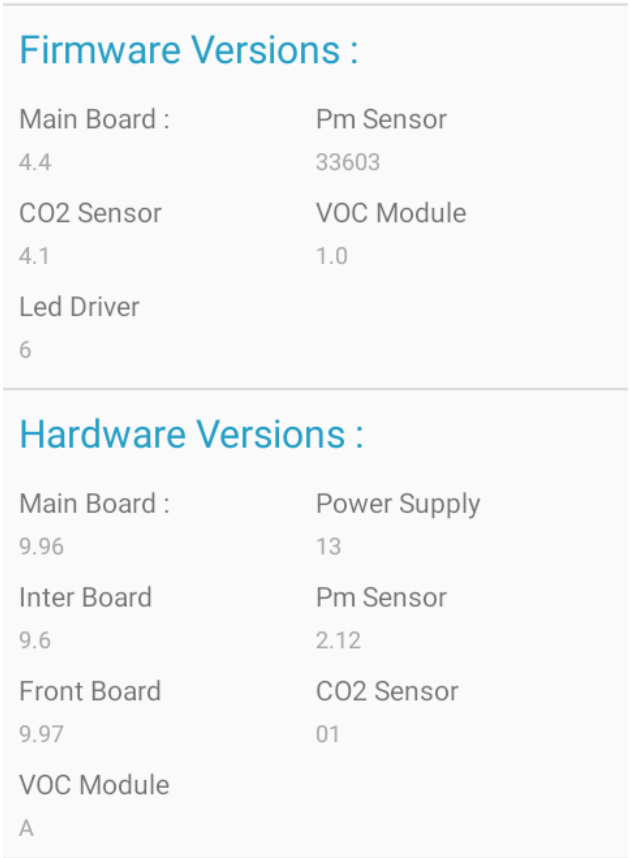
7. Probe's model

By selecting **information**, it is possible to check the probe model, its serial number, its protocol, its firmware and hardware versions and the sensors on board.



If the probe does not have a password, you have the privileges of an administrator and you can record a password for these privileges to become exclusive (only one administrator is allowed or at least one single password).



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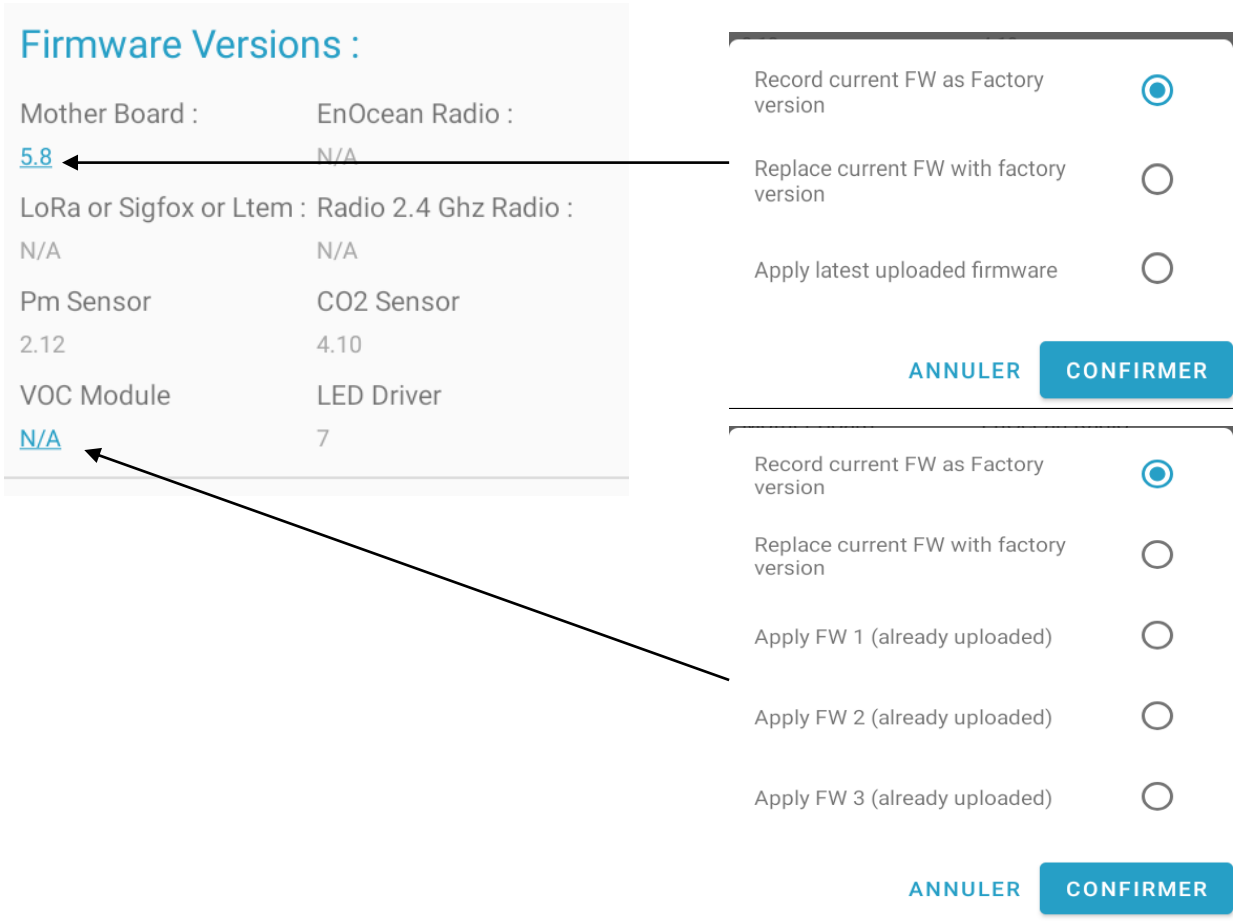
8. Firmware management

From firmware versions, it is possible by clicking on the underlined firmware numbers to manage firmware as follow:



Few seconds after confirmation and a tap, the blue, orange and red defaults LEDs will start blinking together until the end of the process.

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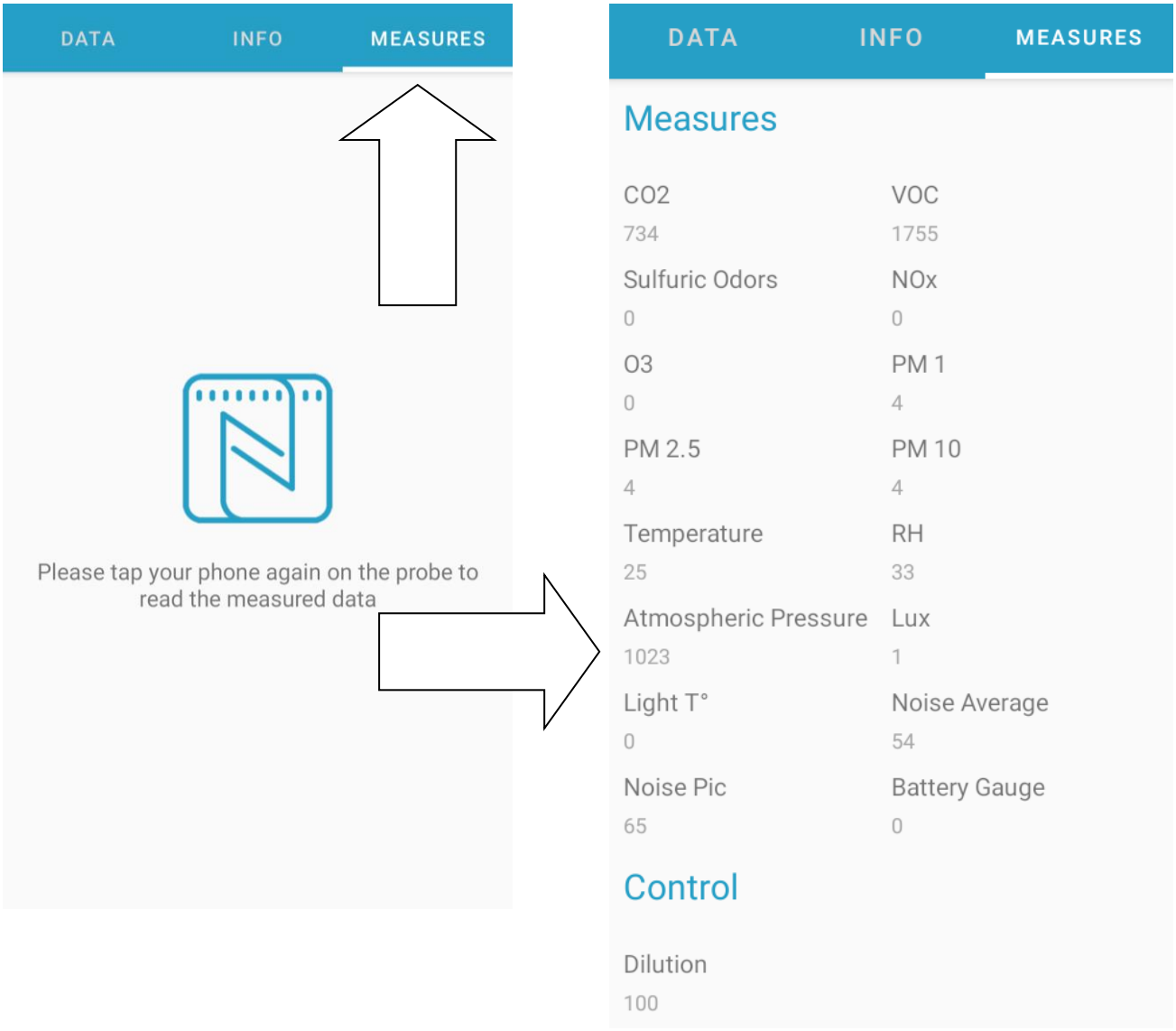
9. Measures

Taping the probe allow writing the last measured and remediation control values in NFC memory after reading by the Smartphone. So it require an additional tap.

This feature is particularly useful for 0.-10V versions where there is no data communication.

To access to values, select **Measures.**



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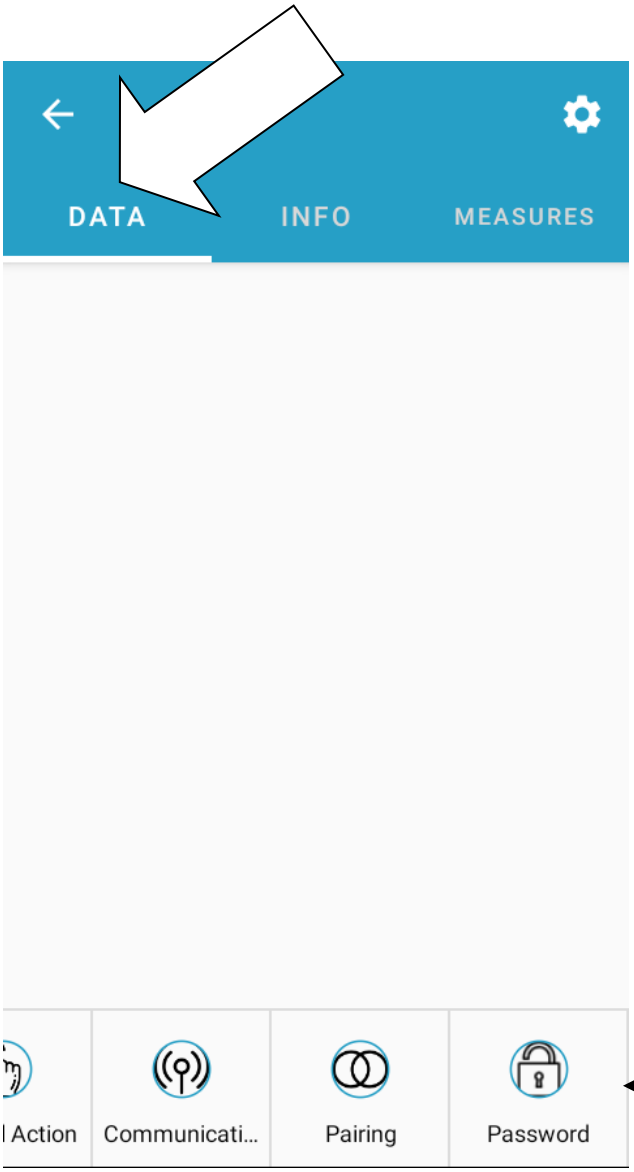
10. Data

Select **Data** to allow reading and setting all parameters.



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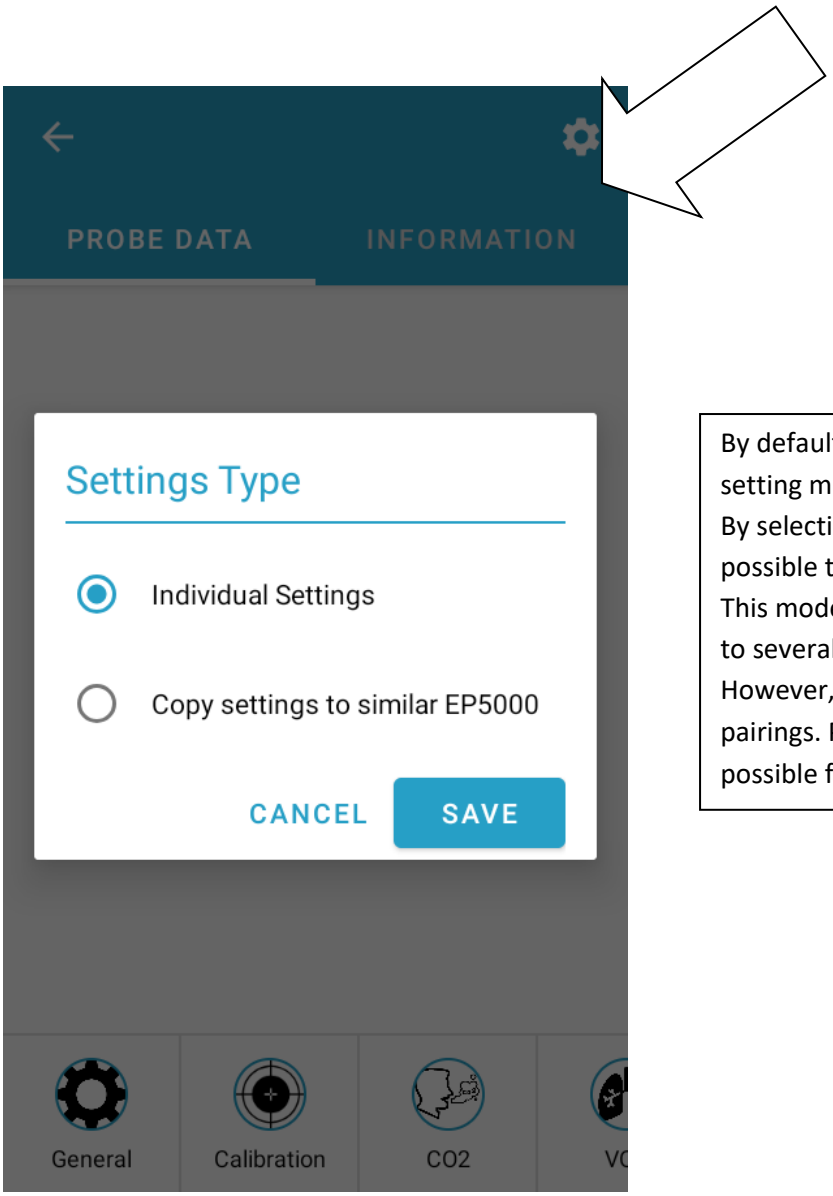
10.1. Duplication of parameters

If commissioning several probes in the same way, a copy-paste function can be used (except for pairings).
In the Data tab, select the toothed wheel, the following menu appears.



By default, the application is in individual setting mode.
By selecting the configuration pictogram, it is possible to select a copying mode.
This mode is used to copy the current settings to several other probes.
However, this copy does not apply to the pairings. Please note that this copy is only possible for identical models.

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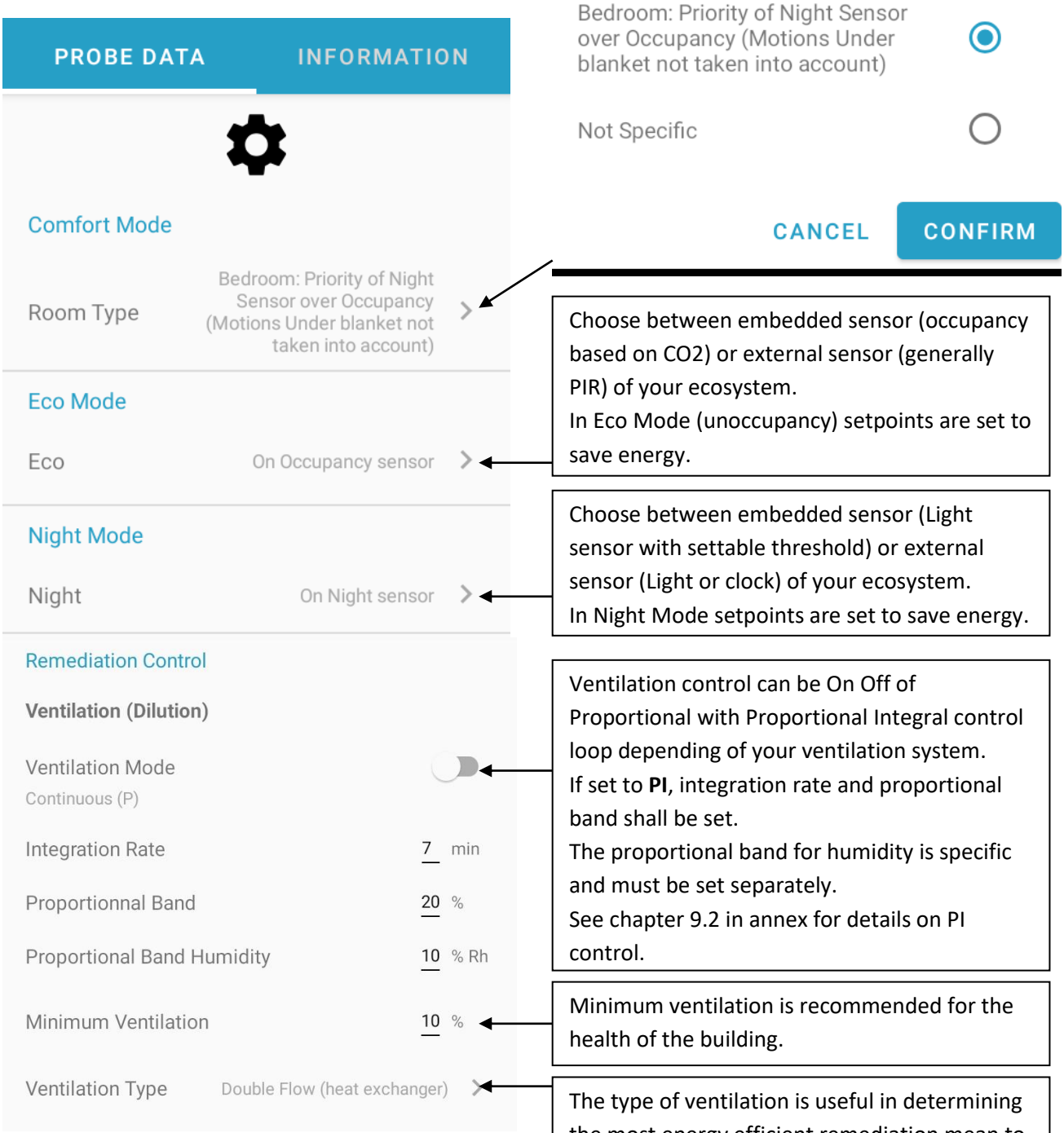
10.2. General Setting



Comfort mode is based on occupancy but there is occupancy and occupancy!!

Choose between embedded sensor (occupancy based on CO2) or external sensor (generally PIR) of your ecosystem.
In Eco Mode (unoccupancy) setpoints are set to save energy.

Choose between embedded sensor (Light sensor with settable threshold) or external sensor (Light or clock) of your ecosystem.
In Night Mode setpoints are set to save energy.

Ventilation control can be On Off of Proportional with Proportional Integral control loop depending of your ventilation system.
If set to **PI**, integration rate and proportional band shall be set.
The proportional band for humidity is specific and must be set separately.
See chapter 9.2 in annex for details on PI control.

Minimum ventilation is recommended for the health of the building.

The type of ventilation is useful in determining the most energy efficient remediation mean to initiate when there are several.

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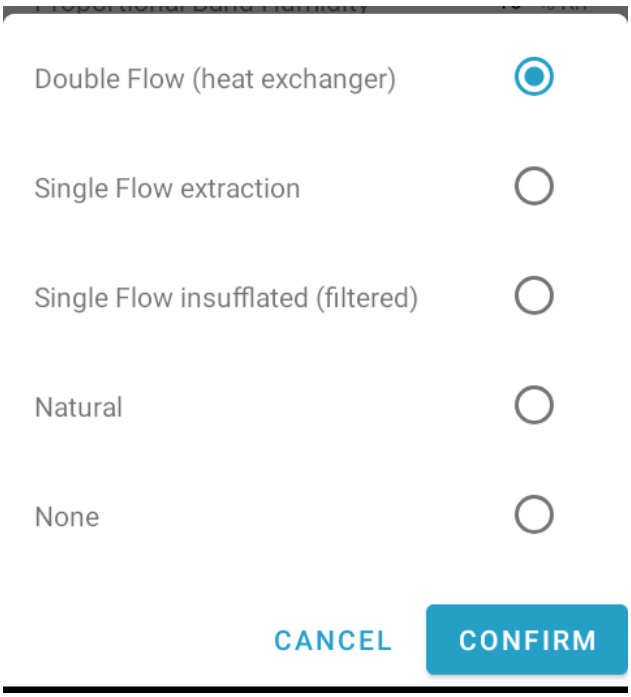

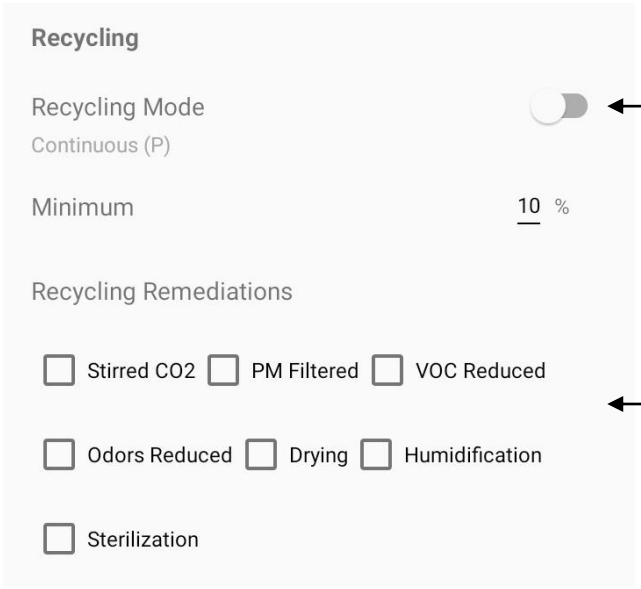

Ditto for recycling if there is any, but the recycling is only Proportional (P).

The remediation effects of recycling serve as initiating criteria versus dilution which is generally more energy intensive.

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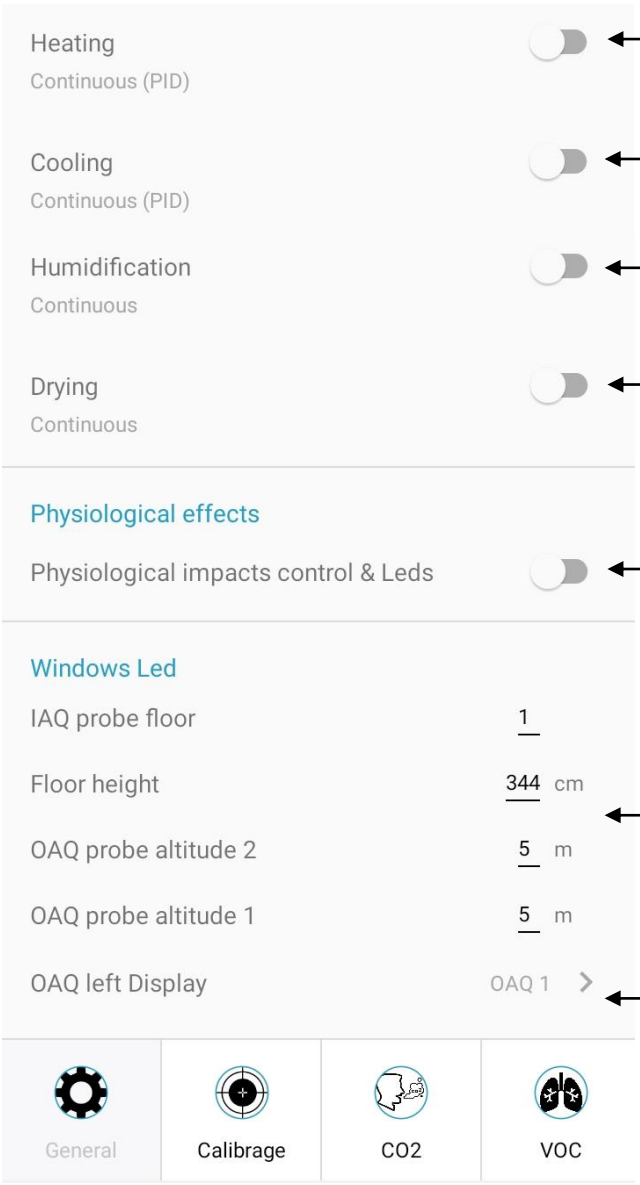
When scrolling down:



Heating uses a control loop based on fuzzy logic automatic setting of the PID for continuous control. In case of On Off, it uses an automatic hysteresis reduction algorithm (electric heaters)

Same for cooling but fuzzy logic automatic setting of the PID.

Same for humidification.

Same for drying.

Activate if you want LEDs and control to be based on physiological impacts (see probe data sheet for details). If activated all CO2, VOC and PM setting tab will disappear and a physio tab appear.

These parameters are used to assess the outdoor air quality at the altitude of the window where the IAQ sensor is installed from the outdoor sensors.
The average height of a floor must be specified to calculate the altitude thanks to the number of floors.

Right and left refer to the positions of the window LED pictograms. Depending on the orientation of the probe, the window opening indications according to the Outdoor Air Quality must match with one facade or another. Indicate here the corresponding OAQ probe.

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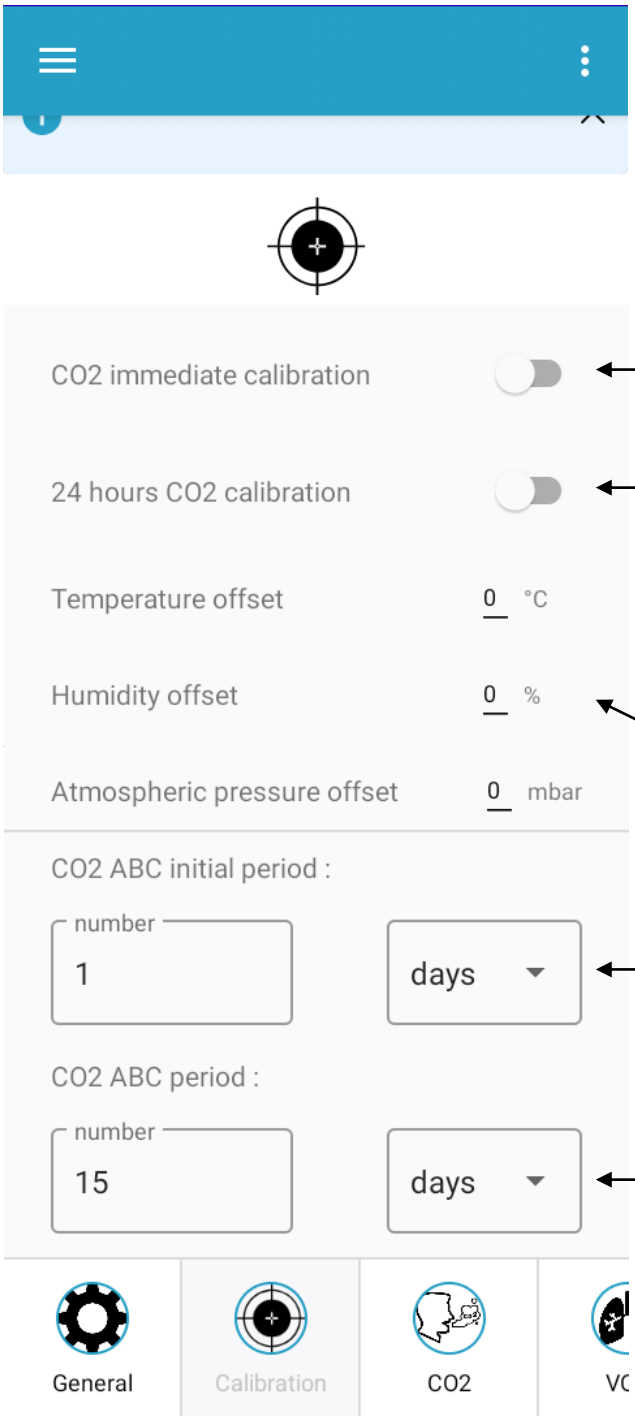
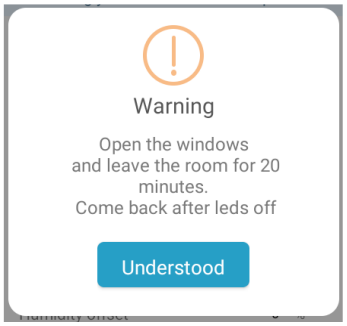
10.3. Calibrations



For immediate CO2 & VOC calibration, this window appears:



Opening windows is an opportunity for the auto-zero VOC sensor.

Force ABC to 24 hours, will revert to 15 days automatically. Performed automatically when first powered on. Make sure that the building is unoccupied (several hours) and that there is sufficient ventilation for the next 24 hours.

Allows adjusting the temperature and humidity measurement. Useful when several sensors are installed in the same room

Allows setting the ABC (Automatic Baseline Calibration) periods of the CO2 sensor. These values are the default ones. It is not recommended to change them.
The initial period must be set before the first power-up (more than 24 hours). It is then no longer accessible.

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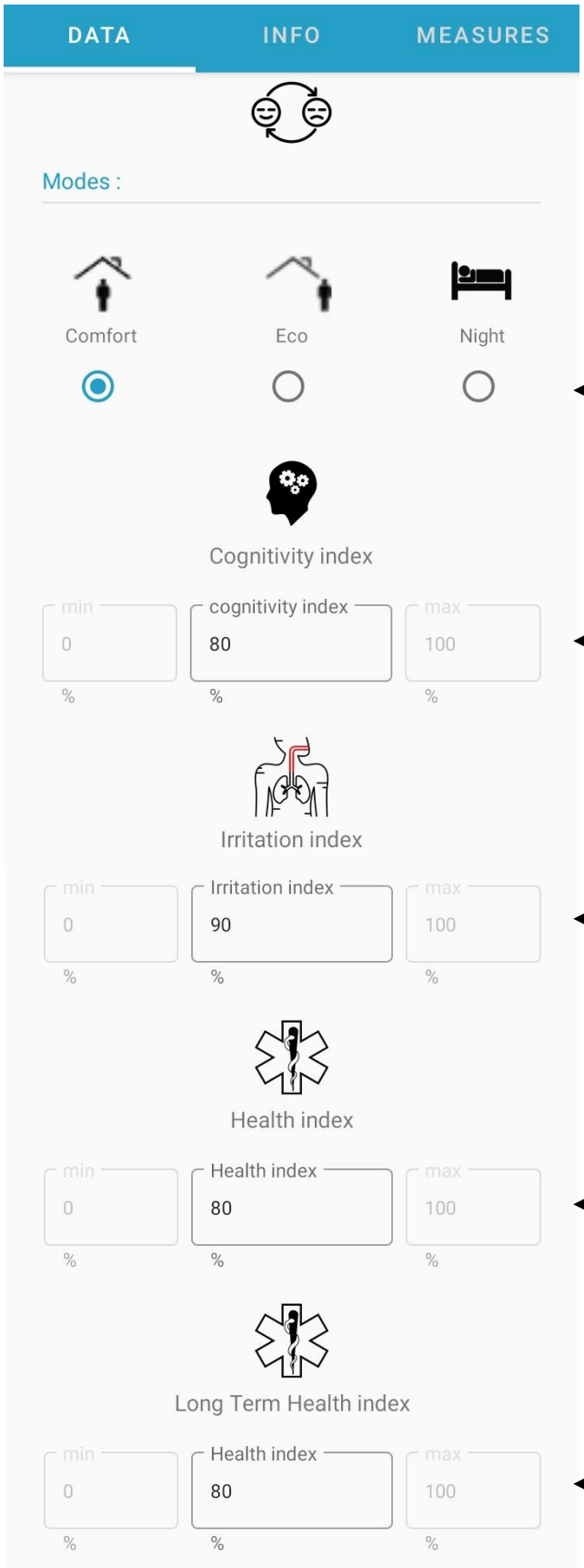
10.4. Physiological effects setpoints



All these settings are reserved to the administrator.
The limits are not adjustable. They are imposed by the Application.

Choose the mode for which you want to apply the setting.

Cognitive functions index. Associated with productivity in the tertiary sector.

Respiratory tract irritation risk index.

Health index based on a conservative hypothesis of short term exposure

Health index based on a conservative hypothesis of chronic exposure

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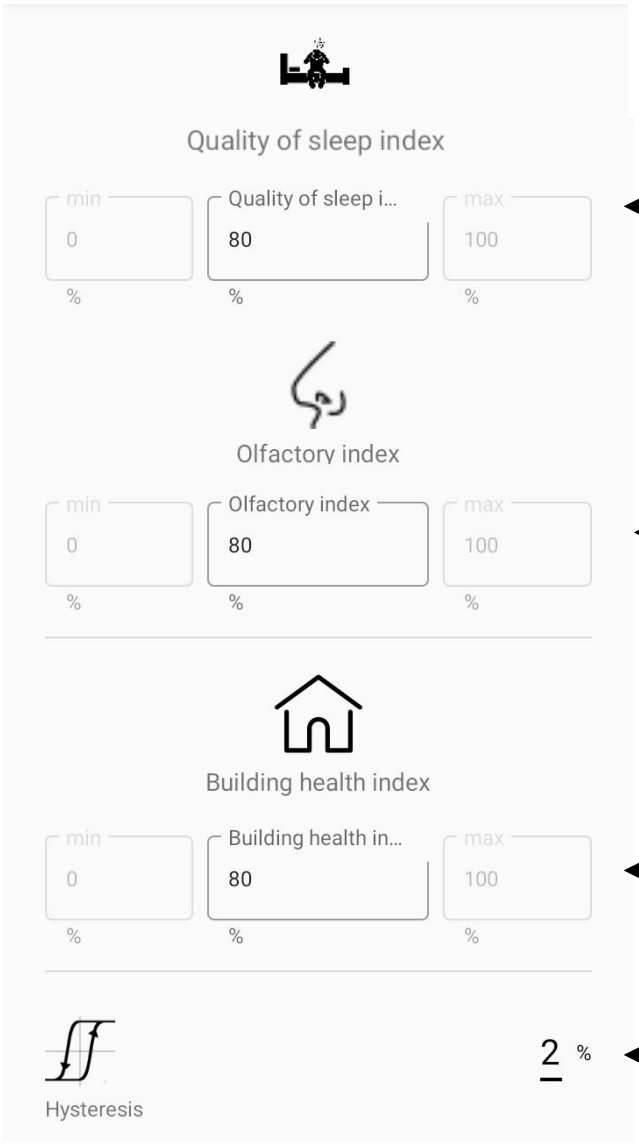

Quality of sleep index.

Olfactory discomfort index.

Health index of the building (risk of condensation, mold, dirt).

In case of On Off ventilation selected in **General**, the hysteresis shall be set.

There is no exemption for users in physiological effects mode.

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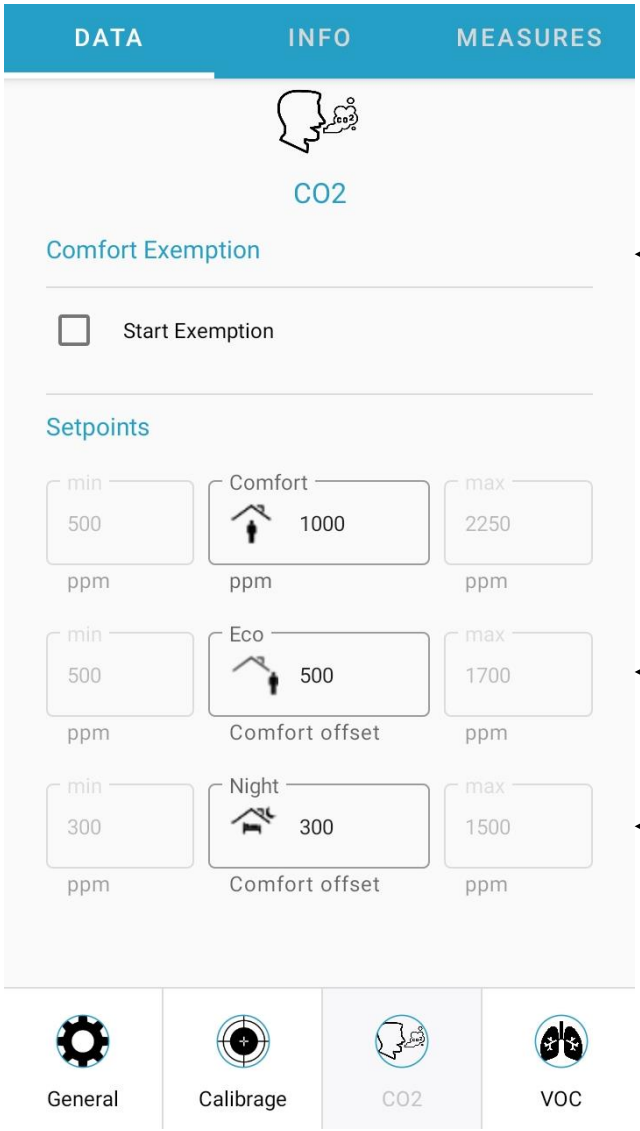
10.5. CO2 setpoints



Exemption, see next page

Setting of the CO2 setpoint during occupancy periods (**Comfort** mode). The min and max values are the authorized setting limits for users (Settable by the administrator).

Setting of the CO2 **difference** between **Comfort** mode and **Eco** mode (unoccupied periods). Settable by the administrator only.

Setting mode of the CO2 **difference** between **Comfort** and **Night** mode. Settable by the administrator only.

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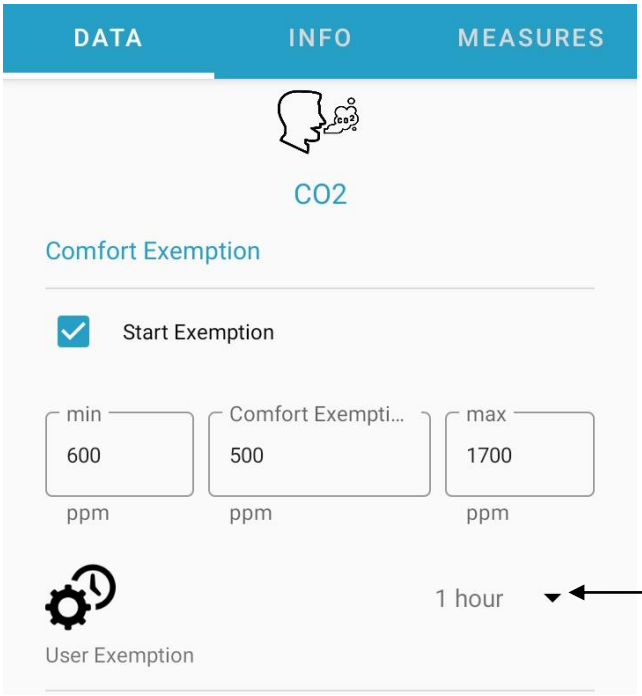
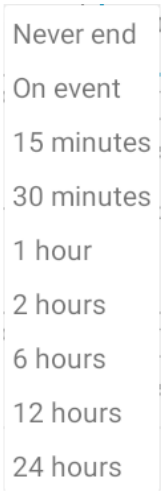


<u>Comfort Mode</u> settings by a user are considered as exemption which can be prohibited or limited by the administrator in time or on event or even be permanent. An event corresponds to a Mode change.



In user mode, the exemption list is grayed because it is reserved for the administrator.

Once an exemption has been initiated by NFC activation (writing), it will end at the end of the duration set by the administrator.

If the NFC memory is read after the exemption duration, the exemption box will be unchecked and the value hidden.

If the NFC memory is read during an exemption, the current value will be displayed. By unchecking the override box, it will end immediately following the next NFC write.

When changing the exemption value, the countdown will be reset following the next NFC write.

This principle applies to all other settings.

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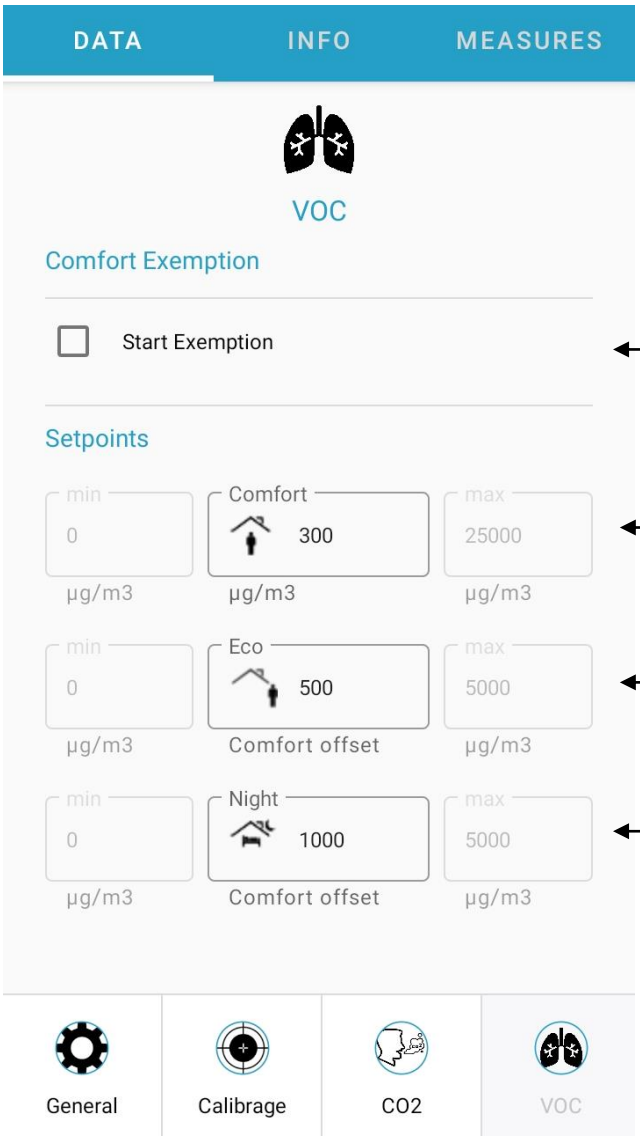
10.6. VOC setpoints



Exemption setting in **Comfort** mode

Setting of the VOC setpoint during occupancy periods (**Comfort** Mode). The min and max values are the authorized setting limits for users (Settable by the administrator).

Setting of the VOC **difference** between **Comfort** Mode and **Eco** mode (unoccupied periods). Settable by the administrator only.

Setting Mode of VOC **difference** between **Comfort** and **Night** Modes. Settable by the administrator only.

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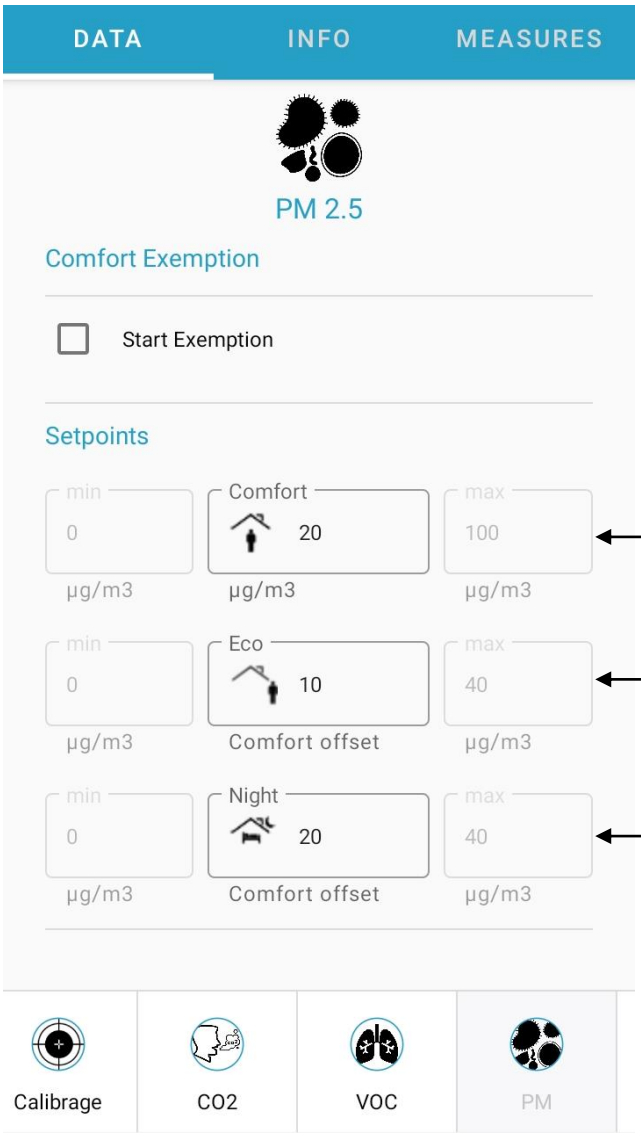
10.7. PM 2.5 setpoints



Setting of the PM2.5 setpoint during occupancy periods (**Comfort** Mode). The min and max values are the authorized setting limits for users (Settable by the administrator).

Setting of the PM2.5 **difference** between **Comfort** mode and **Eco** mode (unoccupied periods). Settable by the administrator only.

Setting Mode of PM2.5 **difference** between **Comfort** and **Night** Mode. Settable by the administrator only.

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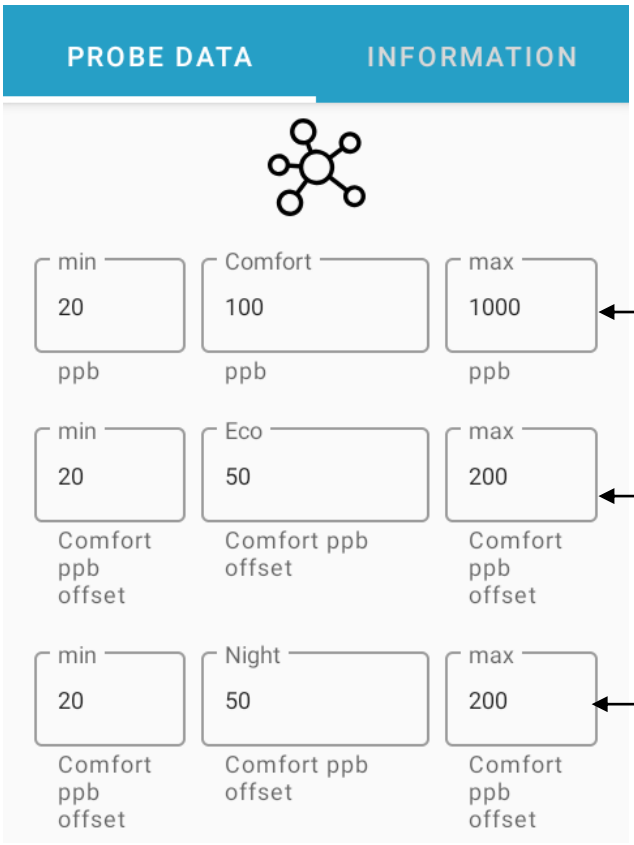
10.8. NOx setpoints (Optional sensor)



Setting of the NOx setpoint during occupancy periods (**Comfort** Mode). The min and max values are the authorized setting limits for users (Settable by the administrator).

Setting of the NOx **difference** between **Comfort** Mode and **Eco** Mode (unoccupied periods). Settable by the administrator only.

Setting Mode of NOx **difference** between **Comfort** and **Night** Mode. Settable by the administrator only.

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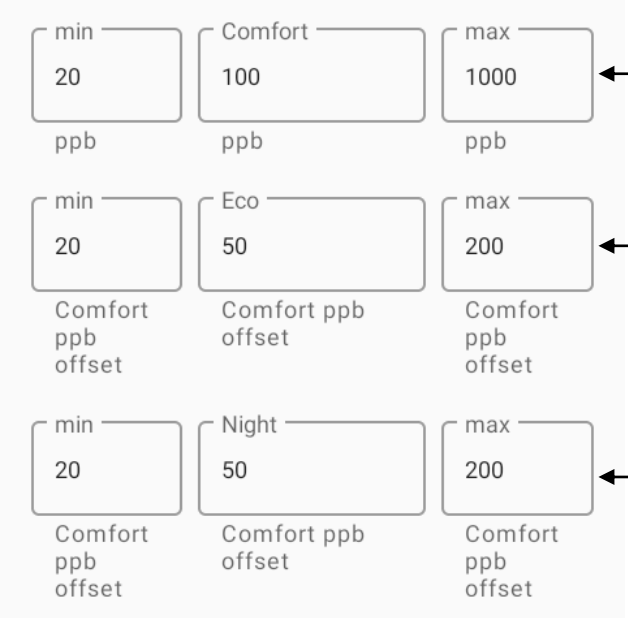
10.9. Ozone setpoints (Optional sensor)



Setting of the Ozone setpoint during occupancy periods (**Comfort** Mode). The min and max values are the authorized setting limits for users (Settable by the administrator).

Setting of the Ozone **difference** between **Comfort** Mode and **Eco** Mode (unoccupied periods). Settable by the administrator only.

Setting Mode of Ozone **difference** between **Comfort** and **Night** Mode. Settable by the administrator only.

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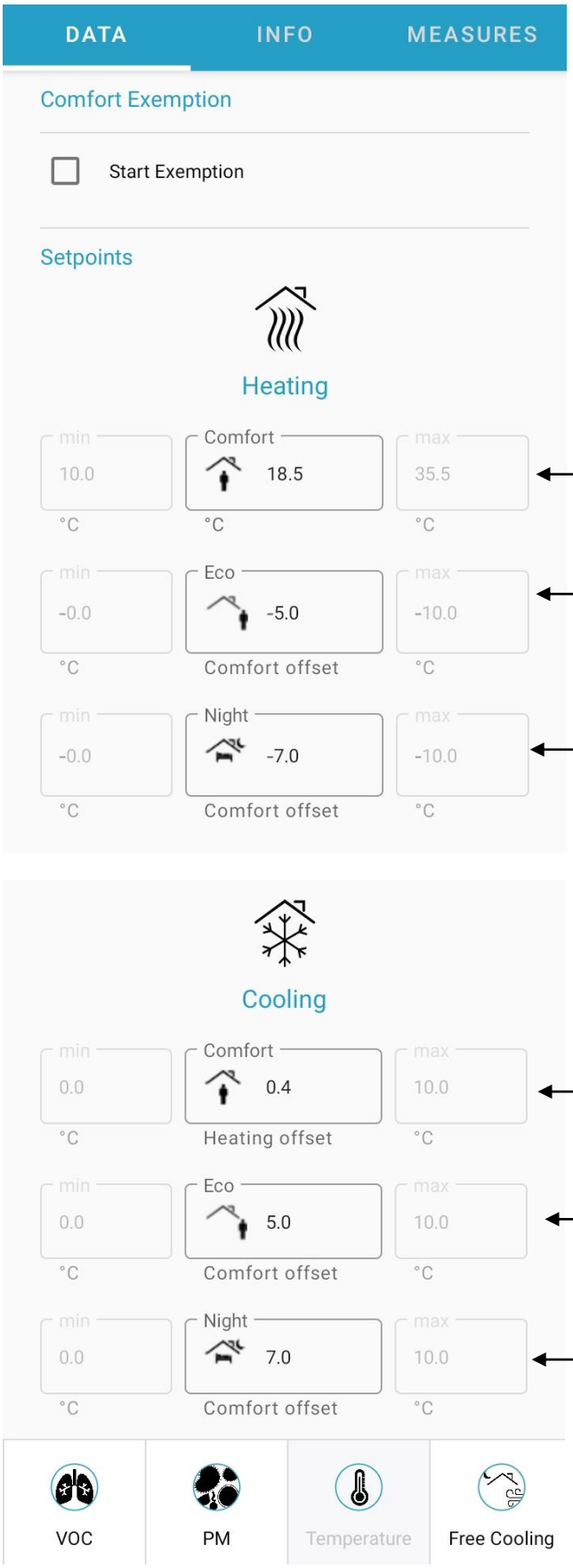
10.10. Temperature settings



Setting of the heating temperature setpoint during occupancy periods (**Comfort** Mode). The min and max values are the authorized setting limits for users (Settable by the administrator).

Setting of the **difference** of temperature between **Comfort** Mode and **Eco** Mode (unoccupied periods). Settable by the administrator only.

Setting Mode of **difference** of temperature between **Comfort** and **Night** Mode. Settable by the administrator only.

Comfort zone between heating and air conditioning during occupancy periods (**Comfort** Mode). The min and max values are the authorized setting limits for users (Settable by the administrator).

Setting of the **difference** of temperature between **Comfort** Mode and **Eco** Mode (unoccupied periods). Settable by the administrator only.

Setting Mode of **difference** of temperature between **Comfort** and **Night** Mode. Settable by the administrator only.

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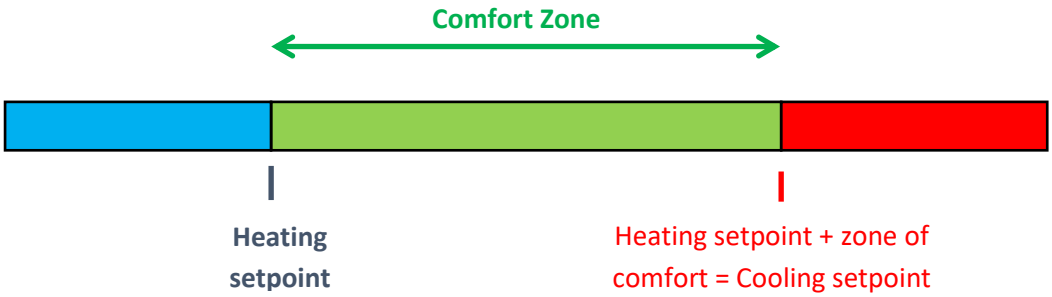
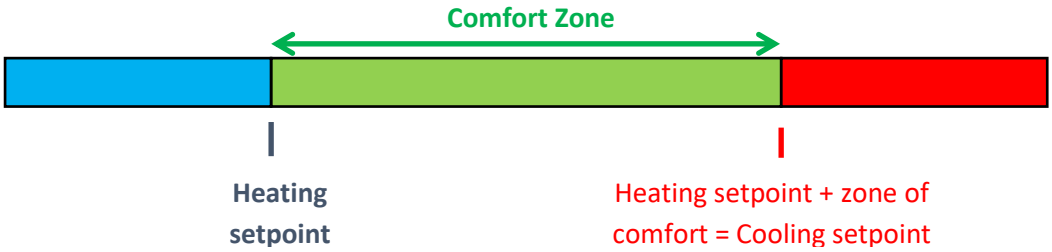
From this setpoint temperatures, the comfort zone between heating and cooling can be determined. The minimum value is 2 °C to avoid any simultaneous triggering related to the thermal inertia.

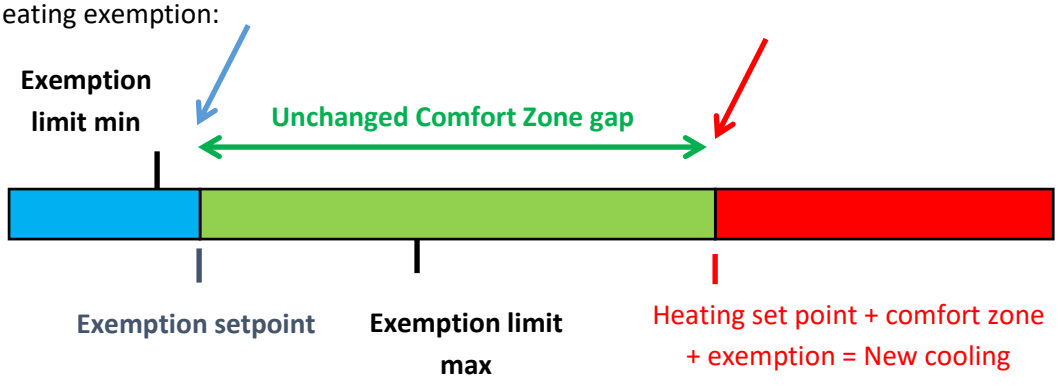


Exemption: It is possible to set a value via NFC to override manually the nominal setpoint.
Exceptions are instructions of users in °C to change the low and high values of thermal comfort zone.

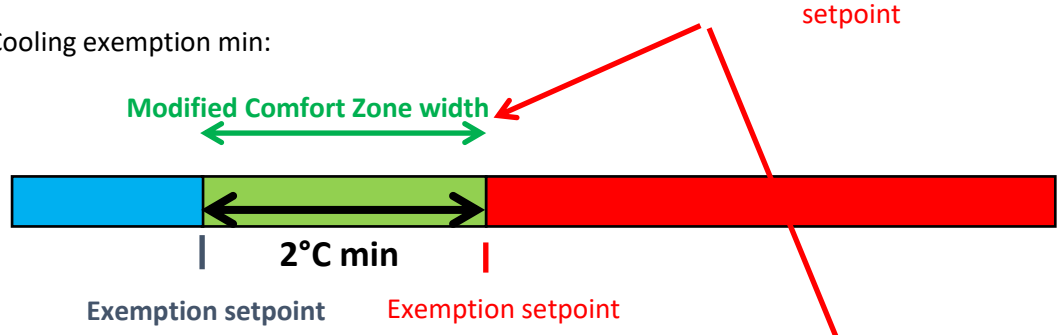
It is possible to limit this exemption by completing the setpoint values limits.



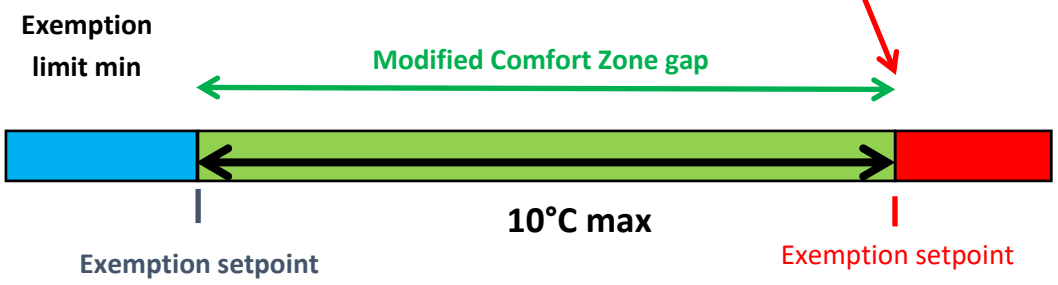
Heating exemption:



Cooling exemption min:



Cooling exemption max:



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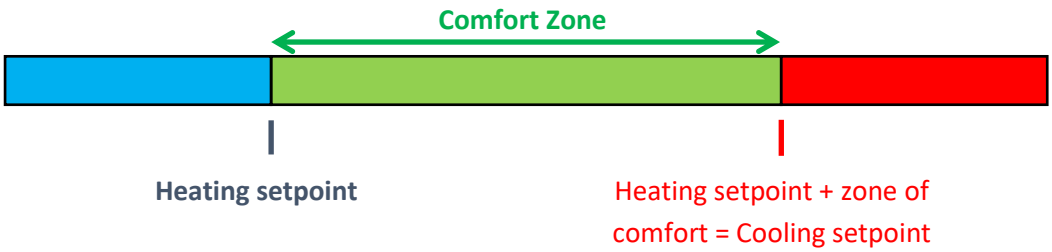
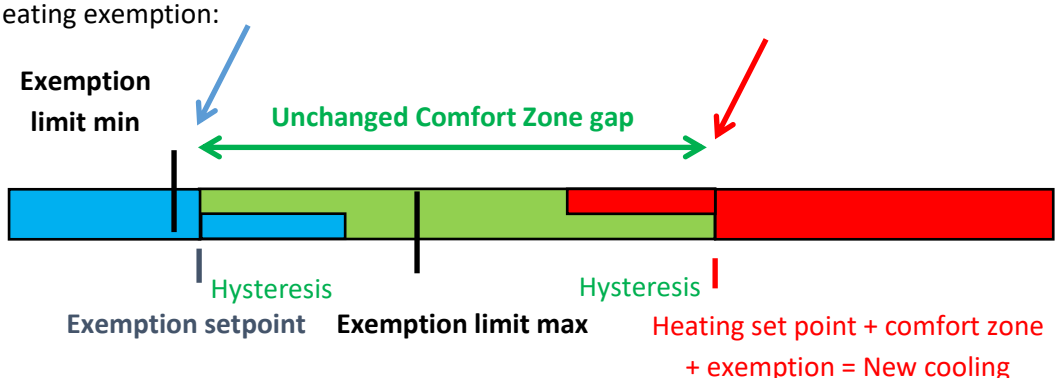
Attention, at least 2°C and at most 10°C must be kept between the exemption limit values. (New comfort zone). **The user will have his exemptions limited automatically.**

In On Off mode, hysteresis are limited by exemptions as follow:

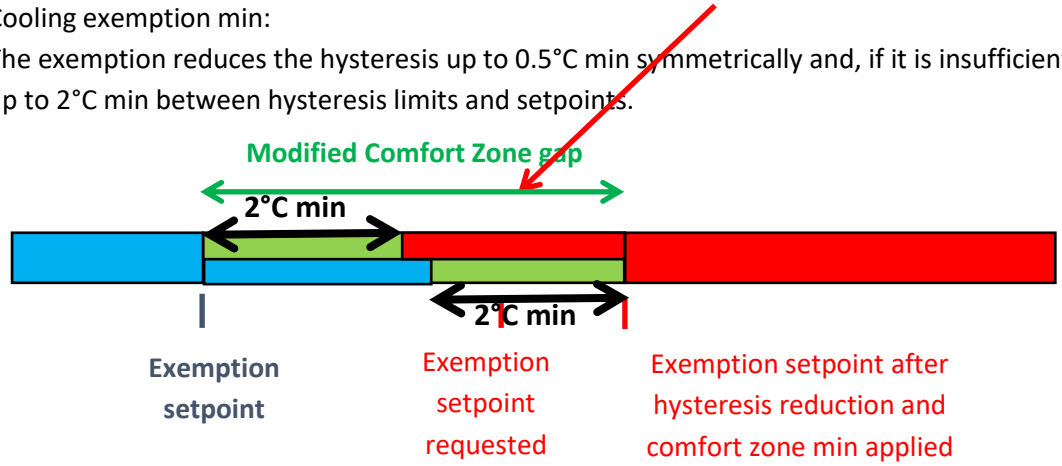


Heating exemption:



Cooling exemption min:

The exemption reduces the hysteresis up to 0.5°C min symmetrically and, if it is insufficient, the comfort zone up to 2°C min between hysteresis limits and setpoints.



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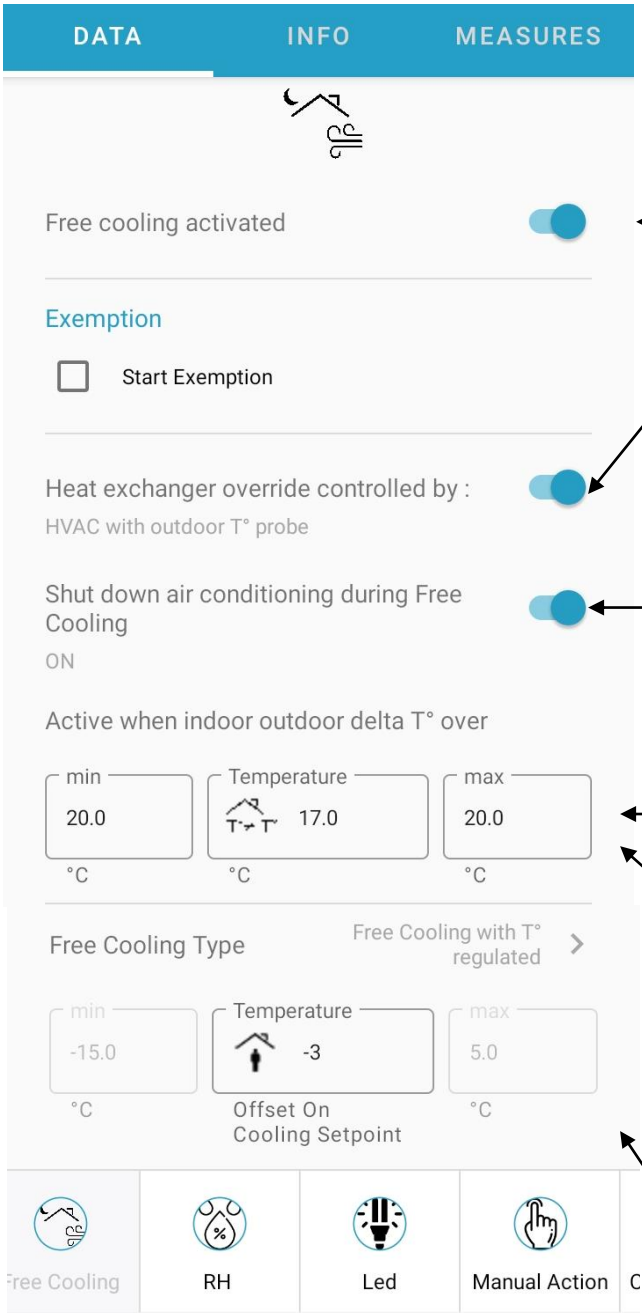
10.11. Free cooling setting



The activation of free cooling generates over ventilation at night when the outdoor air is cooler than the indoor air (without heat exchanger). This freshness accumulates in the mass of the building for the next day.

Bypassing of the heat exchanger can be controlled either by the HVAC (Or double flow ventilation) equipped with its own internal and external temperature sensors or by the EP5000 probe associated with a AAQ probe or an external temperature sensor. (Reserved for the administrator).

To save energy, it is possible to switch off the air conditioning during free cooling.

Adjustment of the difference of temperature. The min and max values are the adjustment limits authorized for users (adjustable by the administrator).

As long as the indoor temperature is higher than the heating setpoint and the indoor-outdoor delta T is valid, the ventilation is either at fixed speed or flow (adjustable in % of nominal) or variable to reach a setpoint temperature. The min and max values are the setting limits authorized for users (limited by the administrator).

The temperature-regulated mode is suitable for occupied buildings at night (residential, risk of colds). In this case adjust the temperature.

Unregulated mode is suitable for buildings that are not occupied at night (offices).

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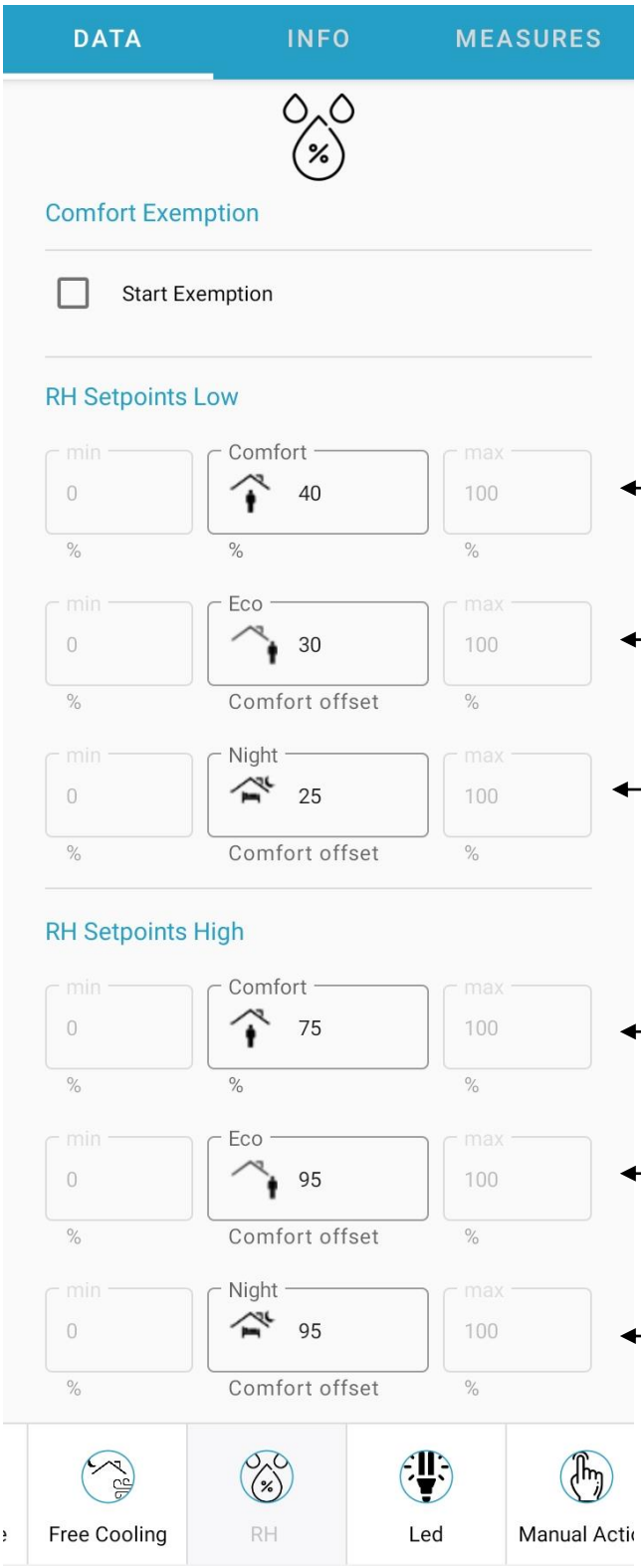
10.12. Humidity setpoints



Setting of the high level humidity setpoint during occupancy periods (**Comfort** Mode). The min and max values are the authorized setting limits for users (Settable by the administrator).

Setting of the **difference** of humidity between **Comfort** Mode and **Eco** Mode (unoccupied periods). Settable by the administrator only.

Setting Mode of **difference** of humidity between **Comfort** and **Night** Mode. Settable by the administrator only.

Setting of the low level humidity setpoint during occupancy periods (**Comfort** Mode). The min and max values are the authorized setting limits for users (Settable by the administrator).

Setting of the **difference** of humidity between **Comfort** Mode and **Eco** Mode (unoccupied periods). Settable by the administrator only.

Setting Mode of **difference** of humidity between **Comfort** and **Night** Mode. Settable by the administrator only.

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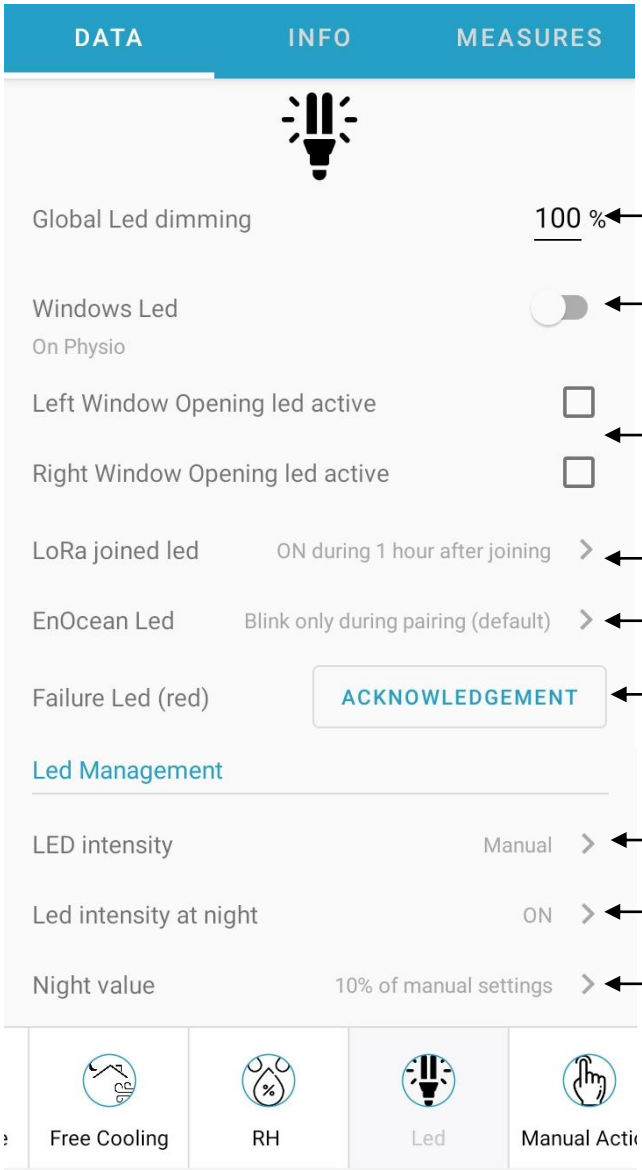
10.13. LED settings



General dimming setting of the front panel LEDs.

Window LED management according to WELL V2 or QAI / QAE comparison via physiological effects.

LED window management according to WELL V2 or IAQ / OAQ comparison via physiological effects.

For LoRaWAN versions only.

For EnOcean versions only.

Acknowledgment of default LED

Dimming mode: Auto / Manuel

Activation of LEDs during the night (On or Off).

If activated at night, intensity level.

Reminder of Well V2

Outdoor air measurement

a. Outdoor levels of ozone, $PM_{2.5}$ or PM_{10}, and temperature are monitored at intervals of at least once per hour based on a data-gathering station located within 4 km [2.5 mi] of the building.

b. Data collected are made available to building occupants.

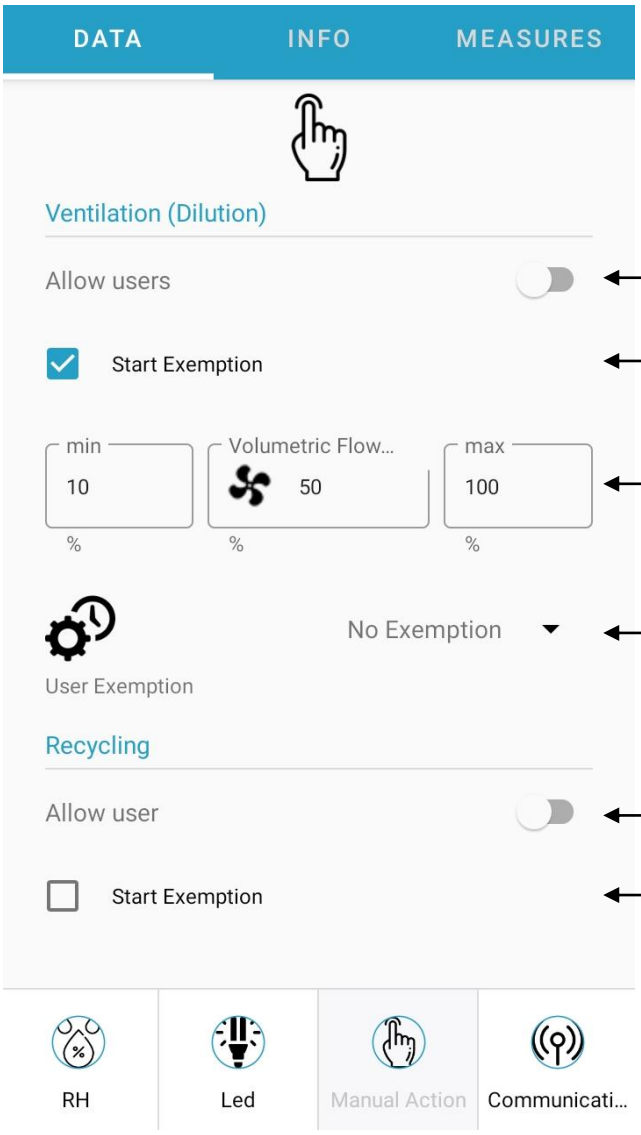
Window operation

Indicator lights to regular building occupants when outdoor air allows for open windows based on when the following thresholds are met:

- Ozone less than 51ppb
- PM2.5: less than 15 µg/m³
- PM10 less than 50µg/m³
- Dry-bulb temperature: within 8°C of indoor air temperature setpoint.

 All Rights Reserved

10.14. Manual overrides



Manual actions are by nature exemptions from automatic regulated modes.
Depending on the type of control defined in **General**: Continuous, On Off or two speeds, the manual actions will be adapted. Here the continuous mode is described.

Allow users. (limited by the administrator).

To launch an exemption, activate this box

Command value in continuous mode

Allow users. (limited by the administrator).

Manual recycling control

To launch an exemption, activate this box

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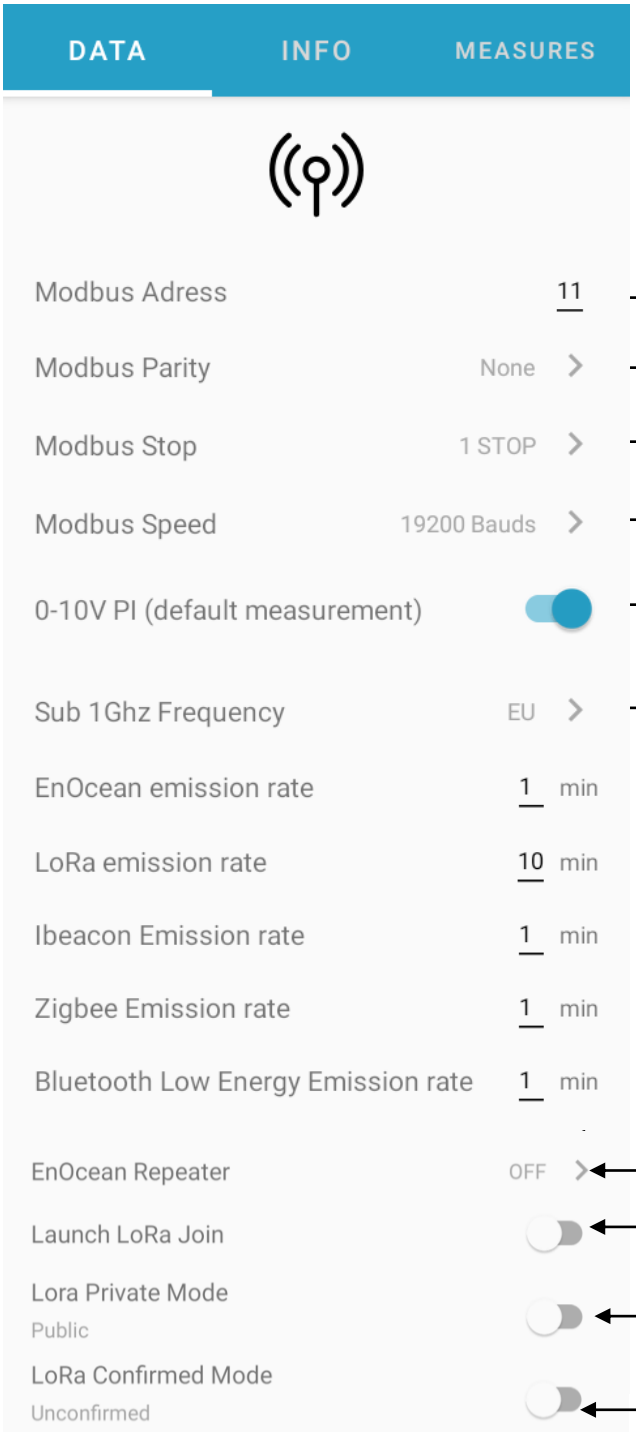
10.15. Communication settings



All these settings are reserved for the administrator.

Setting the bus address (Modbus probe version).

Parity setting.

Stop bit.

Bus speed setting.

Selection 0-10V output on measurements or PI. (versions EP5000VX only)

Choose the region because the modulation, power and frequency bands are specific to local regulations. Applies to LoRa as well as EnOcean.

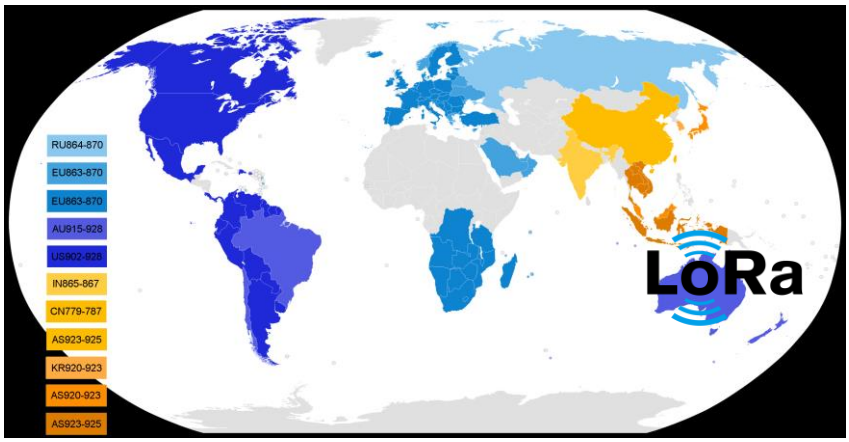
Radio emission rates.

EnOcean repeater activation Level 1 or 2

Manual launch of a LoRa jonction.

Private or public LoRa mode. (different from operated networks)

Confirmed mode allows repeating telegram until acknowledgement



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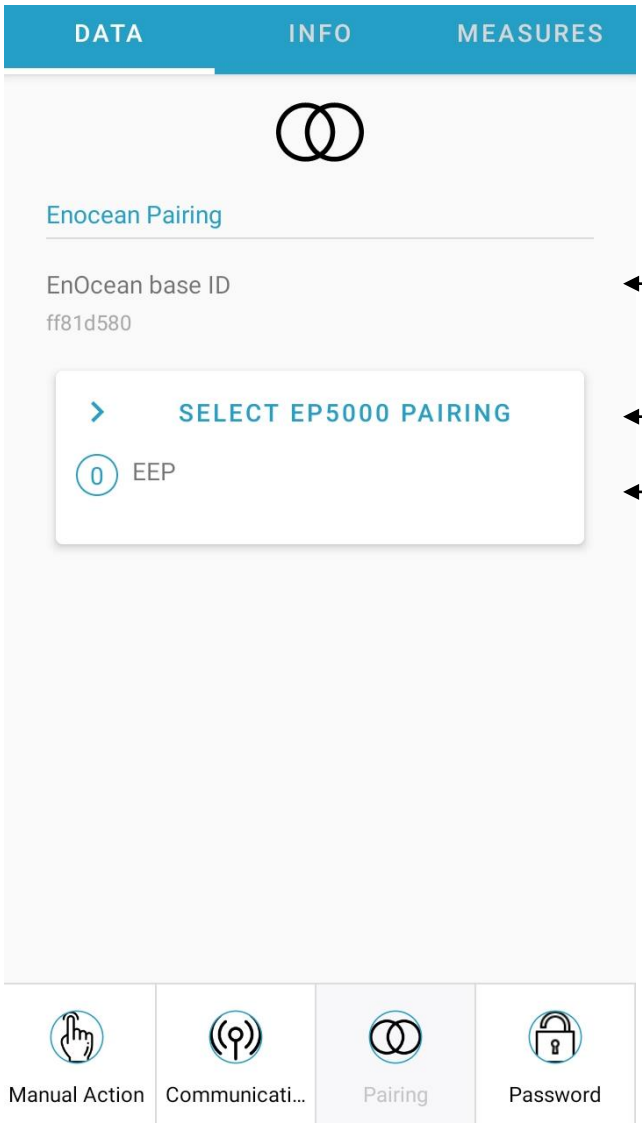
10.16. EnOcean Pairing



This tab only appears for EnOcean versions. Pairings are allowed for the administrator.

ID base of the EnOcean transceiver module used to generate ID of transmitted EEP.

Select the EnOcean pairings to proceed.

Number of EEP that will be paired after taping the NFC.

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10.16.1. Choice of telegrams per usage

This screen offers three families of telegrams to be paired according to their use.

Measures corresponds to the EEP emitted by the probe including indexes.

Control corresponds to the control EEP (ventilation, heating, etc.) emitted by the probe.

Ecosystem corresponds to the EEP of occupancy, window, night and outdoor air quality probes used for the different operating Modes (Comfort, Eco, Night) and to manage the window LEDs.
Since a room can have several windows, the number of opening sensor IDs that can be recorded in the probe is limited to 8 sensors.
The number of occupancy sensors is limited to 7.
Only one night sensor is allowed.

Note that in the absence of occupancy sensors in the ecosystem, it is always possible to rely on CO2 for occupancy and the embedded light sensor for the night. (See in **General**)

Two OAQ probes are authorized (one per facade.

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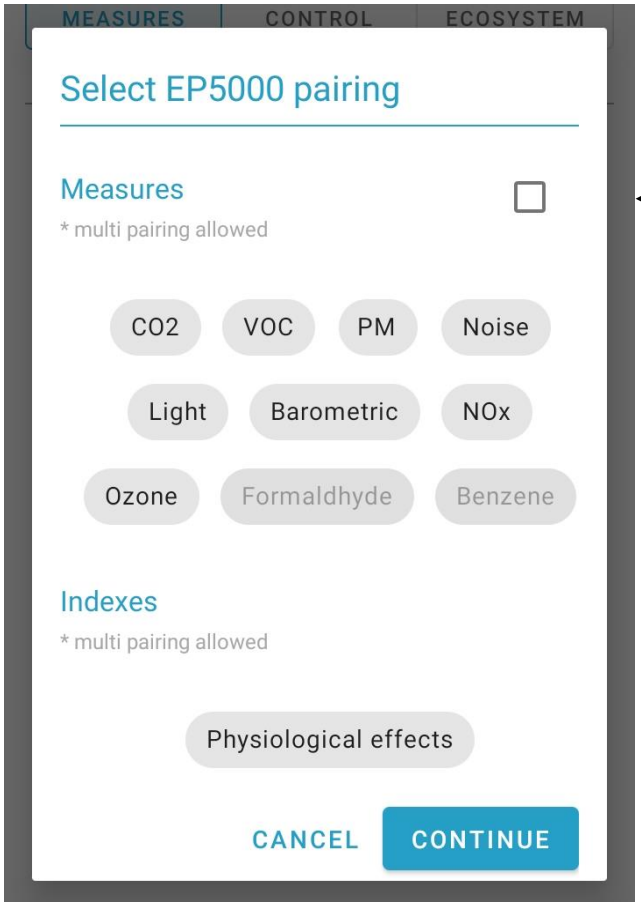
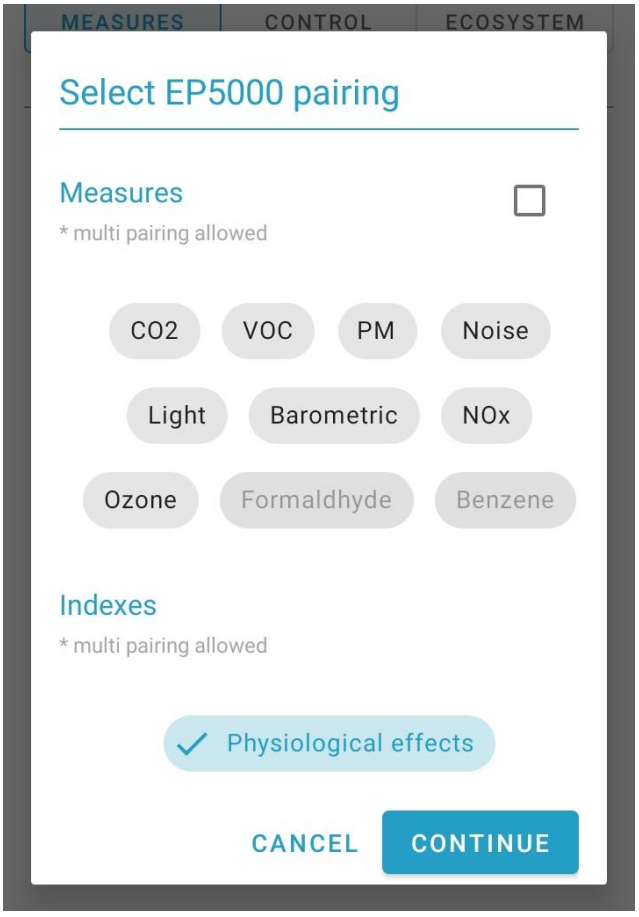
10.16.2. Measures Pairing



This checkbox allows to selects all for a multiple pairing



By clicking on **Physiological effects** a check mark appears. Just click on **continue** to switch on EEPs selection.

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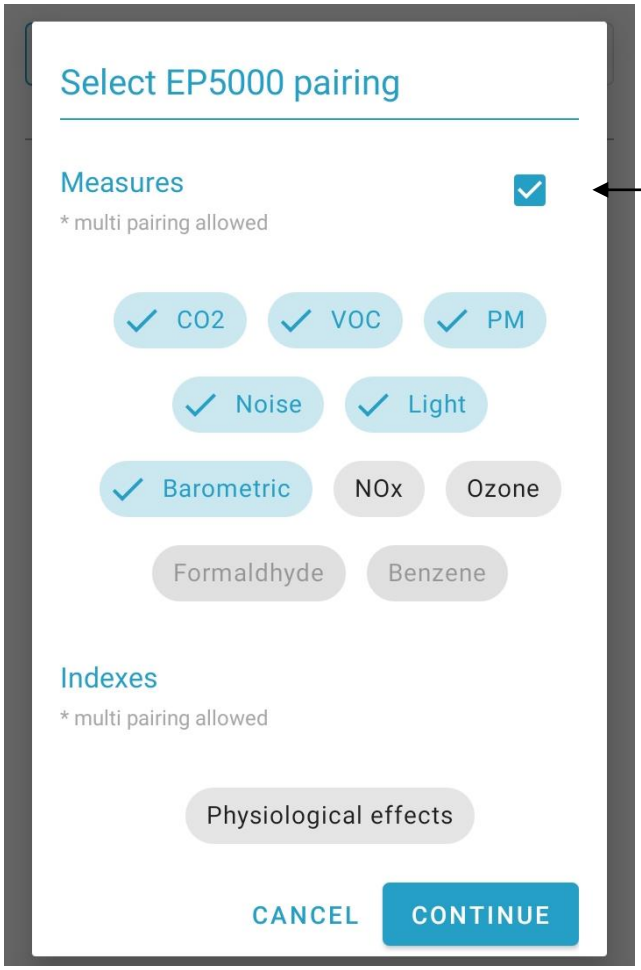

This checkbox allows selecting all measures. However, it is possible to deactivate specific measure (here NOx and Ozone) by clicking on it.

Press **continue** to switch on EEPs selection.

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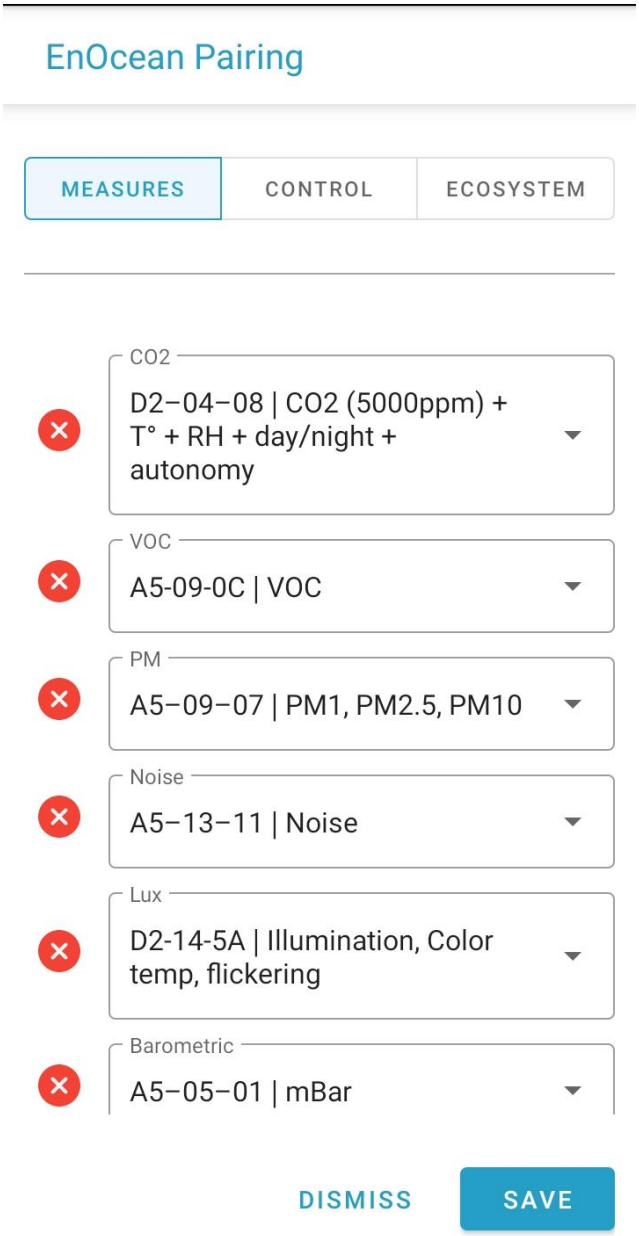
10.16.3. EEP Measures Choice



In EnOcean there are several profiles from which to choose depending on the ecosystem. Most measurements have only one possible EEP with the exception of CO2, but each EEP is listed for clarity.

The red cross is used to deselect an EEP from the pairing list.

Press **SAVE** to switch to the recap

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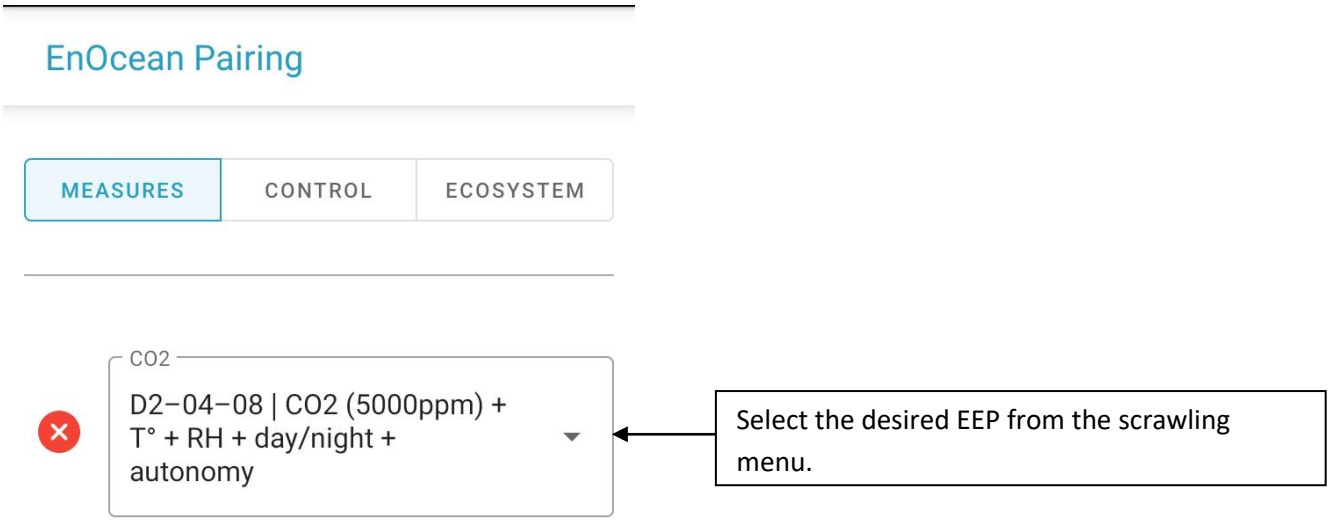
10.16.4. CO2 EEP choice



The list of CO2 EEPs is as follows. The default EEP is displayed and appears highlighted in the list.

EEP	Comment
A5-09-04	CO2 (2550ppm) + T° + RH
A5-09-08	Pure CO2 (2000ppm)
A5-09-09	Pure CO2 (2000ppm) with power failure
D2-04-00	CO2 (2000ppm) + T° + RH + day/night + autonomy
D2-04-01	CO2 (2000ppm) + RH + day/night + autonomy
D2-04-02	CO2 (2000ppm) + T° + day/night + autonomy
D2-04-03	CO2 (2000ppm) + T° + autonomy
D2-04-04	CO2 (2000ppm) + T°
D2-04-05	CO2 (2000ppm) + T° + day/night
D2-04-06	CO2 (2000ppm) day/night
D2-04-07	CO2 (2000ppm) + day/night + autonomy
D2-04-08	**CO2 (5000ppm) + T° + RH + day/night + autonomy**
D2-04-09	CO2 (5000ppm) + RH + day/night + autonomy
D2-04-10	CO2 (5000ppm) + T° + day/night + autonomy
D2-04-1A	CO2 (5000ppm) + T° + autonomy
D2-04-1B	CO2 (5000ppm) + T°
D2-04-1C	CO2 (5000ppm) + T° + day/night
D2-04-1D	CO2 (5000ppm) day/night
D2-04-1E	CO2 (5000ppm) + day/night + autonomy

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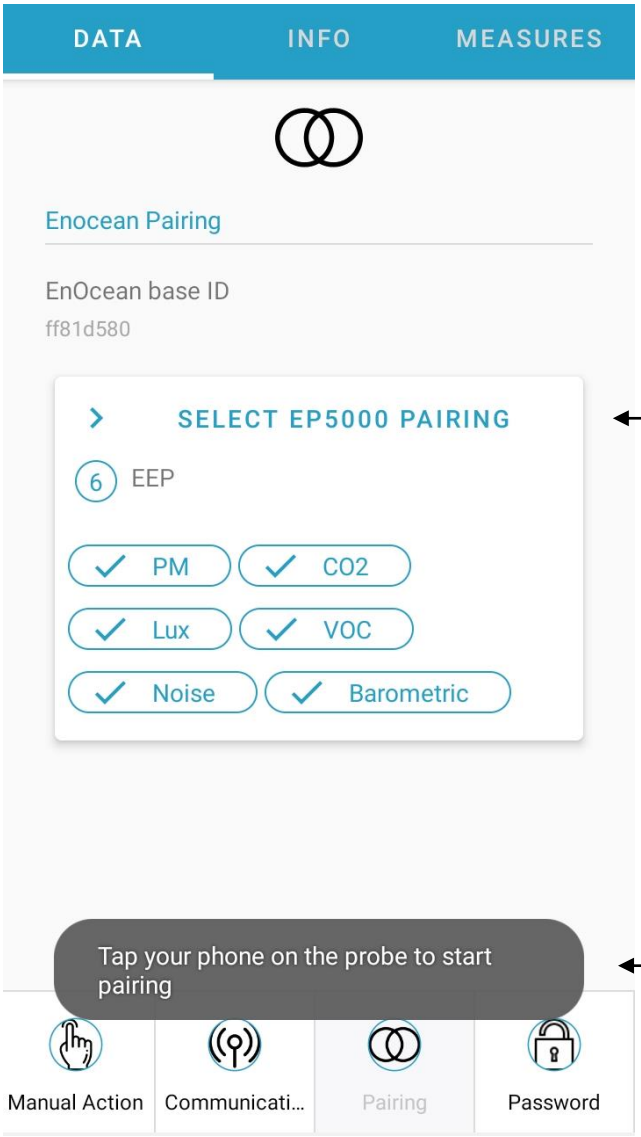
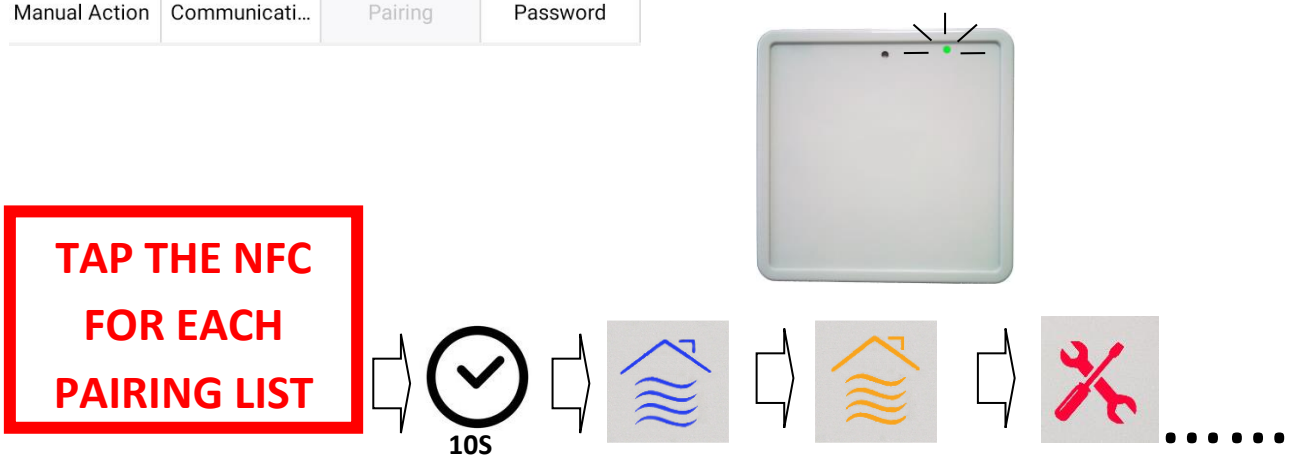
10.16.5. Recap of Measures EEP ready for Pairing



Selecting a pairing will erase this list to create a new one.

The number and the list of EEPs that will be paired are displayed.

This message invites you to tap the NFC to initiate those pairings.



After registering and taping the NFC, the LEDs indicate the pairing process by flashing blue, orange and red in a loop, then the green EnOcean LED lights up each time a pairing telegram is transmitted. Time between pairing telegrams emission is about 2 seconds.

After a pairing, the LED will turn off for a second and will turn on again if there are still sensors to be paired.

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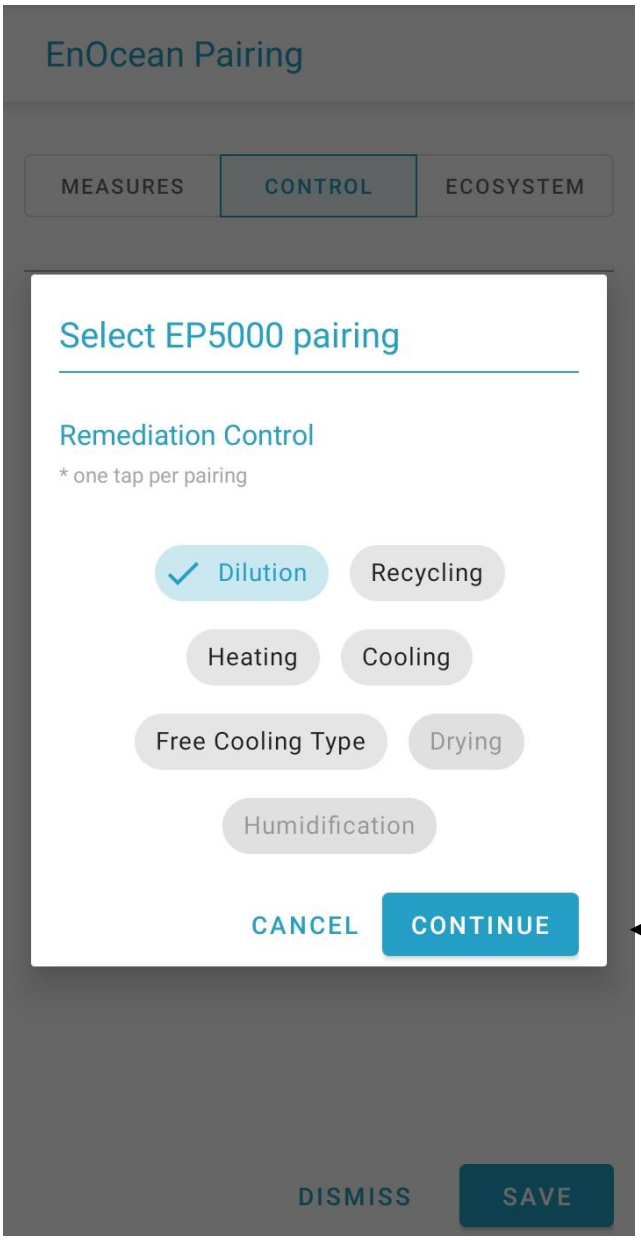
10.16.6. Choice of Control EEP



Unlike measurements, multiple pairings are not possible.

After having selected the type of control click on **continue**.

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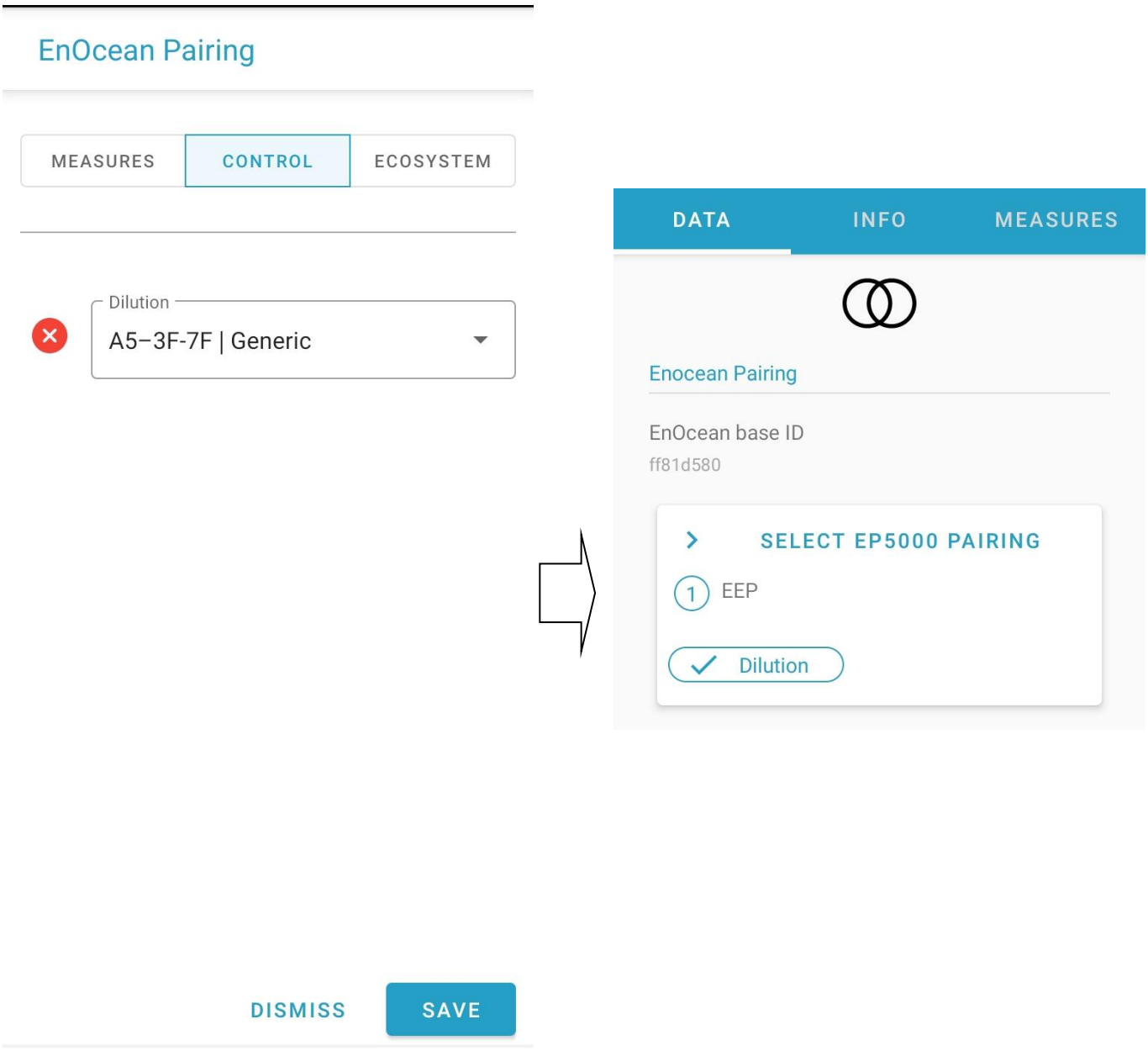
10.16.7. Exemple of Control EEP



The list of ventilation (dilution) EEPs is as follows. The default EEP is displayed and appears highlighted in the list.

EEP	Comment	
F6-02-01	ON/Off	
A5-3F-7F	**Generic (**Byte #1, 0-100%)	
F6-02-01	Speed 1 & 2	

TAP THE NFC FOR EACH PAIRING

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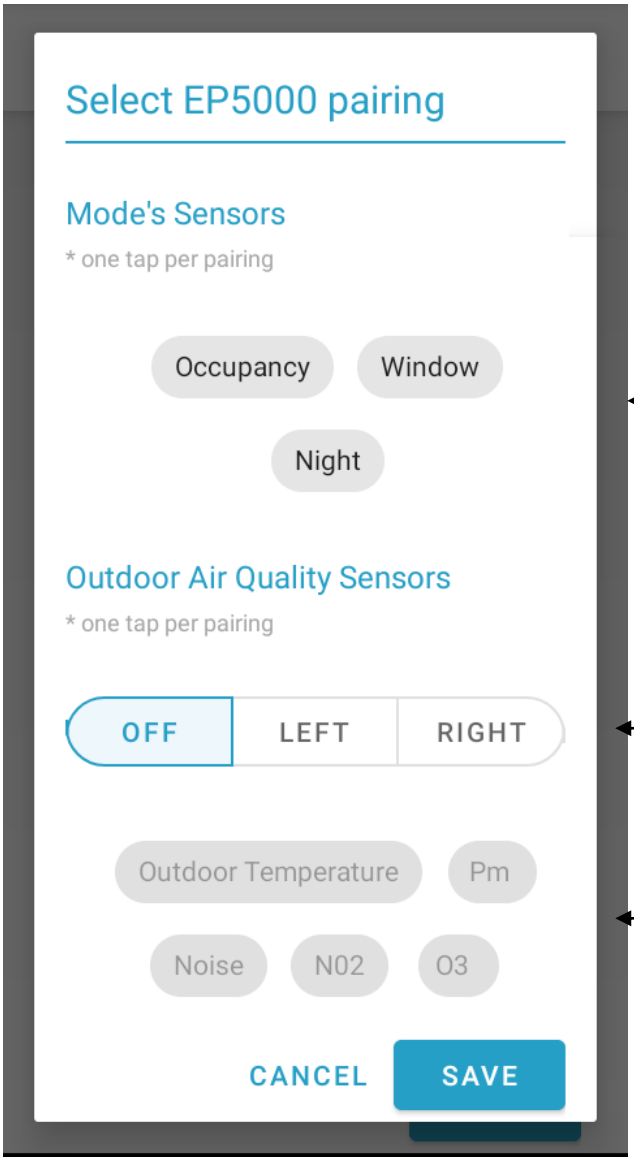
10.16.8. Choice of Ecosystem sensors

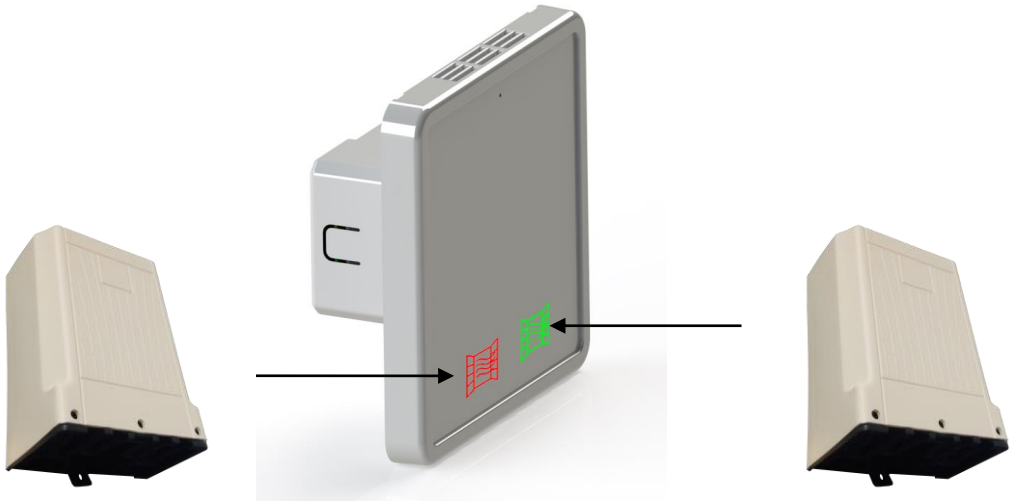


This window is used to select occupancy and night sensors, or even window opening sensors in order to determine an operating **Mode** for the control functions.

Choose one of the sensor types associated with the Modes:
Occupancy for **Comfort** or **Eco** Mode
Night Sensor for **Night** Mode
Windows to cut off ventilation and heating or cooling when opened.

Choose the outdoor air quality sensor corresponding to the display on the front panel.
If looking at the EP5000 probe, the street is on the right, select right for the QAA probe installed on the street side.

Le choix droite ou gauche sélectionnera toutes les cases car l'appairage d'une sonde QAA se fait par un seul appui coté sonde extérieur.



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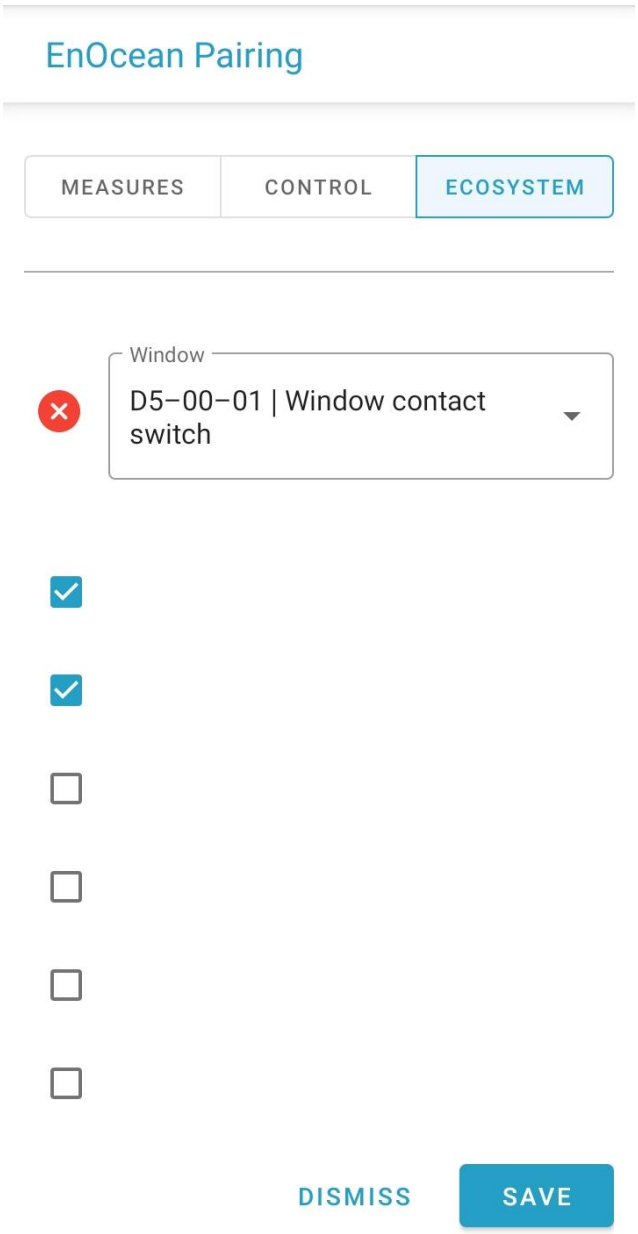
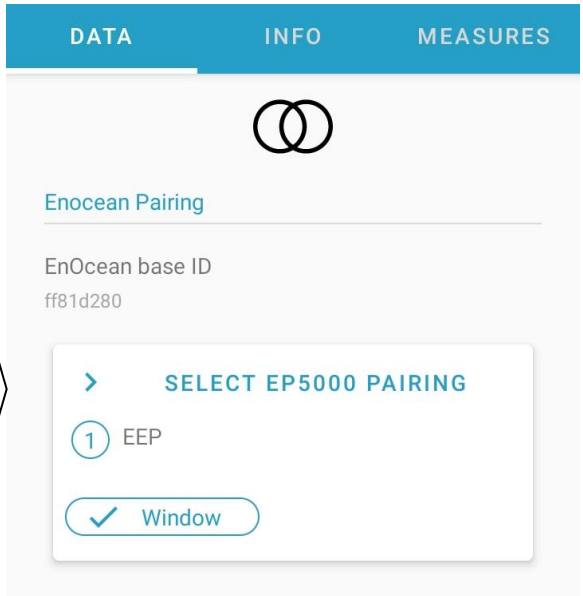
10.16.9. Opening window sensor pairing



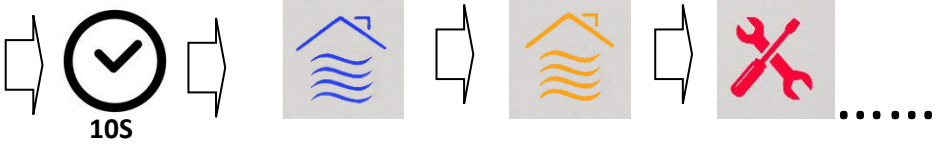
The choice of EEP is common to all windows. It is not possible to mix different profiles.

Check the number of windows to pair (8 max).



After registering and taping the NFC, the LEDs indicate the pairing process by flashing blue, orange and red in a loop, then the green EnOcean LED lights up indicating that it is waiting for a pairing telegram.
After a pairing, the LED will turn off for about 2 seconds and will turn on again if there are still sensors to be paired.

TAP THE NFC FOR EACH PAIRING



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10.17. EnOcean unpairing

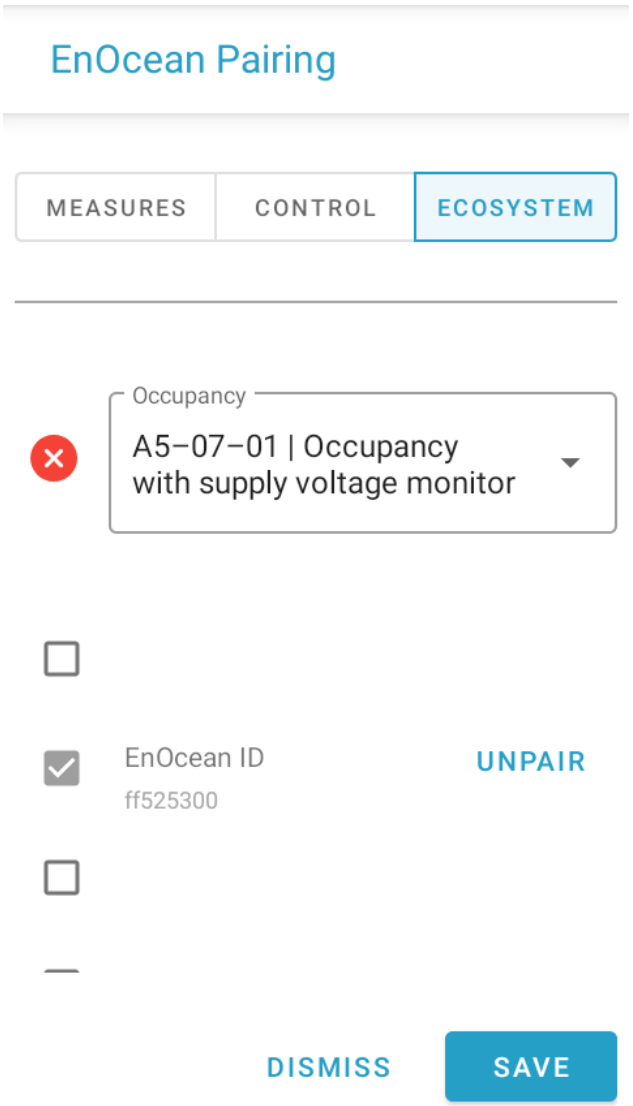
IDs of the telegrams sent by the probe are saved in the receivers (actuator, gateway...). It is therefore appropriate to unpair them from this side. Telegrams will continue to be sent by the probe.

The IDs of the bidirectional actuators on battery or in energy harvesting are saved in the probe.

The IDs of occupancy, night or window opening sensors are also saved in the sensor.

Only IDs stored in the probe can be unpaired.

To unpair, read the NFC memory, return to the pairing menu, choose the profiles concerned in **Control** and **ecosystem** then delete the sensors or actuators that appear with their ID.



The ID of paired occupancy sensors appears and the pairing checkbox is grayed out, as the sensor is already paired. Click on **unpair** the desired sensors and tap the NFC.

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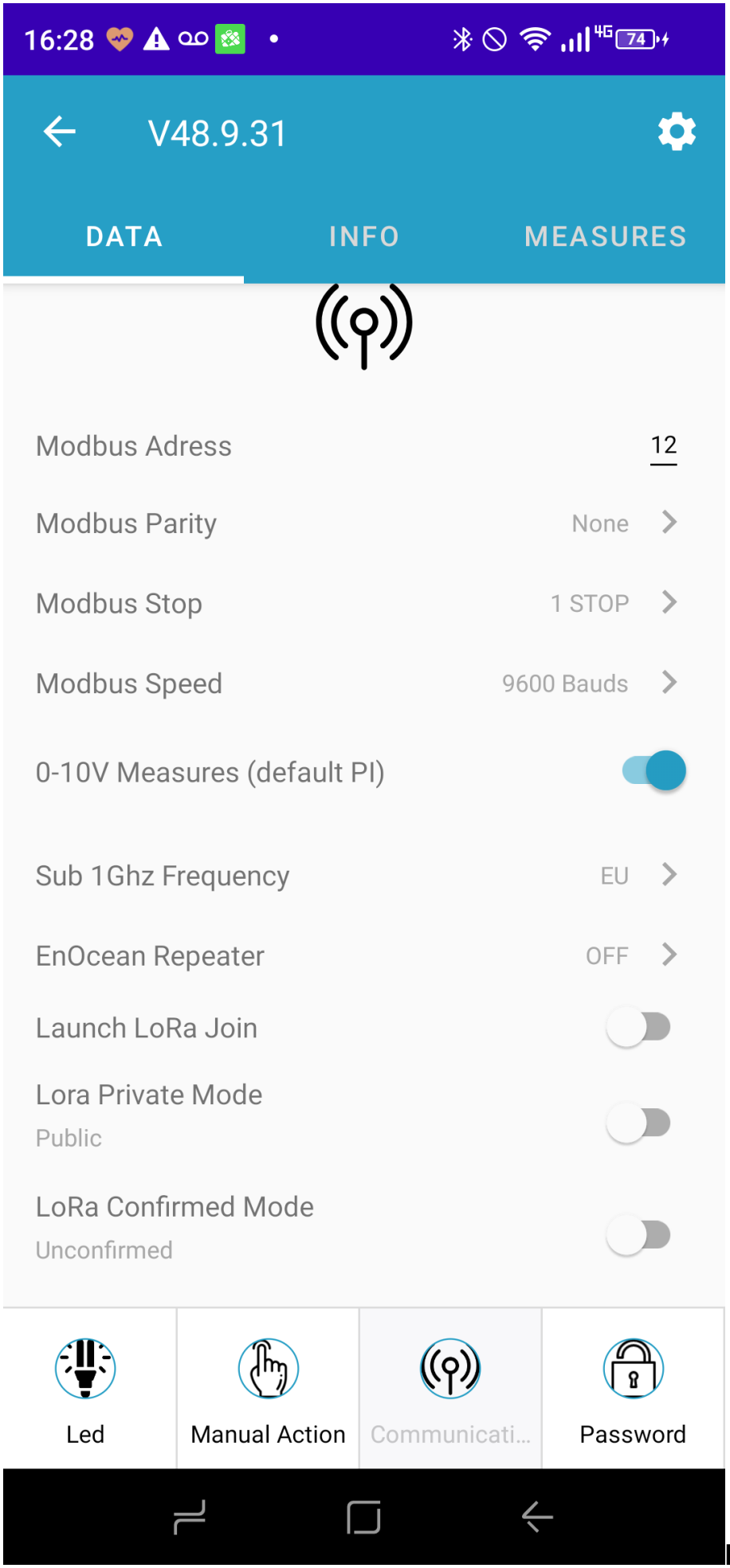

10.18. LoRa

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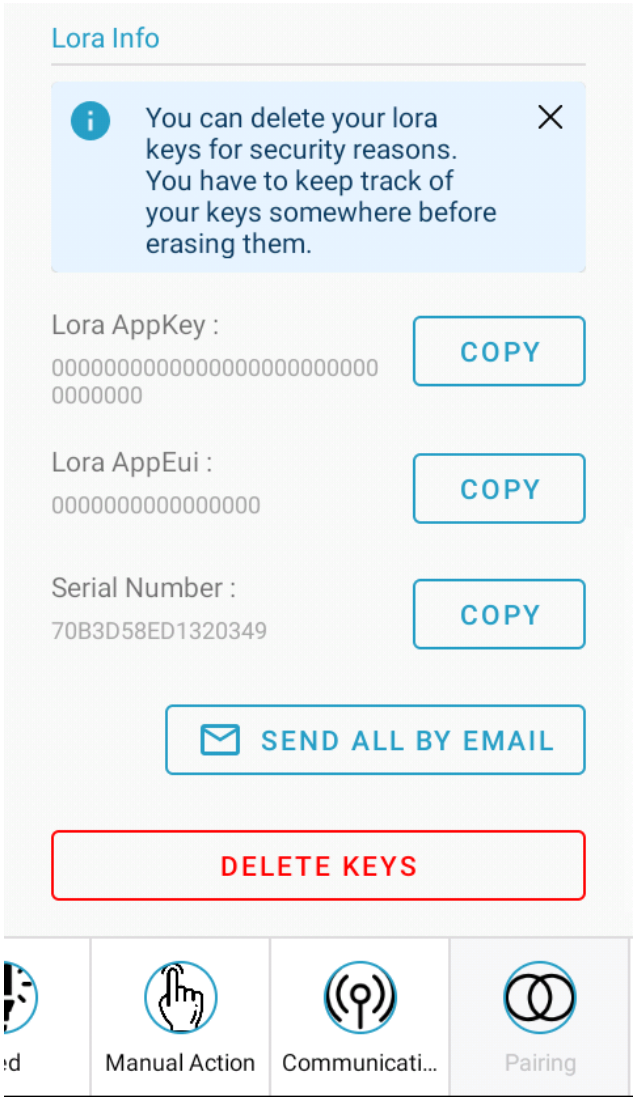
Pairing



This tab only appears for LoRaWAN versions.

Secret LoRaWAN keys. The copy makes it possible to save them on a platform or a gateway via the smartphone.

It is best to keep track of keys by sending them by Email, provided the smartphone has the corresponding software.

Once the recording is complete and tested, it is possible to erase the keys from the memory accessible by NFC. However, they are only accessible to the administrator, so deletion is not essential. In this case, it is imperative to use a password which will be recorded in the probe.

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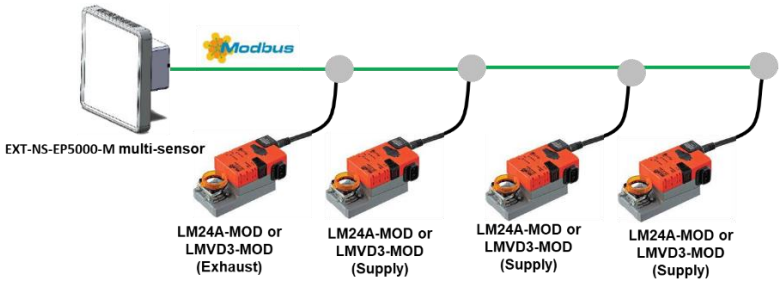
10.19. Modbus Actuators control (Belimo models)

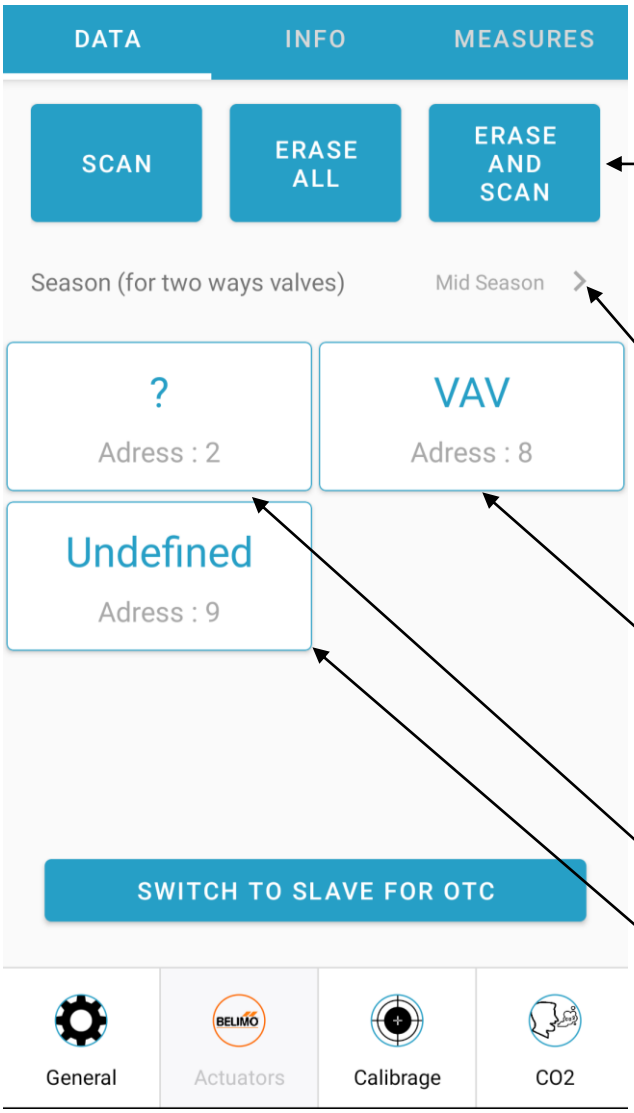
The EP5000MM (**M**aster **M**odbus) version is the ModBus master and interrogates Modbus actuators (VAV, Dampers or valve) at 38400 Bauds with No parity and 2 stop bits (8N2, default Modbus of Belimo actuators) with default settings. If actuators use another setting, set the ModBus in the communication tab.

At start up, the master will scan Modbus from address 1 to 32 and identify actuators types and addresses. Make sure actuators have their addresses within this range and no duplicates thanks to the ZTH EU Belimo tool.

During the scan the orange LED blinks.



The **Actuators** Tab will display up to 8 actuators as follow:

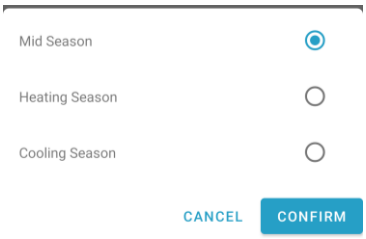


If needed, it is possible:

- To scan a new actuator without losing settings of already scanned one or;
- Erase all actuators or;
- Erase all actuators and their settings and rescan.

Tap the NFC for apply the command and scan or erase.

According to the season, selection of heating or cooling for the 2 ways valves for version without LoRaWAN.



Actuator automatically identified as VAV

Damper or valve to be specified

Actuator not supported

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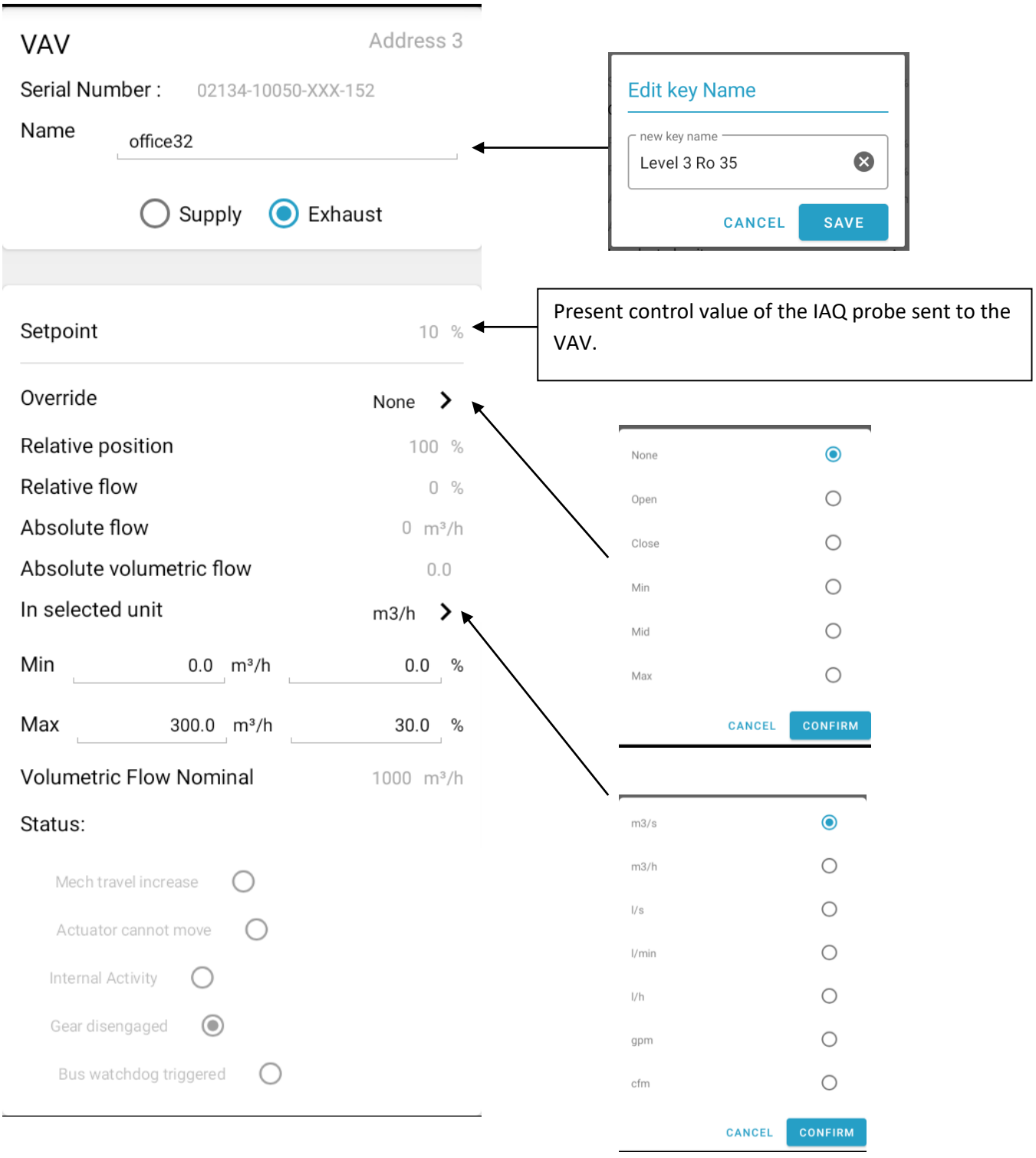
10.19.1. VAV display

When selecting a **VAV**, details will appear as follow:



Data in grey cannot be changed

Data in black can be changed

If changed, tap the NFC for new data to be applied.

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10.19.2. Actuators display

When selecting an **actuator** defined by a **"?"**, details will appear as follow:

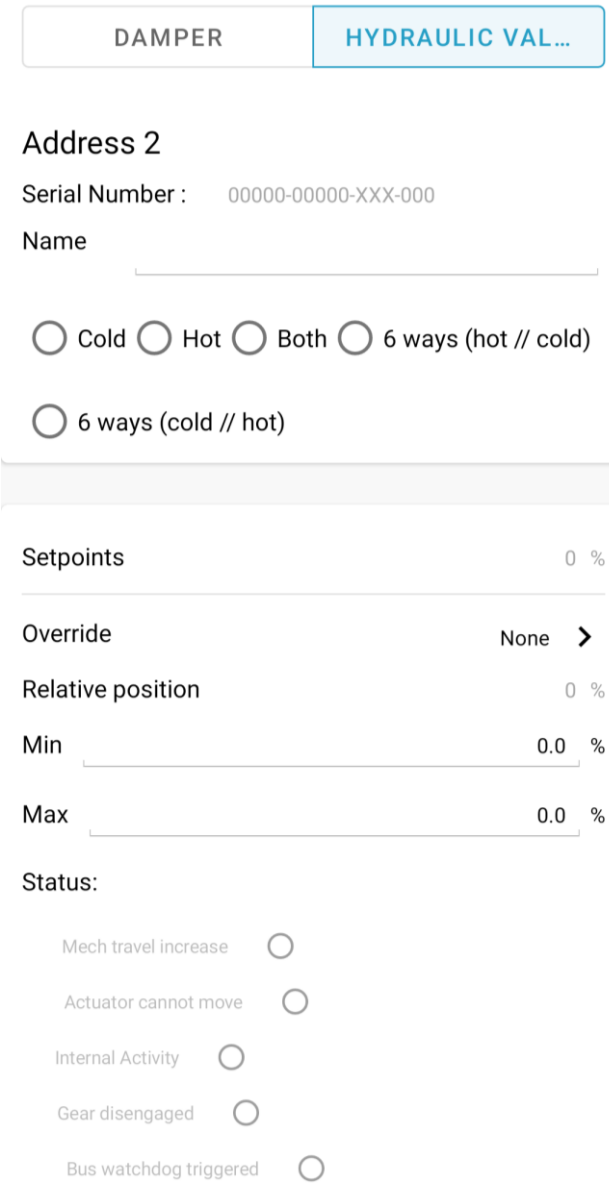
You should first designate if this actuator is motorizing a ventilation damper or an hydraulic valve.

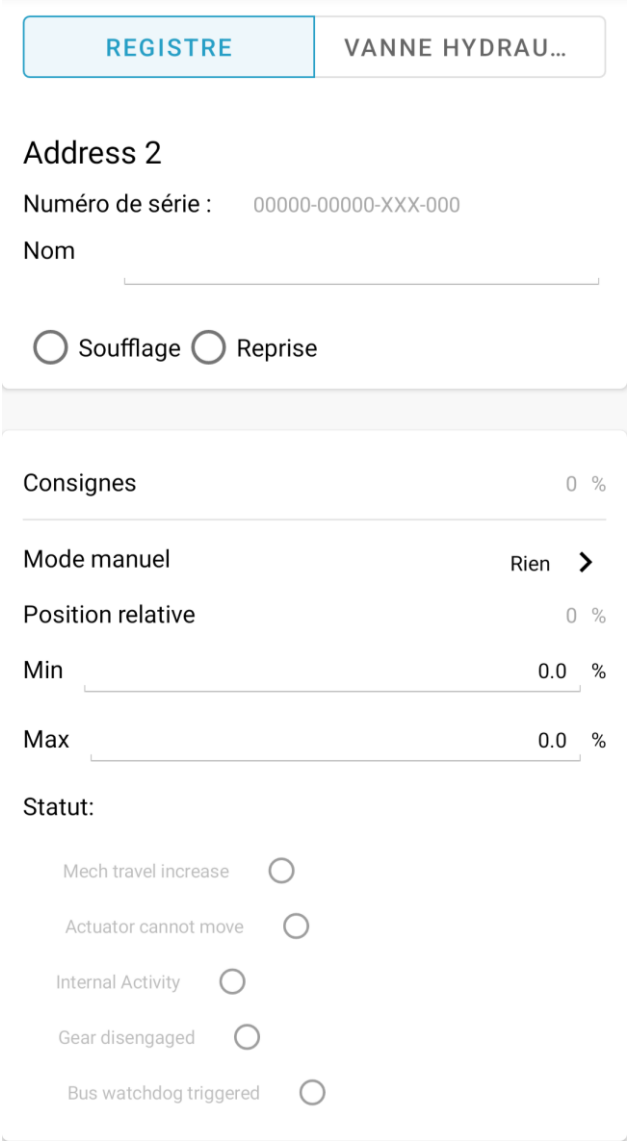
If Damper is selected, you should then specify if for Supply of Exhaust.

If Hydraulic valve is selected, heating, cooling, both (2 ways seasonal) or 6 ways valve shall be specified.

All actuators defined as Dampers will be, like VAV, controlled by PI ventilation control loop.

All actuators defined as valves will be controlled by temperature PID control loop (Heating and cooling).





Data in grey cannot be changed
Data in black can be changed
If changed, tap the NFC for new data to be applied.

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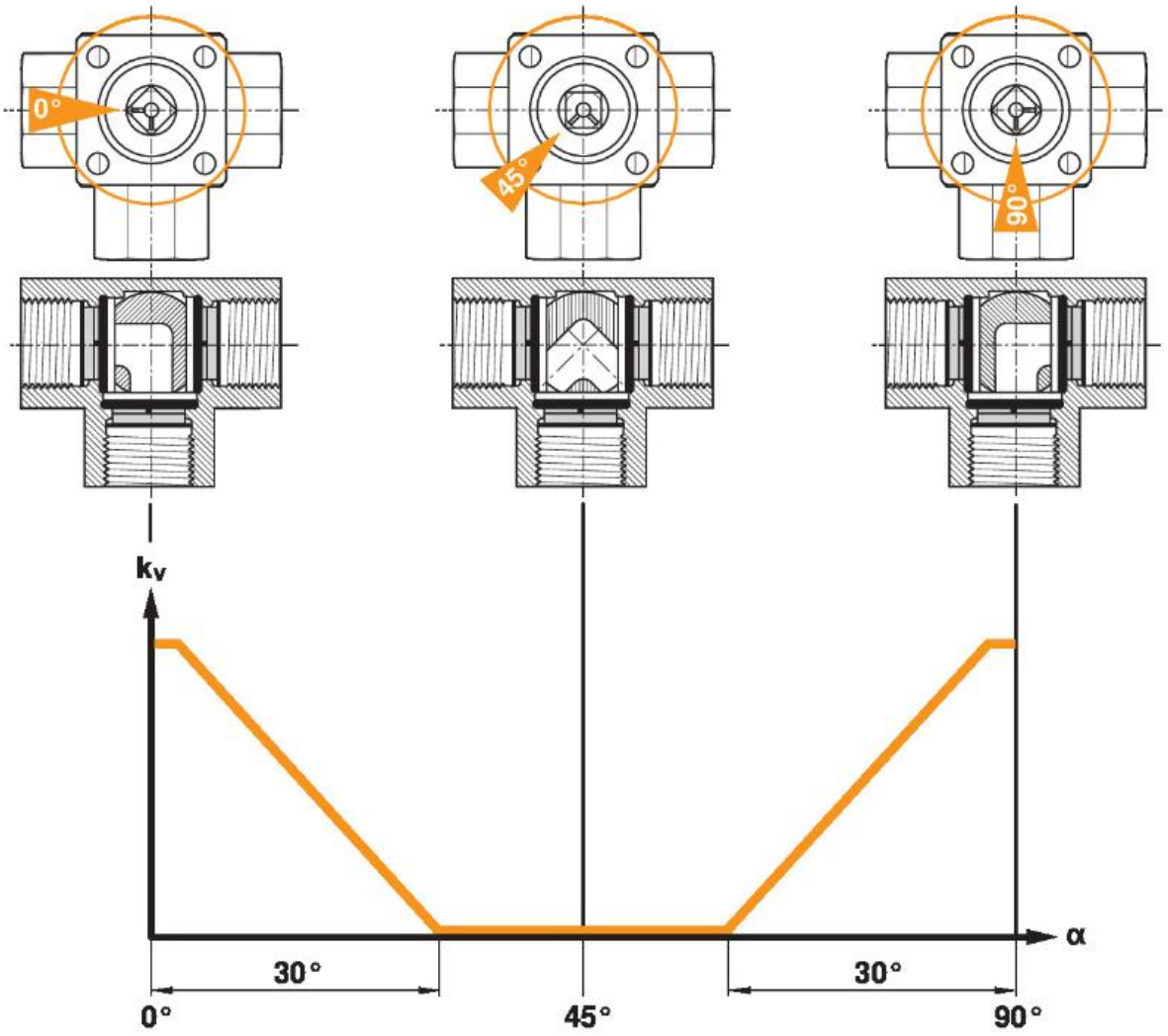
6-way valves details:

The EP5000 probe can control 6-way valves with a 0-90° rotary actuator whose dead zone is as follows:



Note that the hydraulic of six-way valves can be connected differently and appropriate connection selection is required:

- Hot / Dead zone / Cold

Or

- Cold / Dead zone / Hot

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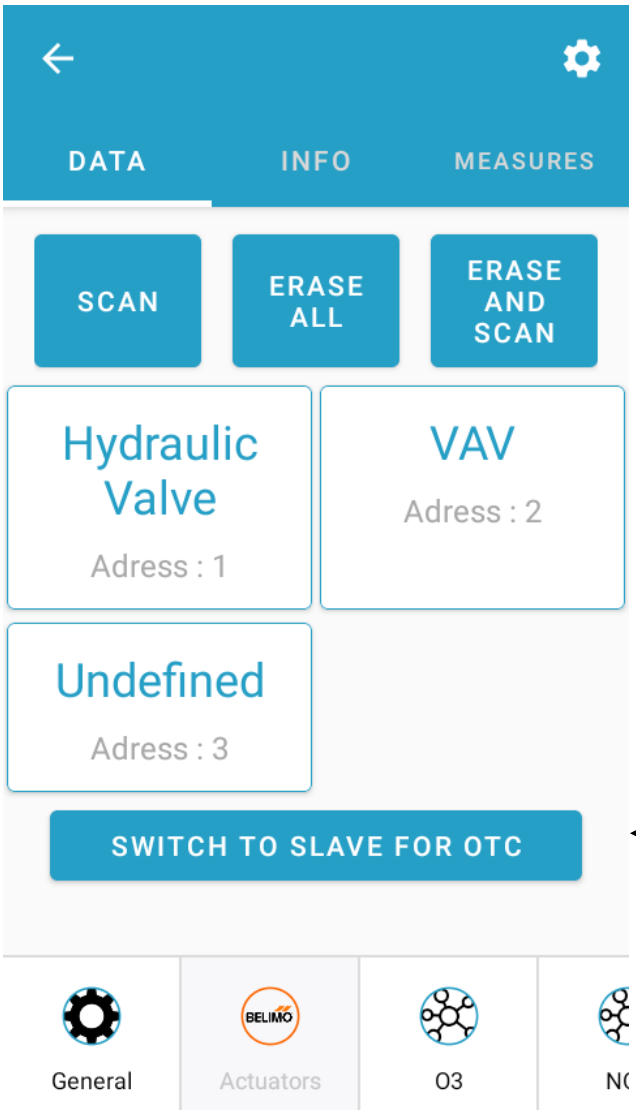
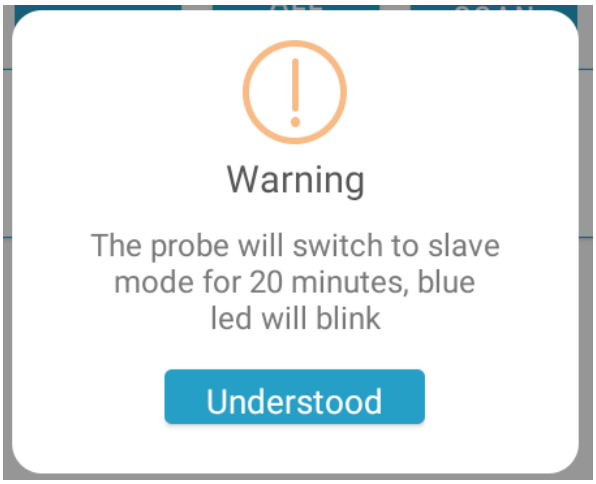
10.19.3. Slave mode for OTC firmware upgrade





Select this feature and tap.
The probe will switch to ModBus slave mode for 20 minutes. As long as the probe is in slave mode, the blue LED blinks.
This is enough time to start firmware upgrade via OTC (use the data logger).
The 20 minutes' time out will be extended as long as the OTC is underway.
The bus will return to master after the firmware upgrade.

As actuators can have addresses between 1 and 32 and stay connected during EP5000 firmware upgrade, make sure to set the EP5000 ModBus slave address above 32 or at least different from actuators addresses.

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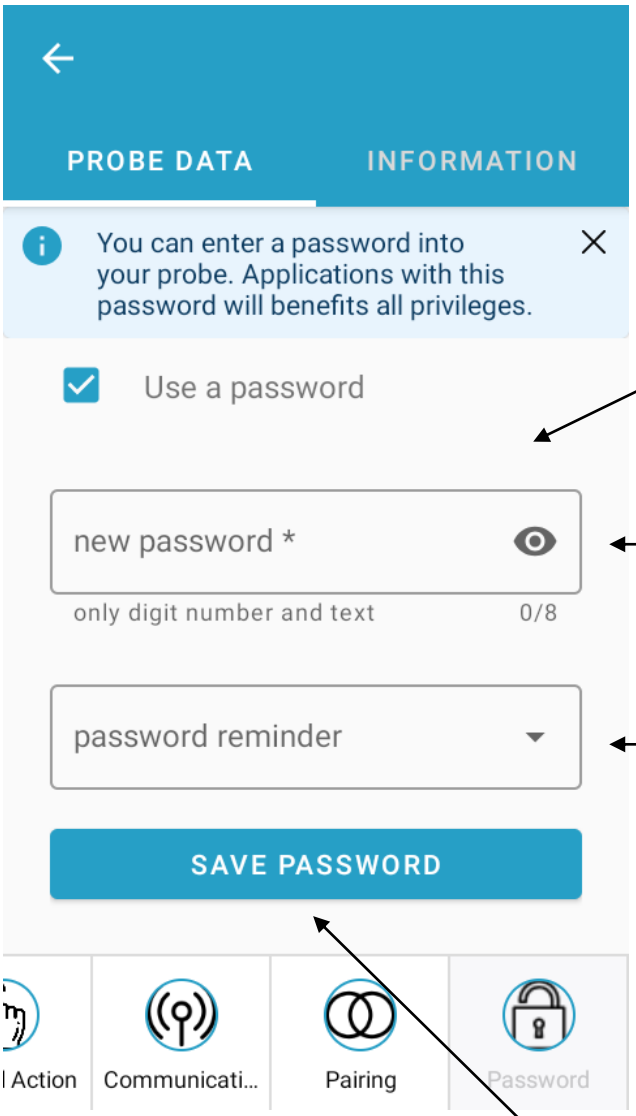
10.20. Record a Password



In selecting the password tab, if the probe doesn't have a password, the App will offer to record a password in order to limit the settings of users without privileges.

Enter a password here (8 characters max). Once a password is entered, users without a password are considered regular users without privilege and will be limited to the allowed settings.

Select one of the following hint to remember the password:

- Mon's birthday
- Dad's birthday
- Favorite cake
- Favorite city
- City of birth
- Mon Birthday
- Grand pa First name
- Grand Ma first name
- Favorite book
- Favorite actress
- Favorite actor
- First car
- First dog's name
- Favorite country
- Favorite place
- Favorite cereal brand

Save Password
Once saved, the following page opens to record the alias of the probe in the smartphone.

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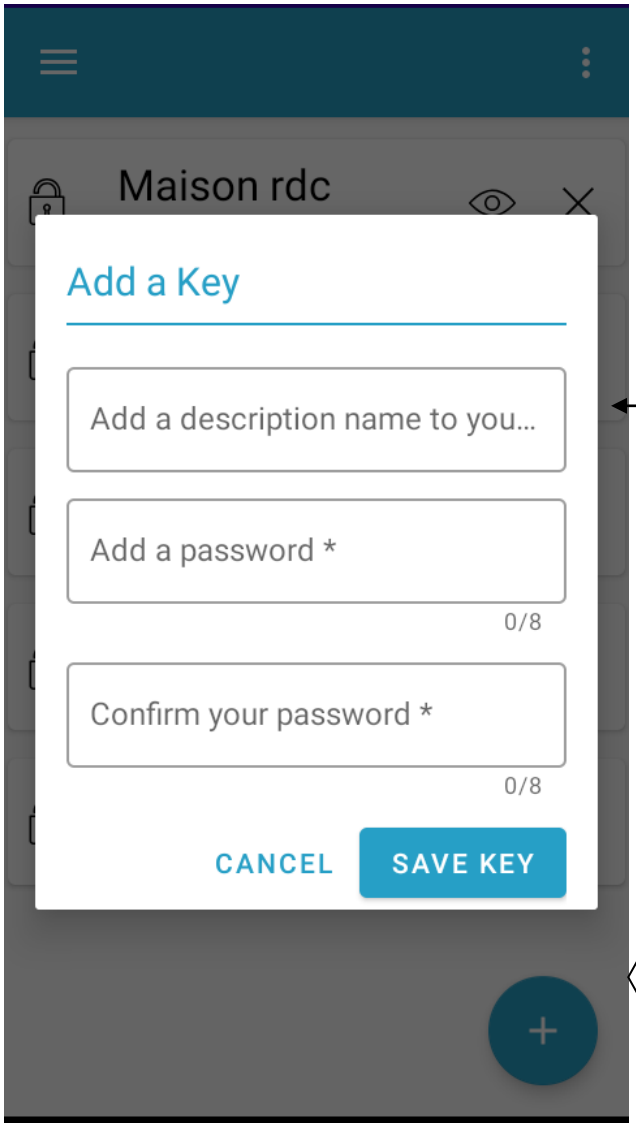
10.21. Enter an Alias



Enter the name (alias) of the probe whose password you want to save in your smartphone. For a building, it is preferable to identify a sensor by address, # of floor, and # of office or apartment.
Please note that the length of this field is limited to 16 characters.

Enter the password in case of manual probe addition.
Password is automatically transferred if the password and its hint were entered in the previous page. Limited to 8 characters.

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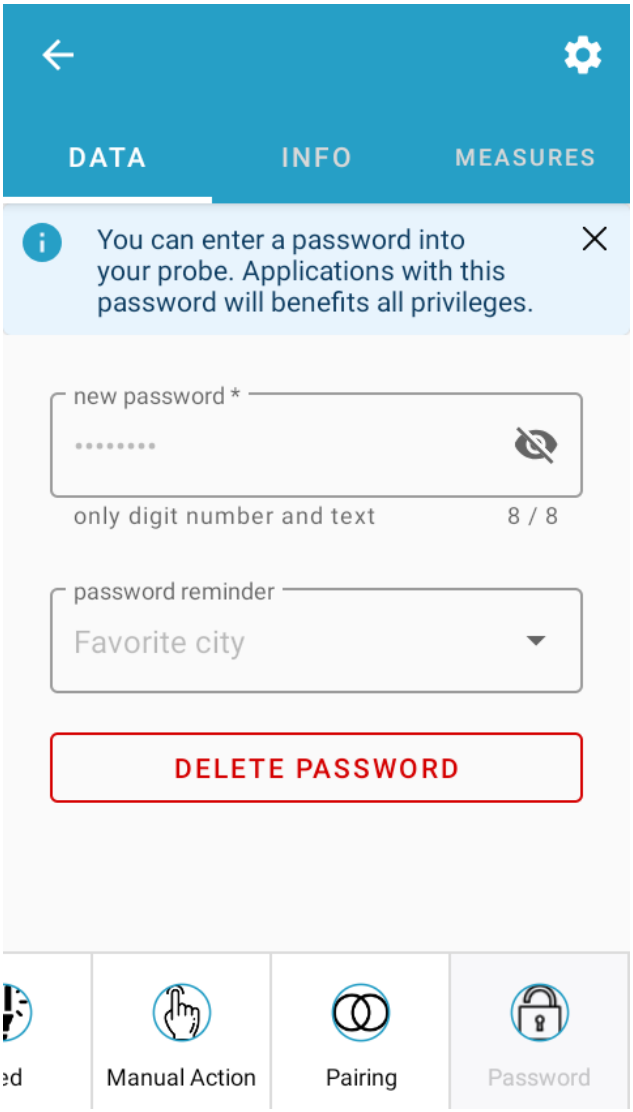
10.22. Removal of a password



In selecting the Password tab, if the probe has a password already recorded in the smartphone, it is possible de visualize it and also to erase it.

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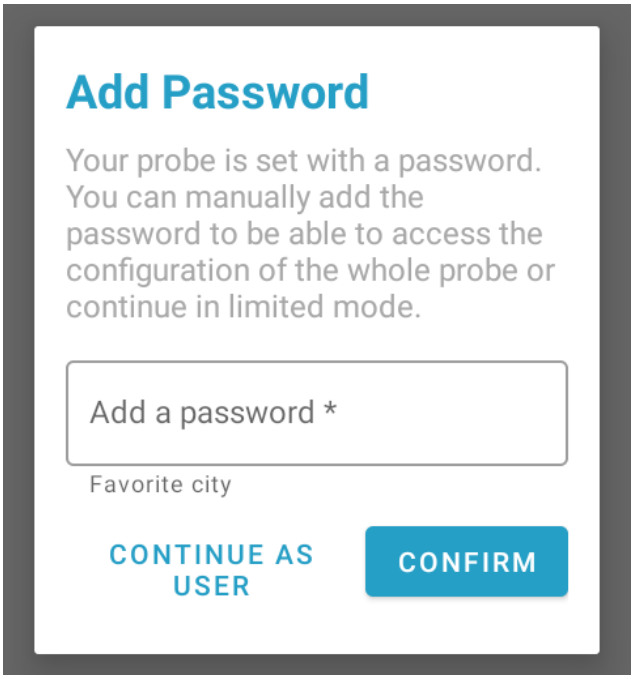
10.23. Unregistered password



After an NFC tap, if the probe has already a password but is not recorded into the smartphone App, this screen appears.
Select continue as a simple user allows to access to all settings allowed by the administrator.

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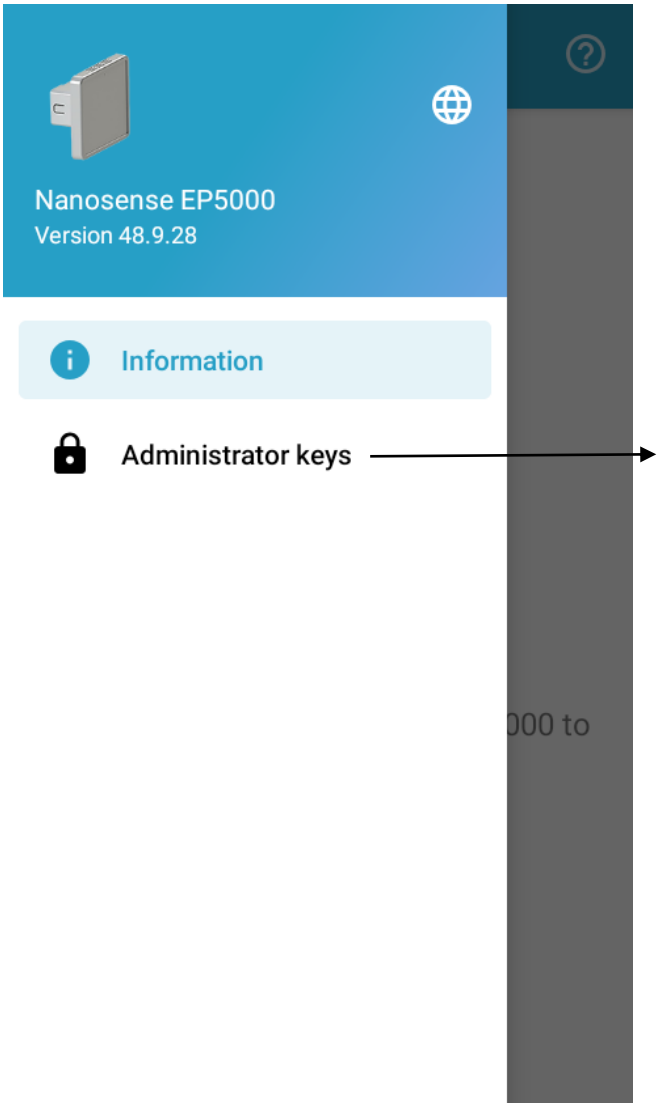
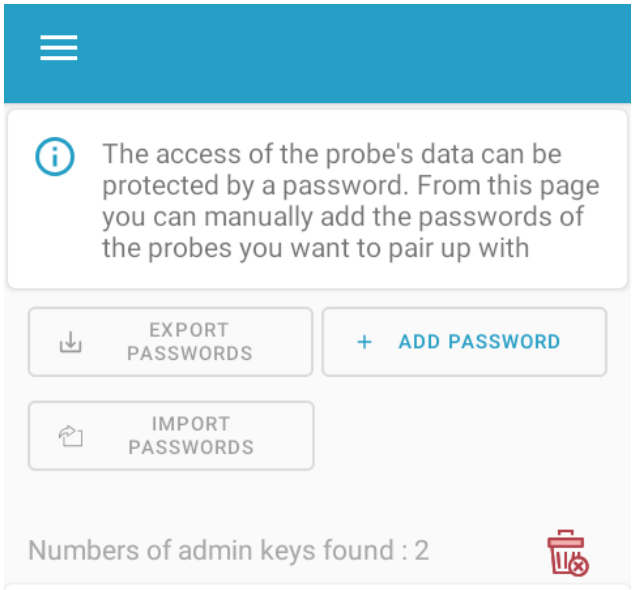
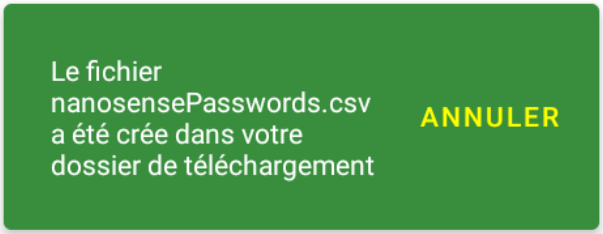
11. Password management

11.1. Passwords back up





Backuping passwords can be useful in case of smartphone change. For such, the App shall be authorized to record a backup file into the smartphone. A .csv file can therefore be created.
This file can be transferred to another smartphone in order to be imported into the App.
Trick: Backup your .cvs file regularly into a PC of an USB key



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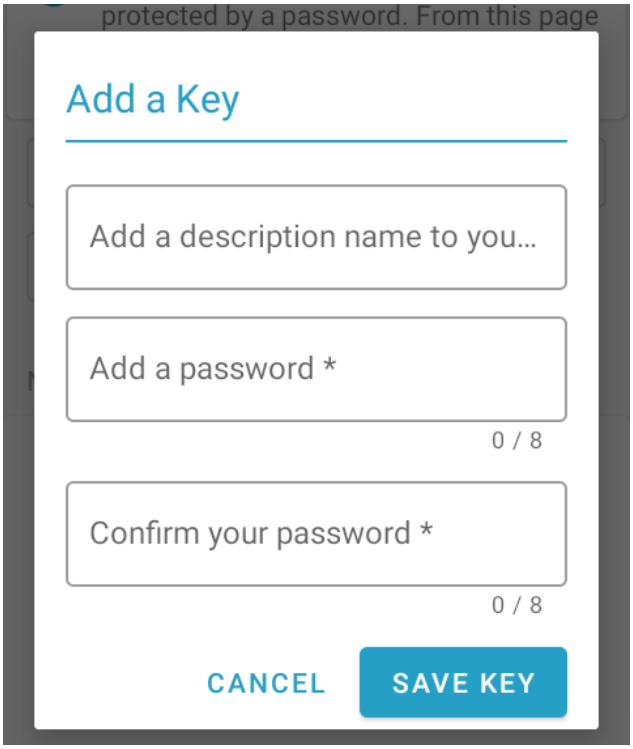
11.2. Adding a password



As seen in the previous page, the Alias is the only way to identify a probe among others. If you install probes in many buildings, it is recommended to identify in the Alias: The building, the floor and the room for example: Elysée-F2-O32 (For building Elysée, Floor # 2 and Office # 32).
The length of the Alias is limited to 40 characters.

Be careful, the length of the password is limited to 8 characters.

Probes with a key recorded in the smartphone will be automatically accessible without having to enter the password.

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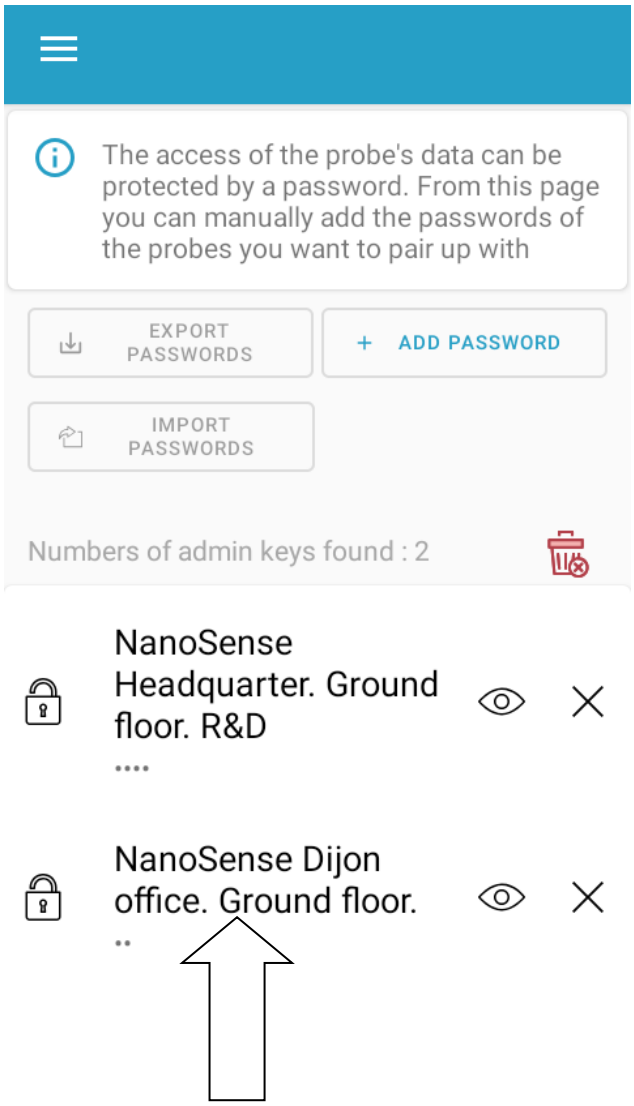
11.3. Changing the Alias



Each PW can be deleted using the cross.

It is possible to change the alias of the probe by clicking on it. Since the password is stored in a probe, it is not possible to change it here. You have to go back to the password tab. If you enter the same alias when saving, the previous one will be overwritten in the smartphone memory.

Please note, if you delete a probe and later wish to access it, the password must be entered to have administrator privileges. The reminder stored in the probe may help you.
If you lost the password, please send a request to the manufacturer.

Be careful, if you change your smartphone, remember to export the PW list to the new smartphone.

Probes with a key recorded in the smartphone will be automatically accessible without having to enter the password.

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12 ANNEX

12.1. VAV

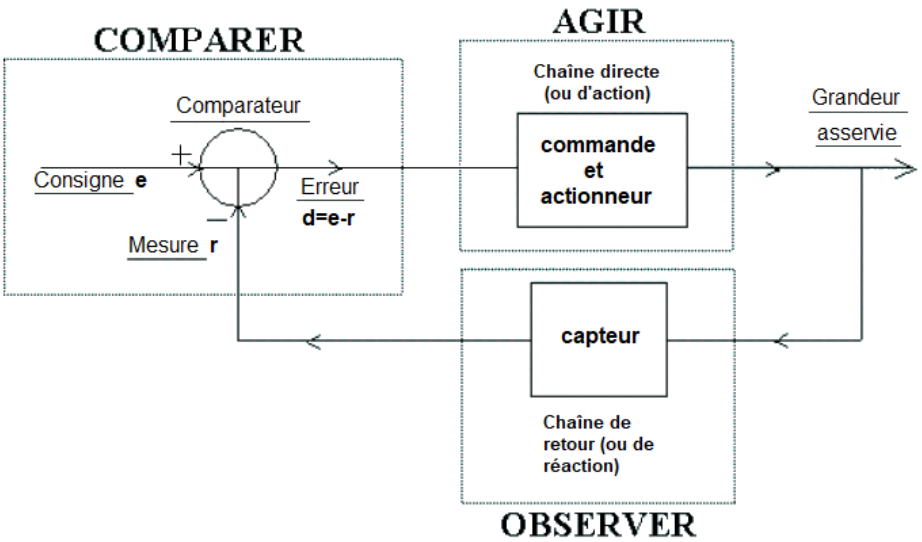
VAV registers (Variable Air Volume)
A VAV is to air flow what a thermostatic valve is to water flow.
A VAV controls the flow rate thanks to a local regulation loop: the regulator compares the measured flow rate with the setpoint flow rate (0-100%), in the event of a deviation it controls the motor which modifies the position of the damper so that the actual flow rate corresponds to the target flow. Thus the air flow is continuously regulated according to the setpoint. Each VAV is set for a maximum flow and the command corresponds to a percentage of that maximum flow. If, for example, a VAV is set to 500m^3 / h maximum, a command of 50% will correspond to a flow rate of 250m^3 / h.

Thus, not only will the air flow correspond to the command but, in addition, in the event of closure, the flow rate of the registers of neighboring rooms, if they are VAV type, will remain constant.
We therefore have a real flow control according to an air flow measurement. It is much more stable and precise than a simple damper driven at an opening angle. This solution is not recommended with a control signal based on measurements but quite appropriate with a PI control signal (see next chapter).

12.2. PI control loop

12.2.1. Ventilation control command

Ideally, ventilation motors or VAVs should be controlled by a real control loop.
A control loop requires a setpoint and a regular comparison between the setpoint and the value reached using a sensor. The greater the difference between the setpoint and the dead end, the greater the control will be (so-called Proportional control). The control loop also includes an integration component (PI) for better accuracy.



The IAQ EP5000 probe is able to control VAVs with a PI control loop.
The IAQ instructions are adjustable using the smartphone application but can also go through the communication system.
If the setpoint is exceeded, the control signal will cause the ventilation to keep the value below the setpoint.

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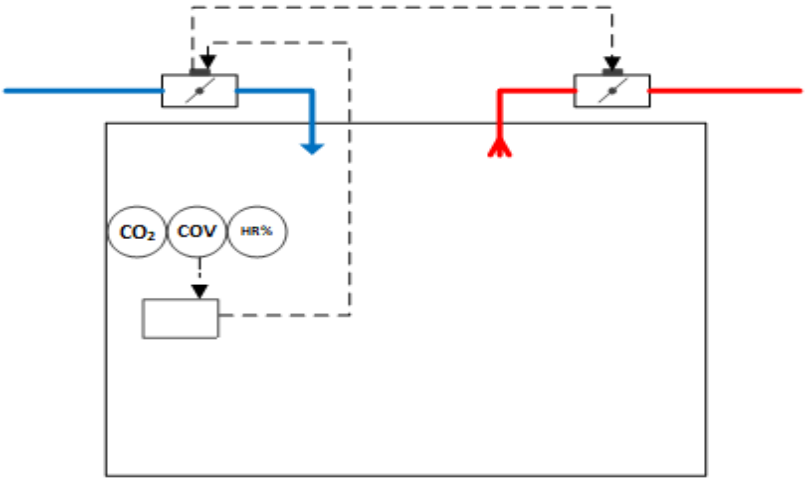
The control signal here will act directly on the air flow if it controls a flow-controlled ventilation motor or VAVs.



12.2.2. Proportional regulation

Imagine a ventilation system with a VAV type damper that modulates the flow rate so that the room receives the volume of just needed air, such that the fresh air just compensates for the CO2 generated by the breathing of the occupants of the room. In this case, the ambient CO2 level would be stable.
Supposing a set point set at 1000ppm. Assuming an initial CO2 rate higher than the setpoint, it is therefore necessary to ventilate.
Supposing the VAV is at 100% of the maximum flow for 1200ppm (200ppm above from the setpoint). Fresh air arrives, the CO2 level drops and reaches 1100ppm. The deviation is then 100ppm and the VAV is only at 50% of the max flow.
Unfortunately, when it reaches 1100ppm, nothing changes: the CO2 level in the room is stabilized and the VAV opening too: it remains open at 50% of the maximum flow.

Why ?
With a flow rate of 50%, it supplies a quantity of fresh air as it exactly compensates the CO2 generated by the occupants of the room. The CO2 remains at 1100ppm, the deviation remains 100ppm above the setpoint, and this deviation results in 50% of the max flow! Everything is stable and will remain so.
It is therefore impossible to achieve the desired 1000ppm! If this were the case, the gap would be zero, the VAV would be closed, the CO2 rate would rise as the occupants continue to breathe, so the gap would not remain zero!
This is the problem of Proportional only regulation: since fresh air is needed, the VAV must be half-open, so a gap must remain. The CO2 rate will stabilize at 1100ppm, instead of the requested 1000ppm.
New idea: could we not reduce the range of CO2 that generates the opening of the register? Returning to the previous situation, if the damper was at 100% of the maximum flow rate above 1100ppm, it would stabilize at 50% of its value for an ambient CO2 level of 1050ppm. This is indeed a possibility: we say that we reduce the proportional band from 200 to 100ppm.
But this solution has its limits: with a too narrow proportional band, the system will start to oscillate, going from too open to too closed, sometimes without being able to stabilize. We say that the system "pumps", unable to stabilize.

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12.2.3. Proportional - Integral (PI) regulation

By acting with a force proportional to the difference between the ambient CO2 level and the setpoint, a difference remains permanently. It is therefore decided that the intervention force will have two components. The first is Proportional force, as above. But a second force completes it: a force linked to the integration of the deviation over time, that is to say a function of the sum of all the deviations continuously measured.
If the CO2 stabilizes at 1100, due to the proportional component, a difference of 100ppm remains. Every "time step", the regulator will measure this difference and add it to the value of a "memory" box. The opening of the register will be given by the sum of the 2 components P and I. As long as the setpoint is not reached, the Integral component will increase, the VAV will open a little more, this time until the setpoint is reached.
Once this is reached, the deviation becomes zero and the integration component is no longer modified (since it adds a value "0"). If the setpoint is exceeded, the deviation will be negative and the integration component will decrease.
But couldn't this integral component work alone? No, it is too slow to react effectively to changes in CO2. It would be necessary to decrease its time step (decrease the "integration time") but then the system becomes unstable. It is indeed the combination of the 2 actions (P and I) that is the most adequate to meet the demand: the **P** component does most of the work, then the **I** component refines over time to converge towards the set value.

12.3. Indication of LEDs in normal operation

The LEDs show the overall synthesis of IAQ (thresholds or physiological impacts on health, cognitivity, respiratory tract irritation and quality of sleep which depend on the combined effects (cocktail effect) of CO2, VOCs, particles, noise and light)

The building health is also synthesized and takes into account: risk of condensation, deposit of particles on cold parts.

This synthesis is materialized by a continuous gradual rising and then descending gradation of breathing type.

The thresholds and the dimming are adjustable via an NFC smartphone and the Android App.

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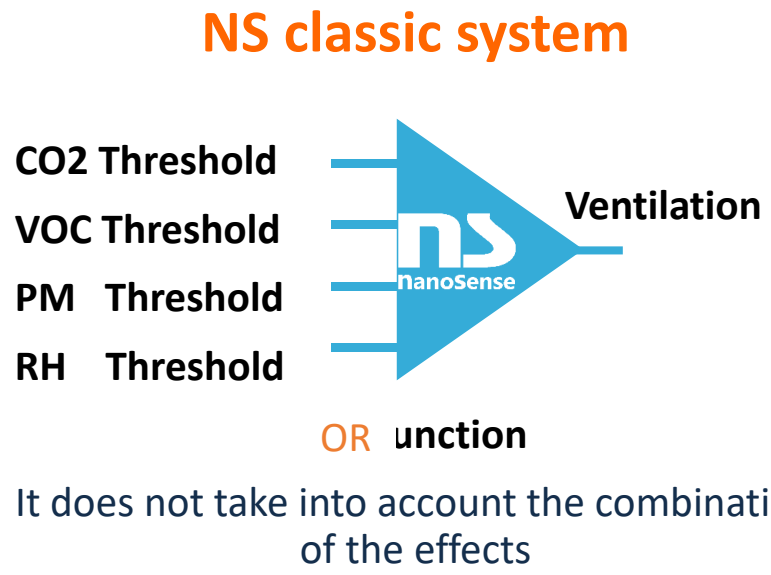
12.3.1. In Measurement thresholds mode



The control of the LEDs is based on the difference between the setpoint (threshold) and the measurement as well as the proportional band.
The proportional band is 10% of readings and 10% RH by default. The proportional band corresponds to a ventilation control of 100%. If for example the CO2 threshold is set at 1000ppm, the ventilation control will be 100% above 1100mm (threshold + 10%).

LEDs Status	Percent of proportional band	
5s cycle	0%	25%
2s cycle	25%	50%
5s cycle	50%	75%
2s cycle	75%	100%

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This results in the following thresholds with the proportional band by default:

LEDs Status	Description
 **5s cycle**	The air quality is ideal. The probe is working perfectly. CO2 < setpoint + 2.5% of setpoint Or VOC < setpoint + 2.5% of setpoint Or PM2.5 < setpoint + 2.5% of setpoint Or RH < setpoint + 2.5% RH
 **2s cycle**	The air quality is acceptable. The probe is working perfectly. CO2 > setpoint + 2.5% of setpoint Or VOC > setpoint + 2.5% of setpoint Or PM2.5 > setpoint + 2.5% of setpoint Or RH > setpoint + 2.5% RH
 **5s cycle**	The air quality is poor. The probe is working perfectly. CO2 > setpoint + 5% of setpoint Or VOC > setpoint + 5% of setpoint Or PM2.5 > setpoint + 5% of setpoint Or RH > setpoint + 5% RH
 **2s cycle**	The air quality is bad. The probe is working perfectly. CO2 > setpoint + 7.5% of setpoint Or VOC > setpoint + 7.5% of setpoint Or PM2.5 > setpoint + 7.5% of setpoint Or RH > setpoint + 7.5% RH

Examples:

	Setpoint	Measures	LED
CO2	1000ppm	1020ppm	 **5s cycle**
COV	500µg/m3	300µg/m3	
PM	25µg/m3	26µg/m3	
HR	80%	75%	

	Setpoint	Measures	LED
CO2	1000ppm	1070ppm	 **5s cycle**
COV	500µg/m3	300µg/m3	
PM	25µg/m3	26µg/m3	
HR	80%	75%	

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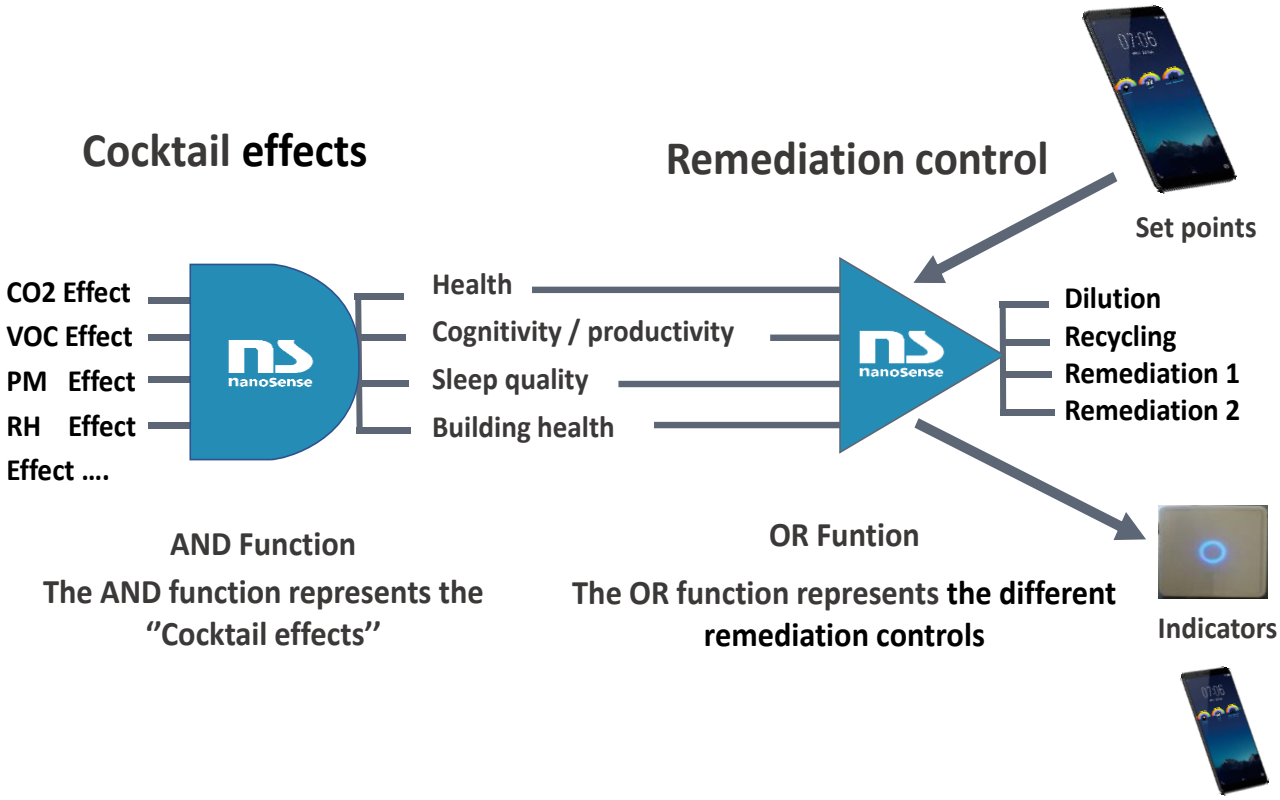
12.3.2. In Physiological Effects Mode



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LEDs Status	Description
 **5s cycle**	The air quality is ideal. The probe is working perfectly. Health Index > Setpoint - 5% Or Cognitivity Index > Setpoint - 10% Or Sleep quality index > Setpoint - 10% Or Respiratory tract irritation > Setpoint - 10% Or Building health index > Setpoint - 10%
 **2s cycle**	The air quality is ideal. The probe is working perfectly. Health Index < Setpoint - 6% Or Cognitivity Index < Setpoint - 12% Or Sleep quality index < Setpoint - 12% Or Respiratory tract irritation < Setpoint - 12% Or Building health index < Setpoint - 12%
 **5s cycle**	The air quality is ideal. The probe is working perfectly. Health Index < Setpoint – 7.5% Or Cognitivity Index < Setpoint - 15% Or Sleep quality index < Setpoint - 15% Or Respiratory tract irritation < Setpoint - 15% Or Building health index < Setpoint - 15%
 **2s cycle**	The air quality is ideal. The probe is working perfectly. Health Index < Setpoint - 10% Or Cognitivity Index < Setpoint - 20% Or Sleep quality index < Setpoint - 20% Or Respiratory tract irritation < Setpoint - 20% Or Building health index < Setpoint - 20%

Examples:

	Setpoint	Index	LED
Cognitivity	82%	80%	 **5s cycle**
Health	90%	81%	
Respiratory tract irritation	80%	71%	
Sleep quality Building	0%	80%	
Building health	70%	65%	

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	Setpoint	Index	LED
Cognitivity	82%	66%	 5s cycle
Health	90%	81%	
Respiratory tract irritation	80%	71%	
Sleep quality Building	0%	80%	
Building health	70%	65%	

12.4. Windows opening LEDs

There are 2 pictograms indicating the opportunity or the danger to open windows on street or backyard facade. Depending on how the probe is installed, each pictogram designates a façade.
There are 2 modes to manage those warnings:

- One is based on comparison between indoor and outdoor air quality physiological effects.
- The other one is based on outdoor air quality level that comply with Well Building Standard (settable with the App)

Those LEDs shall be activated via the App otherwise they will stay Off.
When the probe receives outdoor air quality regarding one or the two building's facades and if the probe is set with the appropriate altitude ("IAQ probe floor" in general setting) and the outdoor probe allocated to the right of left t LEDs, the window LED will provide the following information:

You can open windows on this facade. Outdoor air quality is better than indoor.

It is not recommended to open windows on this facade

12.5. Edge LEDs indications

Registration Required
(POE version only)

Joined (LoRa WAN version)
Pairing (EnOcean)
ZigBee registration

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12.6. Indication of LEDs in case of failure

LEDs indicate failures as follows:

LED code on the front panel	Identification #	Defective FRU
No LED active	NA	Power supply failure suspected or probe power supply board.
Red LED on for 5 seconds		
Followed by a yellow flash	1	Front panel board.
Followed by 2 yellow flashes	2	Single band CO2 sensor module.
Followed by 3 yellow flashes	3	Dual band CO2 sensor module
Followed by 4 yellow flashes	4	VOC sensor module
Followed by 5 yellow flashes	5	Motherboard
Followed by 6 yellow flashes	6	Interconnection board
Followed by 7 yellow flashes	7	Particles sensor board
Followed by 8 yellow flashes	8	Power supply board
Red LED blinking	9	Multiple failures
Alternation Red Blue	10	Perishable sensor reaching the end of life.
All LEDs blinking	11	No communication between front panel and probe. (after 30 seconds)

12.7. Indication in case of LED failure

In case one of the LEDs is detected defective at start up, other LED will stay On all the time. This allow checking visually the defective LED.

The probe will measure and communicate normally. This failure will therefore be transmitted in the Built In Test.

This test is not performed during running, only at start up so if a LED becomes defectives on the way, it will not be detected.

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12.8. Default set points

As set points have a great influence on LED display, it is important to know the default values.

Default values can be seen as a reference as they will be lost after a setting and there is no magic button to comeback to default.

In Measurement thresholds mode (default):

Setpoint	Comfort (default)	Eco	Night
T°	18.5°C	17°C	17°C
CO2	1000ppm	1500ppm	1300ppm
VOCt	300 µg/m^3	800 µg/m^3	1300 µg/m^3
NOx	300 µg/m^3	800 µg/m^3	1300 µg/m^3
O3	300 µg/m^3	800 µg/m^3	1300 µg/m^3
PM2.5	20 µg/m^3	40 µg/m^3	40 µg/m^3
Humidity High	75%	95%	95%
Humidity Low	40%	30%	25%

Note that the night mode is not by default controlled by the probe's embedded light sensor.

In Physiological Effects Mode

Setpoint	Comfort	Eco	Night
Cognitivity	80%	60%	50%
Health	80%	60%	50%
Respiratory tract irritation	90%	70%	60%
Quality of sleep	80%	60%	50%
Odor	80%	50%	40%

Building health	80%

Default values can be changed anytime by manufacturer without warning.

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