User Guide | COMFORT LwM2M | NB-IoT / LTE-Cat-M1

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PRODUCT INFORMATION AND REGULATORY INFORMATION

💡 This User Guide applies to the following product:

COMFORT
Reference : ARF8394AA
APP Version: V1.2

INFORMATIONS DOCUMENT	
Title	COMFORT LwM2M - User Guide
Type	User Guide
Version	1.0.0

DOCUMENTATION GUIDE

PREAMBLE

DISCLAIMER

TECHNICAL SUPPORT

RECOMMENDATIONS

INTRODUCTION

https://s3-us-west-2.amazonaws.com/secure.notion-static.com/dd78f2a8-7180-4738-8756-e1c
93b8b1b37/EU_declaration_of_conformity_(COMFORT_ARF8394A).pdf

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1. PRODUCT OVERVIEW

1.1. General description

The Adeunis COMFORT is a ready-to-use IoT sensor that meets the needs of users for indoor monitoring of **temperature and ambient humidity**. This product is also equipped with an NFC interface, which allows for quick and easy configuration with a smartphone.

Thermal comfort data are transmitted via a cellular IoT network (**NB-IoT** or **LTE-Cat-M1**) to a server. No additional equipment (gateway, router, etc.) is required for data transmission.

The COMFORT integrates the **LwM2M** (Lightweight Machine to Machine) standard, which enables users to achieve integration and maintenance savings, reduce deployment costs, strengthen sensor fleet security, and optimize product battery life.

The product operates autonomously and intermittently. It measures temperature and humidity data from the onboard sensors in "sleep" mode (PSM) and stores the data in its local memory. It then wakes up at preconfigured intervals to transmit the stored data using the LwM2M protocol.

The product is powered by a replaceable battery pack and has been designed to work for over 15 years without maintenance (device configuration : 1 sampling every 60 mins, 1 transmission every 60 mins, LEDs enabled).

COMFORT Serenity	LPWAN Networks	ANTENNA	SERVER
Data acquisition and transmission in the field	Data transmission	Data reception and transmission to server	Data processing ans real-time transmission to associated applications
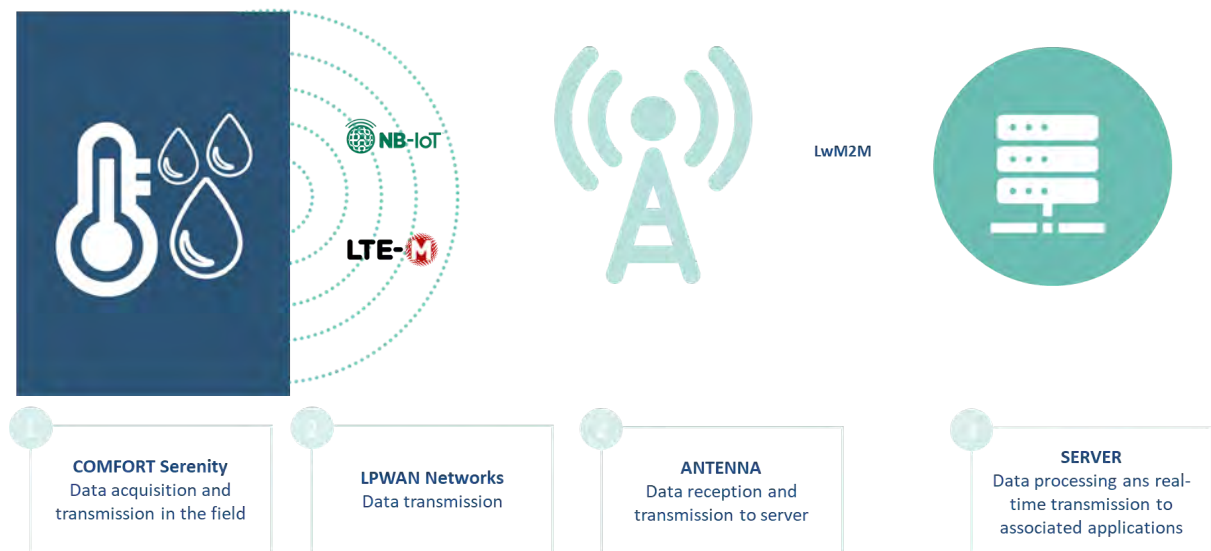
1.2. Features

- **2-in-1 Sensor:** Temperature, humidity

- **Global Cellular Compatibility:** LTE-Cat-M1 and NB-IoT

- **Simplified Application Configuration:** Remotely or locally via the NFC IoT Configurator application

- **Data Transmission Modes:** Periodic and/or event-based (threshold exceeded and/or threshold fallen below)

- **Error/Fault Management:** Configuration error, low battery

- **Data Timestamping:** UTC timestamp, remote synchronization via the network

- **Remote Operational Maintenance:** LwM2M defines all device management operations for a sensor fleet (command sending, configuration read/write, firmware update)

- **Multi-Platform Integration:** Product data format standardization (LwM2M) that IoT platforms can interpret without the need for specific development

- **Bootstrap Support:** Allows the product, when powered on for the first time (or after a factory reset), to download its secret codes and configuration

- **Battery-Powered Autonomous Product:** Powered by a replaceable internal dual-battery pack designed to operate for multiple years without replacement (refer to the autonomy table). The product can also be powered by an external power supply (not provided with the product).

- **Autonomy Optimization:** Data logging and blackout (deactivation of data transmission for a given period)

- **Made in France:** Product designed and manufactured in France

> 📌 **NOTE**
>
> To address different use cases, the COMFORT product also supports the MQTT (Message Queuing Telemetry Transport) communication protocol.
>
> **To use the product with the MQTT protocol, refer to the dedicated User Guide.**

1.3. Package contents

The product is delivered in a cardboard packaging containing the following components: Front face, back face, electronic board, and ER18505H-2 dual battery pack.

1.4. Casing presentation

Opening for casing

LEDs (network attachment)　　　Startup button　　　Mounting screw locations　　　Physical location for external block wires

NFC antenna
positionning
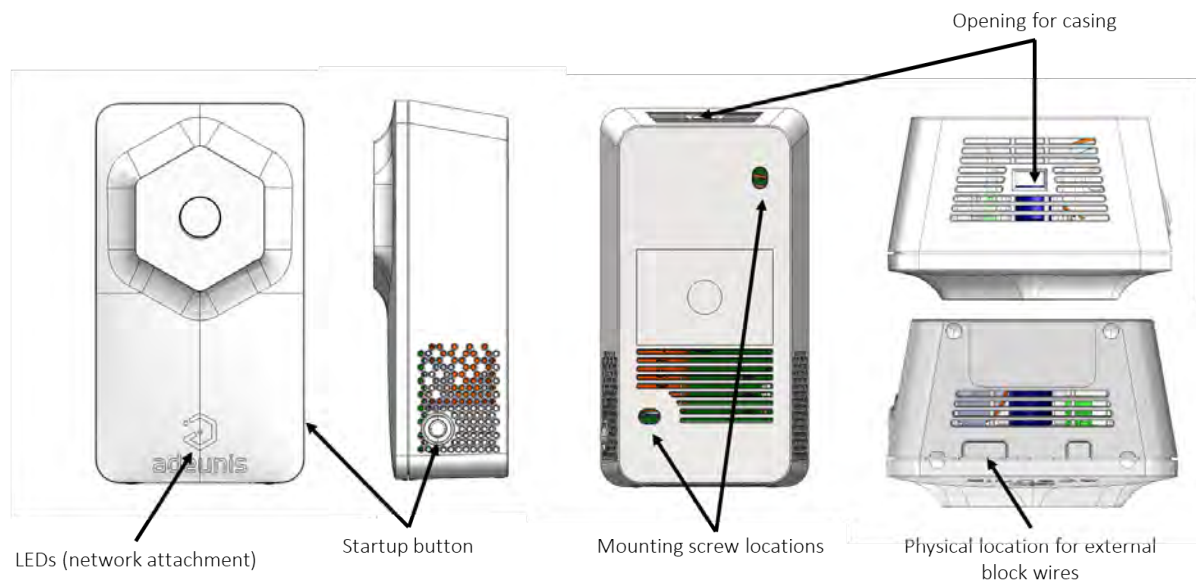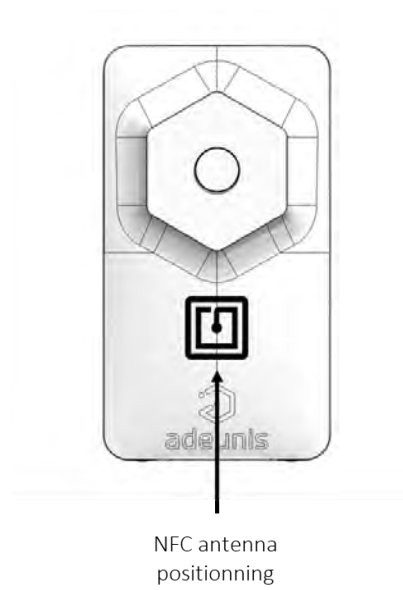
1.5. Dimensions
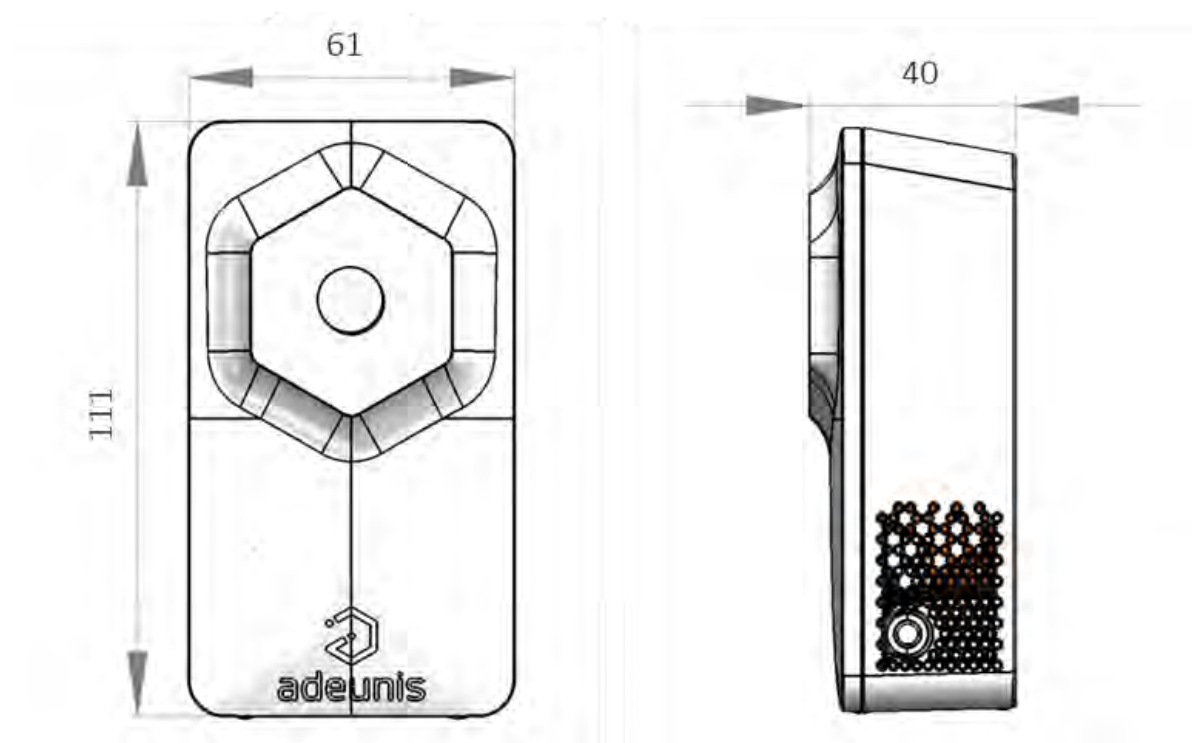
Values in millimeters

1.6. Push button

Function	Action
Product Startup	Long button press (> 5 seconds) when the product is in PARK mode (i.e., turned off)

1.7. LEDs indicator

PRODUCT STATUS	**RED LED status**	ORANGE LED status	GREEN LED status
Product in PARK mode (i.e., turned off)	OFF	OFF	OFF
Product startup	OFF	OFF	Flashing 5 cycles 100 ms ON / 100 ms OFF
Product startup failure	ON for 15 sec	OFF	OFF
Network attachment process in progress	Flashing 50 ms ON / 1 sec OFF OFF	OFF	Flashing 50 ms ON / 1 sec OFF (after RED LED)
Successful network attachment	OFF	OFF	ON for 5 sec
Network attachment failure	O for 5 sec	OFF	OFF
SIM not detected at product startup	Flashing 1 sec ON / 500 ms OFF for 30 sec	OFF	OFF
Temporary emission suspension (blackout period)	OFF	OFF	OFF
Low battery level	Flashing 500 ms ON / 500 ms OFF every 1 min	OFF	OFF

1.8. Power supply

1.8.1 Power source

The COMFORT can be powered by a double-pack of FANSO Li-SOCl2 ER18505H-2 batteries or by an external power supply connected to a 2-pin terminal block (external power supply not provided).

- When both batteries and external power supply are used simultaneously, the external power supply takes priority.

- When the external power supply is used, the product operates with the same cycle as when powered by the double-pack batteries (PSM mode).

The certified external power supply recommended by Adeunis for use with the product is **GS05E-USB - Wall Mount AC Adapters 5W 5V 1A W/Euro Plug WallMount USB Output from Mean Well**.

If another external power supply model is selected to work with the product, it must strictly adhere to the electrical specifications mentioned above and comply with the standards EN/IEC 62368-1 and EN

61000-3-2, EN 61000-4-2, EN 61000-4-4, EN 61000-4-5. The user must independently verify the compatibility of this power supply with the product.

1.8.2 Low Battery Management

1.8.2.1 Detection mode

When the product detects that the battery is not capable of delivering the required energy for transmission (due to extreme temperatures or end of battery life), it waits until it is capable of transmitting. If it detects that the delay exceeds 1 minute, it notifies the user that the battery level is low.
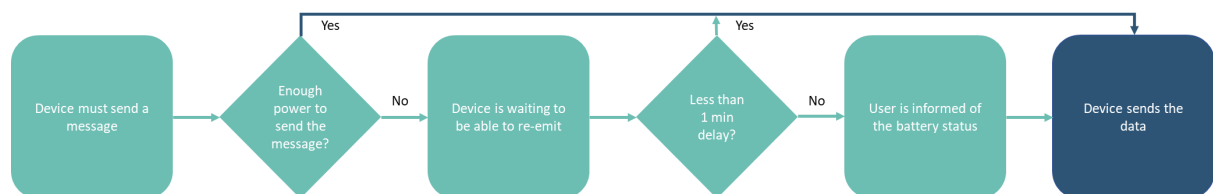
1.8.2.2 User information

The user can be informed of the product's battery status either locally through the NFC IoT Configurator application or the LED display, or remotely.

The low battery indication automatically changes when the battery is replaced or when temperature conditions are favorable for proper battery operation.

User Information through visual indication on the product's LEDs:

The red LED flashes every 60 seconds for 500 ms if the product's battery level is low.

User Information through the NFC IoT Configurator application:

Go to the "DIAGNOSTIC" section of the sensor to check the battery status as "OK" or "LOW
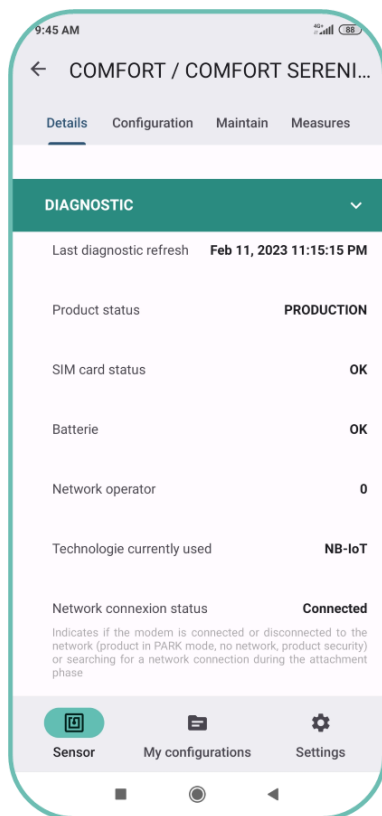
User Information through an LwM2M server:

The LwM2M server can request the product to report its battery status. To do this, the user needs to trigger a READ operation on the "error code" resource via the server, which will return the current value of this resource, or an OBSERVE operation can be initiated.

URI	Object name	Resource Name	Access type	Unit	Description
/3/0/11	Device	Error code	R	-	0= No error 1= Low battery

1.8.3 Changing the double battery pack

When the low battery indicator is activated, it is possible to change the internal battery pack of the enclosure.

It is important to use the same battery reference, namely ER18505-2.

PROCEDURE FOR CHANGING THE DOUBLE BATTERY PACK:

1. Insert a flathead screwdriver tilted towards the front of the enclosure into the opening at the top and press. The enclosure will open in two and the front panel will detach.

Face avant
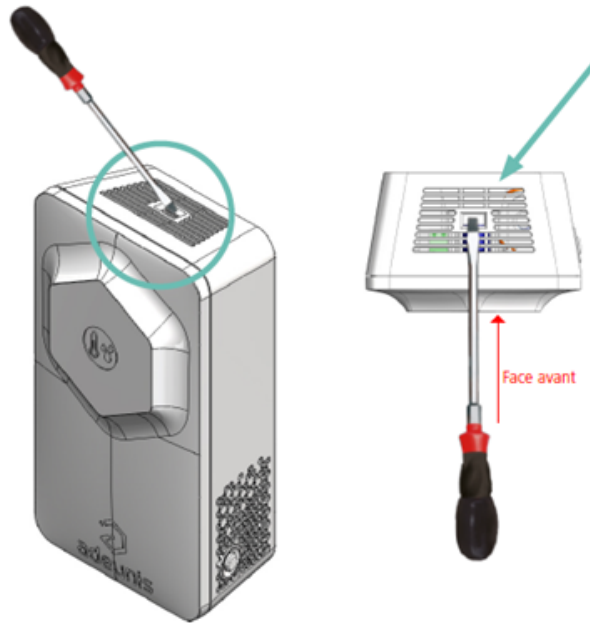
CAUTION: Press gently to avoid damaging the enclosure

2. Remove the current battery and replace it with the new one, making sure to observe the polarity indicated on the electronic board and the battery model.
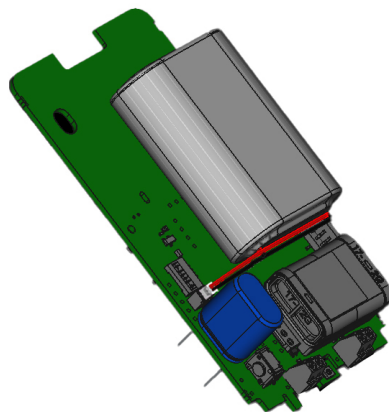
3. To close the enclosure, insert the bottom of the front panel first and snap the top of the enclosure
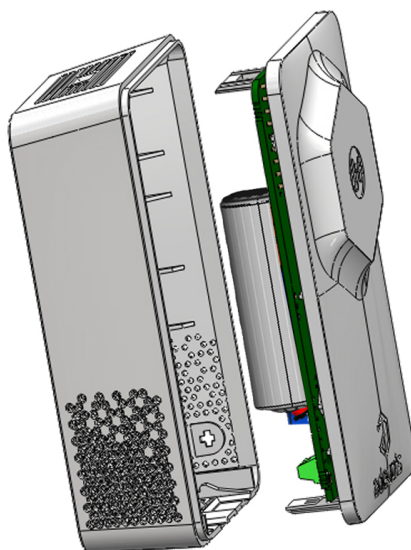
After this battery replacement procedure, the product will automatically resume its "normal" operation and clear the low battery indicators (status and LED).

1.8.4 Connecting the external power supply

1. Insert a flathead screwdriver tilted towards the front of the enclosure into the opening at the top and press. The enclosure will open in two and the front panel will detach

Face avant
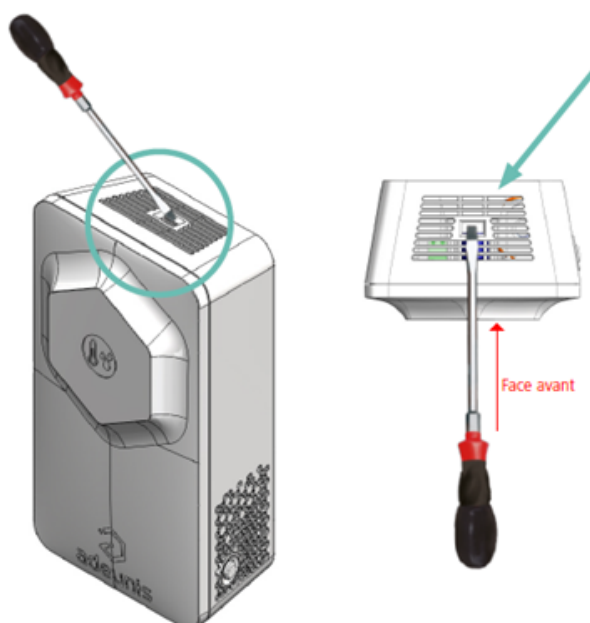
CAUTION: Press gently to avoid damaging the enclosure

2. Connect the external power supply using the dedicated connector.
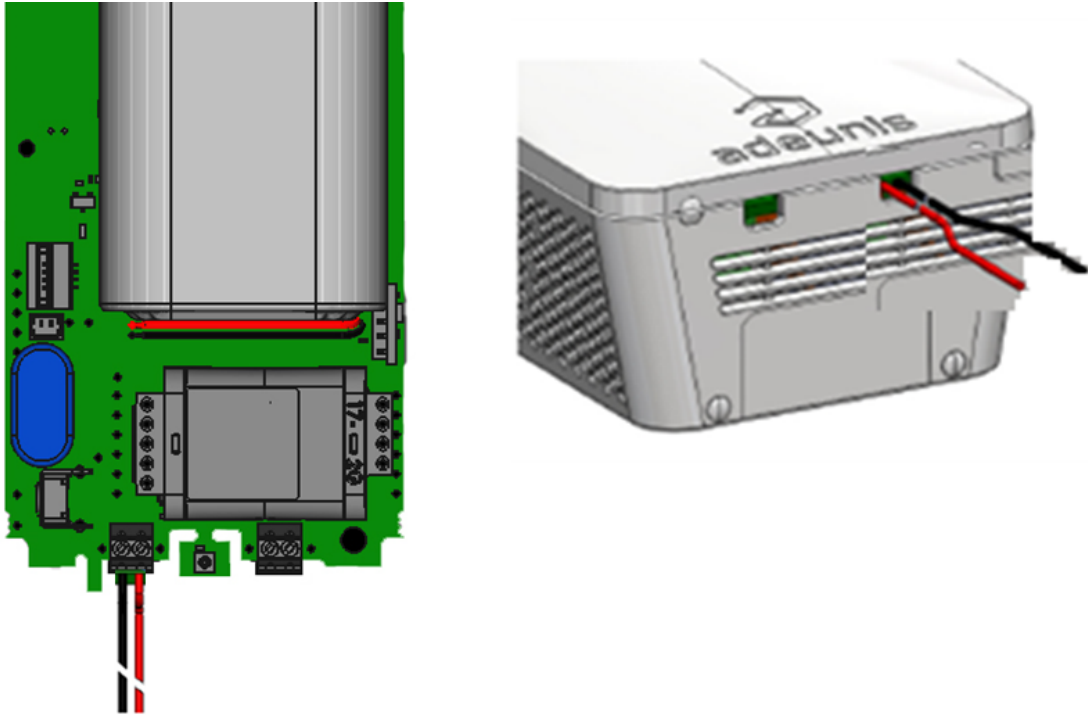
3. To close the enclosure, insert the bottom of the front panel first and snap the top of the enclosure
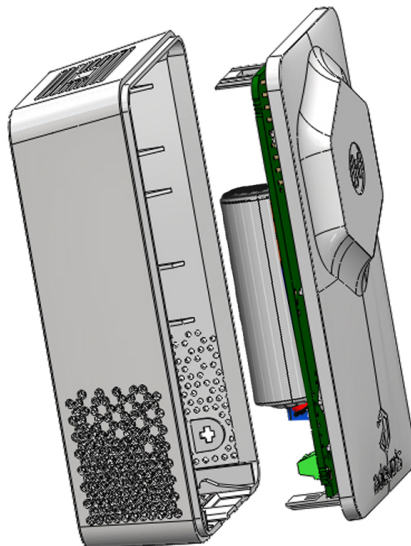
2. TECHNICAL SPECIFICATIONS

2.1 General characteristics

Mechanical characteristics	
Dimensions	111 x 61 x 40 mm
Weight	140 g
Enclosure	IP20
Mounting system	Wall-mounted or freestanding

Electrical characteristics	
Batter power	Battery type: Replaceable Double Pack-Pile FANSO Li-SOCl2 - ER18505H-2 Nominal voltage: 3.6 V Maximum current: 70 mA Capacity: 8200 mAh
External power supply (not included)	Input range: 4.2 V to 6.0 V Maximum current:6700 mA

Operating conditions	
Recommended operating range	+0°C to +50°C when powered by a double pack-pile +0°C to +40°C when powered by an external power supply
Operating temperature range	10°C to +70°C

2.2 Connectivity

2.2.1 Compatible networks and protocols

Connectivity	
SIM Card	Nano SIM 4FF Class C (1.8 V)
Cellular Standard	3GPP LTE Version 13
Cellular IoT Networks	NB-IoT, LTE-Cat-M1
Data Transfer Protocol	LwM2M, MQTT (refer to the dedicated User Guide to use the product with MQTT protocol)

2.2.2 Data Consumption Estimation

This section presents data consumption estimates for the COMFORT based on the chosen communication mode and the frequency of data scanning and transmission.

📌 **NOTE 1**
Product/server communications such as lifetime, keep alive, time synchronization, server registration, and firmware updates are not considered in the data consumption estimates below.

NOTE 2
Data consumption is significantly reduced when using data history in "PUSH" mode.

NOTE 3
Data consumption is equivalent regardless of the technology (NB-IoT or LTE-Cat-M1) used by the product to connect to the cellular network.

Product/Server Communication Mode	Data Sent per Transmission	Monthly Data Consumption for Transmission Every 10 Minutes	Monthly Data Consumption for Transmission Every Hour
"OBSERVE" Mode	1 value of: - Temperature - Humidity	1240 ko	**320 ko** Default configuration of the product in "OBSERVE" mode (1 measurement/transmission per hour)
"OBSERVE" Mode + "reliable notifications" option activated	1 value of: - Temperature - Humidity	3000 ko	510 ko
"PUSH" Mode without data history	1 value of: - Temperature - Humidity	1650 ko	280 ko
"PUSH" Mode with data history	6 values of: - Temperature - Humidity	2550 ko	**430 ko** Default configuration of the product in "PUSH" mode (1 measurement/transmission per hour)

2.3 RF specifications

RF specifications	NB-IoT	LTE-Cat-M1
Frequency Bands	B1, B2, B3, B4, B5, B8, B12, B13, B17, B19, B20, B25, B26, B28, B66	B1, B2, B3, B4, B5, B8, B12, B13, B18, B19, B20, B25, B26, B28, B66
Max Transmit Power	+23 dBm	+23 dBm
Tx Bandwidth	200 kHz	1.4 Mhz
Theoretical Data Rate	65 Kbps (UL) 30 kbps (DL)	375 kbps (UL) 300 kbps (DL)

RF specifications	NB-IoT	LTE-Cat-M1
Sensitivity	> -108 dBm -113 dBm typ.	> -103 dBm -107 dBm typ.
Power Consumption Reduction Feature	PSM	PSM

2.4 Updates

Application configuration	Configuration via NFC using the Adeunis NFC IoT Configurator mobile application on Android or remotely
Firmware update	Remote firmware update for both application firmware and modem firmware (FOTA)

2.5 Integrated sensor specifications

Specifications		Value
Temperature	Technology	CMOSens
	Recommended Operating Range	-0°C / +65°C
	Accuracy	± 0.2°C typ. ± 1°C max.
	Typical Resolution	0.01°C
Humidity	Technology	CMOSens
	Recommended Operating Range	10% / 90% HR
	Accuracy	± 2% HR typ. ± 4.5% HR max.
	Typical Resolution	0.01 % HR
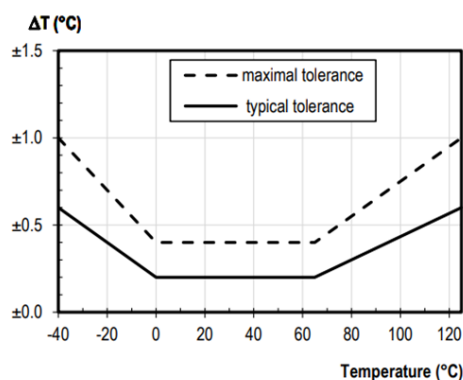
Figure 1 : Temperature measurement accuracy
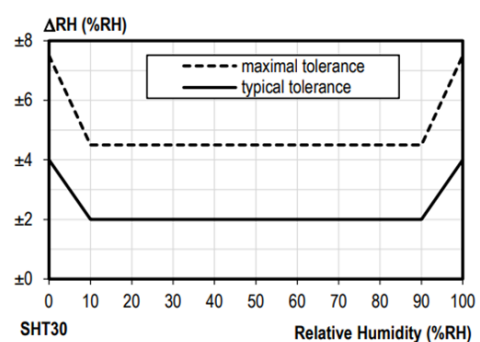
Figure 2 : Relative humidity tolerance at 25°C

3. PRODUCT AUTONOMY

This chapter presents estimates of the autonomy of COMFORT based on the selected network type, data transmission periodicity and network quality.

To ensure proper product functioning and autonomy, Adeunis strongly recommends:

- Selecting an operator that supports PSM mode on its own network. Note that in the case of a roaming connection, Adeunis recommends verifying that PSM mode is also guaranteed on other operator networks. For more information on PSM mode, please refer to the dedicated section

- Selecting the technology (NB-IoT or LTE-Cat-M1) that the product will use to connect to the cellular network

- Limiting the number of frequency bands used by the product to connect to the cellular network (for example, in France, only band 20 is used by operators)

- Favoring LwM2M servers with a connection ID

- Favoring the use of "PUSH" mode for product-server communication

- Limiting the number of OBSERVATIONS in the case of using "OBSERVE" mode

3.1. Battery Life Estimates in "OBSERVE" Mode

3.1.1 NB-IoT Network

The two battery life tables below have been estimated based on a product configured to communicate with an LwM2M server in "OBSERVE" mode and connected to an NB-IoT network with PSM (Power Saving Mode) support. Please note that the product's battery life may vary depending on the selected operator.

Sampling period	Transmission period	Good Network Autonomy (years)	Poor Network Autonomy (years)
Every 10 minutes	Every 10 minutes	13.2	1
Every hour (default product configuration)	Every hour (default product configuration)	> 15	5.3
Every 2 hours	Every 2 hours	> 15	9.9
Every 6 hours	Every 6 hours	> 15	> 15
Every 12 hours	Every 12 hours	> 15	> 15
Every 24 hours	Every 24 hours	> 15	> 15

3.1.2 LTE-Cat-M1 Network

The two autonomy tables below were estimated based on a product configured to communicate with an LwM2M server in "OBSERVE" mode and connected to an LTE-Cat-M1 network with PSM mode

support.

Please note that the product's autonomy may vary depending on the selected operator.

Sampling period	Transmission period	Good Network Autonomy (years)	Poor Network Autonomy (years)
Every 10 minutes	Every 10 minutes	9.2	3.4
Every hour (default product configuration)	Every hour (default product configuration)	> 15	> 15
Every 2 hours	Every 2 hours	> 15	> 15
Every 6 hours	Every 6 hours	> 15	> 15
Every 12 hours	Every 12 hours	> 15	> 15
Every 24 hours	Every 24 hours	> 15	> 15

> 📌 **NOTE 1 - Evaluation Conditions**
>
> The autonomy values below are estimates made under certain usage and environmental conditions (maximum product storage of 1 year before use, calculations performed at an indoor temperature of 25°C).
>
> They do not represent any commitment on the part of Adeunis.
>
> The battery life depends on numerous non-predictive network parameters, including:
>
> - The quality of the signal emitted by the antenna
>
> - The transmission power required by the product to send a message

3.2. Battery Life Estimates in "PUSH" Mode

3.2.1 NB-IoT Network

The two autonomy tables below were estimated based on a product configured to communicate with an LwM2M server in "PUSH" mode and connected to an NB-IoT network with PSM mode support.
Please note that the product's autonomy may vary depending on the selected operator.

Sampling period	Transmission period	Good Network Autonomy (years)	Poor Network Autonomy (years)
Every 10 minutes	Every 10 minutes	> 15	< 1
Every 10 minutes	Every hour (historization)	> 15	3.4

Sampling period	Transmission period	Good Network Autonomy (years)	Poor Network Autonomy (years)
Every hour (default product configuration)	Every hour (default product configuration)	> 15	3.4
Every hour	Every 6 hours (historization)	> 15	> 15

3.2.2 LTE-Cat-M1 Network

The two autonomy tables below were estimated based on a product configured to communicate with an LwM2M server in "PUSH" mode and connected to an LTE-Cat-M1 network with PSM mode support. Please note that the product's autonomy may vary depending on the selected operator.

Sampling period	Transmission period	Good Network Autonomy (years)	Poor Network Autonomy (years)
Every 10 minutes	Every 10 minutes	7.8	3.6
Every 10 minutes	Every hour (historization)	> 15	> 15
Every hour (default product configuration)	Every hour (default product configuration)	> 15	> 15
Every hour	Every 6 hours (historization)	> 15	> 15

📌 **NOTE 1 - Evaluation Conditions**
The autonomy values below are estimates made under certain usage and environmental conditions (maximum product storage of 1 year before use, calculations performed at an indoor temperature of 25°C).
They do not represent any commitment on the part of Adeunis.
The battery life depends on numerous non-predictive network parameters, including:

- The quality of the signal emitted by the antenna

- The transmission power required by the product to send a message

NOTE 2 - Optimizing Battery Life by Enabling a Blackout Period
Configuring a blackout period for the main functions allows for optimizing the product's autonomy by 10% to 20%.

3.3. PSM mode support

The COMFORT product supports the PSM (Power Saving Mode).

The main advantage of PSM mode is that it allows the product to operate for extended periods with reduced power consumption.

- The product periodically enters a prolonged inactive phase during which it is disconnected from the network. During these periods, the sensor does not receive signals from the network and does not send data. This significantly saves battery power as the product does not need to maintain a continuous connection to the cellular network.

- When the product needs to send data, it exits PSM mode and temporarily rejoins the network. It establishes a connection with the base station and transmits the collected data.

- Once the data is transmitted, the product returns to a low-power consumption state.
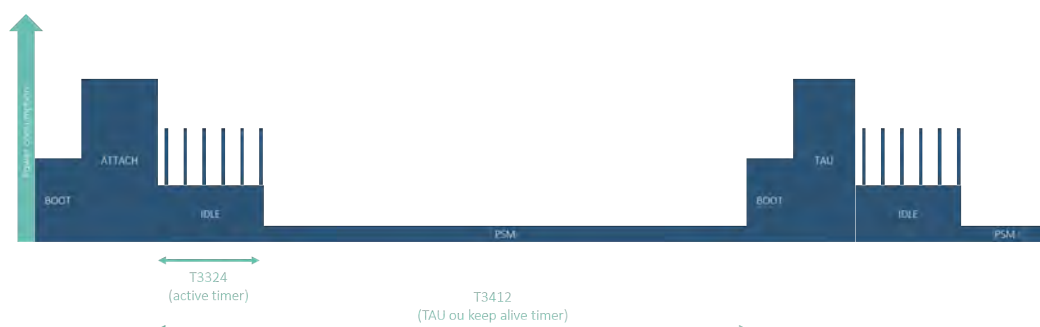
The user can configure the following PSM parameters via the **NFC IoT Configurator application**:

- The period during which the product is reachable by the network to receive downlink data (T3324)

- The deep sleep period during which the product remains attached to the network but is unreachable (T3412)

> 📱 Go to the "CONFIGURATION" menu of the sensor **=>** Select the "NETWORK" section **=>** Configure the "T3412 Multiplier," "T3412 Value," "T3324 Multiplier" and "T3324 Value" parameters **=>** Apply the new configuration to the product via NFC.

Please note that while the product indicates the desired reachability period and the PSM period to the network, these trigger values (T3324 and T3412) can be modified by the network during the attachment procedure or when updating its location (TAU).

At any time, the user can check the trigger values (T3324 and T3412) on the **NFC IoT Configurator application**.

Go to the "DETAILS" menu of the sensor **=>** Select the "DIAGNOSTIC" section **=>** Monitor the "T3412" and "T3324" parameter values

NOTE
If the T3324 value displayed on the application is -1, it means that the network to which the product is connected does not allow access to PSM mode.

4. PRODUCT SETUP

4.1 NFC IoT Configurator App

NFC IoT Configurator is an Android application for mobile/tablet that allows configuring the network, server, and application parameters of the COMFORT product through an NFC interface.

NFC antenna positionning

1. Download the application for free from the Play Store

https ://play.google.com/store/apps/details ?id=com.adeunis.nfcconfigurator

2. Enable NFC on your smartphone and launch the NFC IoT Configurator application

3. Place your smartphone against the product. The Android application recognizes the product and reads the information it contains

4. The product's current information and configuration are automatically displayed on the NFC IoT Configurator application

5. Modify the product's configuration quickly and intuitively if necessary, using the various drop-down menus in the application

6. Apply the new configuration to the product by pressing the "Apply Changes" button on the NFC IoT Configurator application
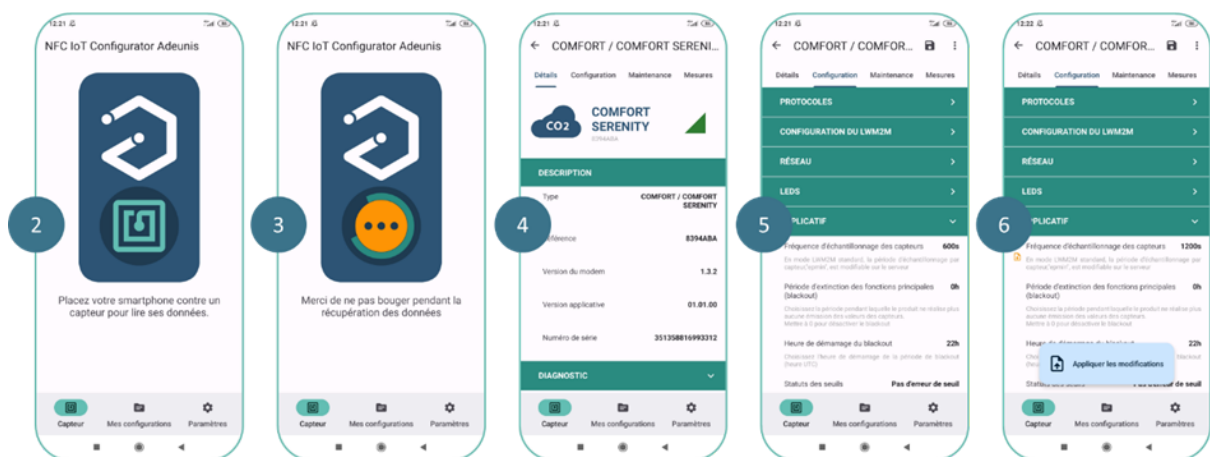
The application also allows saving, exporting, and importing an application configuration for quick duplication onto other products.

📌 **NOTE 1**

The use of the NFC antenna has an impact on the product's battery life. To preserve battery autonomy, it is preferable to only bring the smartphone close to the NFC antenna of the COMFORT product when performing a read/write operation. Once the read/write operation is complete, remember to move the smartphone away from the NFC antenna of the product.

NOTE 2

The sensor is protected against unauthorized external access by an NFC security key consisting of 8 alphanumeric characters. Therefore, only authorized individuals can modify the sensor's configuration through this interface.

The NFC security key of the sensor can be changed by the user after the initial connection. If the security key of a sensor is changed, the new key must also be entered in the application settings to allow it to continue communicating with the sensor.

4.2 Product operating modes

The product has 2 operating modes
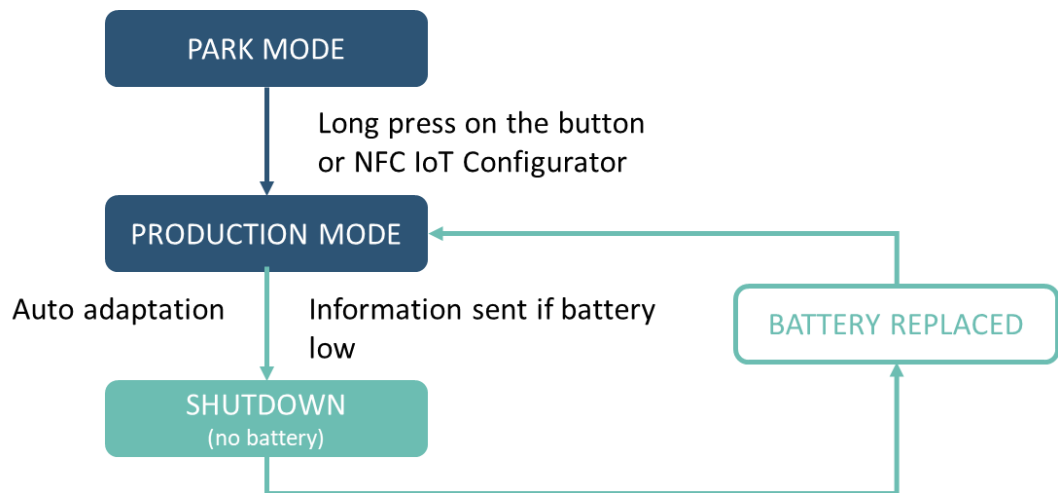
4.2.1 PARK Mode

The product is delivered in PARK mode, where it is in standby mode, and its consumption is minimal.

The NFC interface of the product remains active to allow the user to read and modify the product's configuration through the **NFC IoT Configurator application**.

4.2.2 PRODUCTION Mode

This mode allows the product to function in its final use.

The NFC interface of the product is active to allow the user to read and modify the product's configuration through the **NFC IoT Configurator application** at any time.

4.3 SIM Card Installation

SIM CARD INSTALLATION PROCEDURE:

1. Verify that the product is in PARK mode using the NFC IoT Configurator application

2. Open the casing

3. Detach the electronic card from the front face of the casing

4. Carefully slide the metal cover from the "LOCK" position to the "OPEN" position
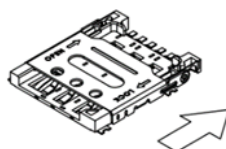
5. Open the metal cover to allow for the insertion of the Nano SIM card
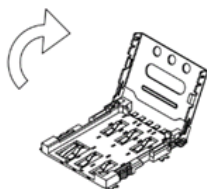
6. Place the Nano SIM card against the contacts, with the chip facing down
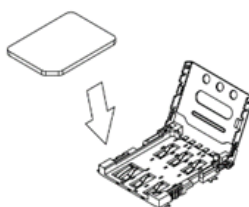
7. Close the metal cover and slide it to the "LOCK" position
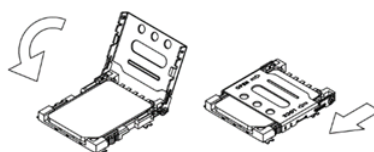
8. Place the electronic card back into the front face of the casing

3. Close the casing

CAUTION

Make sure the product is in PARK mode when inserting or removing a SIM card. Inserting or removing the SIM card with the product powered on can damage it.

> 📌 **NOTE**
> Configuring a PIN code is not supported in the COMFORT product.

4.4 Using the "Quick Start" Function

The **NFC IoT Configurator** app offers users a "Quick Start" function for the COMFORT product, allowing them to configure the server URI, network connection preferences, and initiate an automatic startup of the product (transition from PARC mode to PRODUCTION mode) with just 3 clicks.

Once in PRODUCTION mode, the COMFORT product will communicate with the LwM2M server in "OBSERVE" mode, following its default application configuration:

Application parameters	Default configuration
Sensor Sampling Frequency	3600 sec
Transmission Frequency	3600 sec
Temporary Emission Suspension (blackout)	Disabled
Alarm Mode for High and/or Low Threshold Detection for Temperature, Humidity	Disabled
LEDs Operating Mode	Enabled - 100%

CAUTION

Ensure that the COMFORT product contains a Nano SIM card before using the "Quick Start" function. If the product fails to detect a SIM card during startup, the red LED will blink for 30 seconds, and the product will automatically return to PARC mode.

📌 No data will be sent to the LwM2M server until the user programs an OBSERVE operation or triggers a READ operation on one or more resources.

The Quick Start function is automatically offered to the user during the initial connection of the product to the NFC IoT Configurator app.
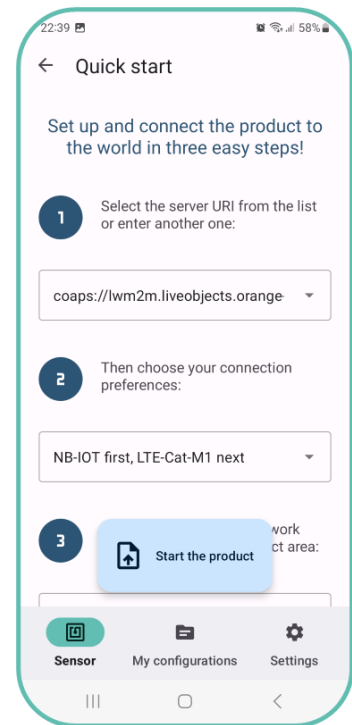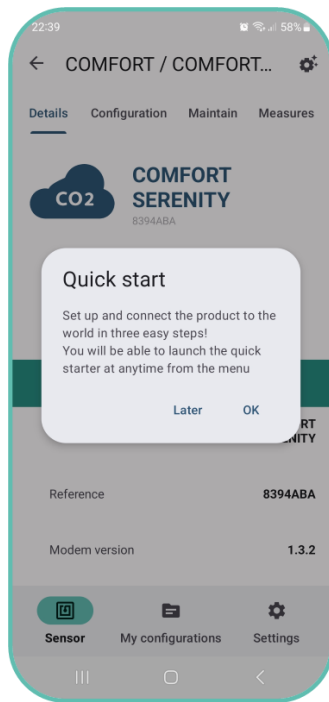
> 📱 Subsequently, the user will be able to access the Quick Start function of the NFC IoT Configurator app from the secondary menu in the "DETAILS" section of the sensor.

4.5 Other product startup modes

In order to use the other startup modes of the product, the user must have previously configured the server and network parameters of the product using the NFC IoT Configurator application.

Refer to the following sections of this User Guide:

- **Section 5.1 "Server-related parameter configuration"**
- **Section 5.2 "Cellular network-related parameter configuration"**

4.5.1 Product startup via push button

The startup via push button is performed by pressing and holding the side button of the product for more than 5 seconds.

The green LED will light up to indicate the detection of the button press.

Start-up button

4.5.2 Startup of the product via NFC IoT Configurator app

> Go to the "CONFIGURATION" menu of the sensor **=>** Select the "PRODUCT ACTIVATION" section **=>** Enable "PRODUCTION" mode **=>** Apply the new configuration to the product via NFC.

The green LED then flashes rapidly during the mode change phase (rapid blinking of 5 cycles with 100 ms ON / 100 ms OFF).

In case of a faulty product, the red LED will light up for 15 seconds, and then the product will reboot.

Once the product is configured in PRODUCTION mode, it will immediately attempt to attach to the network in order to take measurements and communicate them to a server.

4.6 Network attachment

4.6.1 Startup Network Attachment and Configuration

The product performs a network attachment phase at startup (when transitioning to PRODUCTION mode).

4.6.1.1 Automatic Network Attachment

If a single-operator Nano SIM card is inserted into the product, it will automatically attach to the network.

If a multi-operator or multi-technology Nano SIM card is inserted into the product, it will automatically search and select the best operator or technology at product startup (based on the list of operators supported by the SIM card).

During the network attachment process, the green and red LEDs will alternately blink for 50 ms every second.
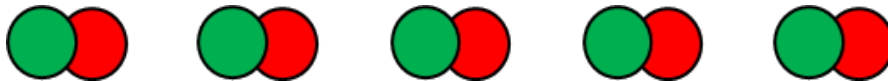
If the network attachment fails, the red LED will stay on for 5 seconds. By default, the product will attempt 2 network attachments every 12 hours. This mechanism helps to preserve the product's battery life in case of a poor network connection. These 2 parameters (number of network attachment attempts and waiting time between two network attachment attempts) can be configured via the **NFC IoT Configurator app**.

As long as the product has not been attached to the network at least once, for each failed attachment attempt, the red LED will stay on for 5 seconds.

4.6.1.2 Manual Network Attachment

Once the network attachment is successful, the user can choose to manually attach to a specific operator via the **NFC IoT Configurator app.**

> Go to the "CONFIGURATION" menu of the sensor **=>** Select the "NETWORK" section **=>** Configure the "Network Selection" parameter to manual mode **=>** Specify the MCC-MNC code corresponding to the network to which the product should connect in manual mode using the "Network to Use in Manual Mode" parameter **=>** Apply the new configuration to the product via NFC.
> It is also possible to select the technology used by the product to connect to the network (NB-IoT or LTE-Cat-M1) using the "Connection Preference" parameter.

Once the operator is selected, the product will automatically restart and operate on that operator, even after subsequent power cycles.

ATTENTION

If the manually selected network is not accessible (not supported by the SIM card or no network coverage), then the product will not be attached to any network.

4.6.2 Monitoring Network Attachment Status

At any time, the user can check the network connection status on the **NFC IoT Configurator app**.

> 📱 Go to the "DETAILS" menu of the sensor **=>** Select the "DIAGNOSTIC" section **=>** Monitor the network attachment status using the "Network Connection Status" parameter..

Network attachment status	Description
Connected	Product in PARK mode or no network at the installation location
Disconnected (timeout)	Network attachment time exceeds the configured timeout in the product (default 120 seconds)
Searching	Product searching for a network connection
Connected	Product connected to the network

4.7 Network Quality Verification

Adeunis recommends that the installer check the network coverage level before installing the product in its final location.

4.7.1 Verification via NFC IoT Configurator app

> 📱 Go to the "DETAILS" menu of the sensor **=>** Select the "DIAGNOSTIC" section **=>** View the values of RSRQ, SNR, RSRP, Transmission Power parameters.

Two icons, visible at the top of the "DIAGNOSTIC" section, also make it easy to monitor two key parameters to assess the proper functioning of the product:

- The quality of the signal emitted by the antenna.

- The transmission power required by the product to send a message.

4.7.2 Network Quality Verification via LwM2M Server

The LwM2M server can request the product to return network quality information. To do this, the user must trigger a READ operation from the server, which will return the current value of the following resources:

RI	Object Name	Resource Name	Access Type	Unit	Description
/4/0/2	Connectivity monitoring	Radio Signal Strength	R	dBm	RSRP - Average received power of a reference signal or base station
/4/0/3	Connectivity monitoring	Link Quality	R	dB	RSRQ - Quality of the received reference signal
/34450/0/33	COMFORT	Tx Power	R	dBm	Power of the signal transmitted by the product

The user can also configure an "OBSERVE" operation on these resources.

Once the product is installed and connected to the network, it automatically performs a network quality diagnosis (RSRQ, RSRP, Tx Power) every time it wakes up from sleep mode.

The installer/user can check this network quality information at any time using the NFC IoT Configurator application or the server. They can potentially relocate the product to an area with better network quality.

4.8 Specific Case of Starting without a Nano SIM

It is possible to use the COMFORT product in "disconnected" mode, meaning without inserting a Nano SIM card. By activating this mode, the product will not connect to a cellular network and will not transmit its data to a remote server. Comfort and air quality data will only be accessible locally through the LED indicator and/or the NFC IoT Configurator app.

📌 **Features accessible in "disconnected" mode**
- Configuration via the NFC IoT Configurator application
- Measurement of temperature, humidity
- Visualization of these 2 data through the NFC IoT Configurator app

> **Activating the Nano SIM-less operating mode via the NFC IoT Configurator application**
> Go to the "CONFIGURATION" menu of the sensor **=>** Select the "PRODUCT ACTIVATION" section **=>** Enable "PRODUCT WITHOUT SIM" mode **=>** Apply the new configuration to the product via NFC.

5. PRODUCT CONFIGURATION

5.1 Configuration of Server-Related Parameters

There are 2 options for registering the COMFORT on an LwM2M server:

- **Using a bootstrap procedure**

- **Direct connection to the LwM2M server**

> 📌 The use of a bootstrap LwM2M server is recommended for mass deployments because this server allows products to securely and automatically retrieve their PSK encryption keys without human intervention.

ATTENTION

Some LwM2M server providers may require the use of a bootstrap LwM2M server.

5.1.1 Using a Bootstrap Service to Register the Product

Bootstrap is a mechanism that allows the COMFORT product to securely register with an LwM2M server:

- Initialization on the product of the "required" objects to register with an LwM2M server via the "Write bootstrap" operation

- Management of keys required for secure connection between the product and the LwM2M server

- Transmission of access rights information to perform an operation for the LwM2M server

- Fallback mechanism allowing the product to automatically reconnect to the bootstrap server in case of connection issues with the LwM2M server

The following table lists the parameters to configure on the product to connect to a bootstrap LwM2M server.

Parameters	Description	Configuration
PSK Identity	PSK Identity configured in the product for product identification on the bootstrap server (unique ID)	A unique ID is pre-configured in the product before delivery
PSK Key	Key configured in the product to enable data encryption For the product to be recognized, this key must also be provided on the bootstrap server side	A unique key in hexadecimal characters is pre-configured in the product before delivery This key can be modified by the user (be cautious to follow the hexadecimal format)
Bootstrap Server URI	URI of the bootstrap server (including the port) that the product should communicate with	To be specified by the user

> **To configure the bootstrap server via the NFC IoT Configurator application**, go to the "CONFIGURATION" menu **=>** Then select the "LwM2M CONFIGURATION" section **=>** Apply the new configuration to the product via NFC.

5.1.2 Registering the Product on an LwM2M Server without Using a Bootstrap Service

The following table lists the parameters to configure on the product to connect to an LwM2M server without using a bootstrap service.

Parameters	Description	Configuration
PSK Identity	PSK Identity configured in the product for product identification on the LwM2M server (unique ID)	A unique ID is pre-configured in the product before delivery This unique ID can be modified by the user
PSK key	Key configured in the product to enable data encryption For the product to be recognized, this key must also be provided on the LwM2M server side	A unique key in hexadecimal characters is pre-configured in the product before delivery This key can be modified by the user (be cautious to follow the hexadecimal format)
LwM2M Server URI	URI of the LwM2M server (including the port) that the product should communicate with	To be specified by the user

📱 **To configure the LwM2M server via the NFC IoT Configurator application**, go to the "CONFIGURATION" menu **=>** Then select the "LwM2M CONFIGURATION" section **=>** Apply the new configuration to the product via NFC.

Once the connection parameters to the LwM2M server are configured in the product, it is ready to be registered on an LwM2M server.

📌 In the case where both the bootstrap server connection parameters and the LwM2M server connection parameters are configured in the product, the product will attempt to connect to the LwM2M server five times within a 24-hour period if it encounters a connection problem before switching to the bootstrap server.

5.2 Configuration of Cellular Network Parameters

The COMFORT product needs to be connected to a network in order to transmit its data to an LwM2M server.

The following table lists all the network parameters of the COMFORT product and their default values.

Parameters	Description	Default Configuration
Network Selection	Automatic or manual selection of the cellular network used by the product to connect during startup	Automatic
Connection Preference	Technology used by the product to connect to the network	NB-IoT followed by LTE-Cat-M1
Frequency Bands	Frequency bands used by the product to connect to the network The default configured bands are the European bands. It is possible to limit the bands to reduce the product's attachment time. For example, in France, only band 20 is used by operators	1,3,8,20,28
Maximum Network Attachment Duration	Maximum duration for the modem to attach to the network If this time is exceeded without successful attachment, the attachment is interrupted	120 seconds
Number of Network Attachment Attempts	Number of consecutive network attachment attempts	2

Parameters	Description	Default Configuration
Delay between 2 Network Attachment Attempts	Delay between 2 consecutive network attachment attempt	12 hours
APN	pecifies the Access Point Name that determines the product's connection settings to the internet (network and operator)	-
T3412 Value	Timer defining the period for periodic Transmission Area Update (TAU) signal emission to the network When the T3412 timer expires, the product exits a deep sleep state with no radio activity (PSM cycle) The value of T3412 will be multiplied by its multiplier to obtain the Keep-alive duration	1
T3412 Multiplier	Multiplier for the T3412 timer	6 hours
T3324 Value	Timer indicating the period during which the sensor remains reachable by the network after a transmission When the T3324 timer expires, the product enters PSM mode but remains registered on the network The value of the T3324 timer will be multiplied by its multiplier to obtain the Active-time duration	5
T3324 Multiplier	Multiplier for the T3324 timer	2 seconds

> **If desired, the user can modify the default cellular network connection parameters in the product using the NFC IoT Configurator application:**
>
> Go to the "CONFIGURATION" menu of the sensor **=>** Select the "NETWORK" section **=>** Configure the product **=>** Apply the new configuration to the product via NFC.

5.3 Configuration of Application Parameters

The COMFORT product can be configured to communicate with the LwM2M server in "OBSERVE" mode or "PUSH" mode.

OBSERVE MODE

The LwM2M server controls the transmission of data.

Default mode of the product

Default mode of the product

Data transmission is only possible upon specific request (READ operation) or periodic request (OBSERVE operation) from the LwM2M server

PUSH MODE

The COMFORT product controls the transmission of data

The PUSH mode also allows managing specific features of the COMFORT product

> 📱 **Configuration of the communication mode via the NFC IoT Configurator application:**
> Go to the "CONFIGURATION" menu of the sensor => Select the "CONNECTIVITY" section => Choose the "PROTOCOLS" subsection => Configure the parameter "Product-Server Communication" => Apply the new configuration to the product using NFC.

> 💻 **Configuration of the communication mode via an LwM2M server**

The LwM2M server can modify the communication mode configuration through a WRITE operation that changes the value of the "PUSH period" resource.

URI	Object Name	Resource Name	Access Type	Unit	Description
/34450/0/0	COMFORT	PUSH period	R/W	-	0 = STANDARD mode 1 = PUSH mode

5.3.1 Configuration of application parameters in "OBSERVE" mode

5.3.1.1 Configuration of the sampling interval

The sampling interval determines how often the COMFORT product will retrieve the values of temperature, humidity inside a building.

- The default sampling interval is set to 60 minutes.

- The user can choose any sampling interval between 60 and 604,800 seconds, which is equivalent to 7 days.

- The minimum interval between two sampling events is 1 minute.

- The sampling granularity is set to the minute, rounded down to the nearest lower value (e.g., 90 seconds = 1 minute).

📌 The sampling interval is the same for all four ambient data measured by the product to avoid data transmission desynchronization that could impact its autonomy.

Any configuration on the LwM2M server for the attributes "minimum evaluation period (epmin)" and "maximum evaluation period (epmax)" in an observation operation will not be taken into account by the product.

📱 **Configuration of the sampling interval via the NFC IoT Configurator app:**
Go to the sensor's "CONFIGURATION" menu **=>** Select the "APPLICATION" section **=>** Configure the Sensor Sampling Frequency parameter **=>** Apply the new configuration to the product using NFC.

💻 **Configuration of the sampling interval via un LwM2M server**

The LwM2M server can modify the configuration of the polling interval through a WRITE operation, changing the value of the "sensor sampling period" resource.

URI	Object Name	Resource Name	Access Type	Unit	Description
/34450/0/2	COMFORT	Sensor sampling period	R/W	Seconds	3600 sec for the default configuration

5.3.1.2 Transmission mode configuration

The COMFORT product allows for the measurement of temperature, humidity in a room, and sending the information using two transmission modes.

Concrete use cases and examples of associated configurations are provided in the ANNEXES of the User Guide.

mission Mode	Definition	Concrete Use Case
Single emission	The single emission mode retrieves the last known value of TEMP/HUM and sends it to the server. **LwM2M READ OPERATION**	**ANNEX 3**
Periodic E**mission**	Periodic transmission allows for regularly retrieving the values of TEMP+HUM based on the configured sampling interval and sending only the latest observed value (no historical data) for long-term analysis. **LwM2M OBSERVE OPERATION**	**ANNEX 4**

> 📌 **NOTE**
>
> Server-initiated OBSERVE requests in LwM2M are not limited to application data (temperature, humidity) and can be made for all supported and available objects, object instances, and resources (OIR).

Other transmission modes of the product are also possible, such as emission on threshold exceedance, periodic emission, and emission on threshold exceedance.

These transmission modes can be configured by modifying the parameter settings of the following attributes during the creation of an OBSERVE operation via the server:

Paramètres d'OBSERVATIONOBSERVE Paramters	Description
Minimum Period (Pmin)	The Minimum Period attribute indicates the minimum time the product must wait between 2 notifications
Maximum Period (Pmax)	The Maximum Period attribute indicates the maximum duration the product can wait between 2 notifications
Greater than	This attribute defines a high threshold value
Less than	This attribute defines a low threshold value
Step	This attribute defines the minimum change value between 2 notifications

📌 **NOTE**
Any server-side configuration of the attributes "minimum evaluation period (epmin)" and "maximum evaluation period (epmax)" in an OBSERVE operation will not be taken into account by the product.

⚠️ Adeunis strongly discourages the configuration of these attributes as it may generate uncontrolled connections to the server, significantly impacting the product's battery life and data volume.

To operate the product with a threshold exceedance transmission mode, Adeunis recommends using only the "PUSH" communication mode "PUSH"

5.3.1.3 Reliable Notifications Configuration

To prevent data loss in a degraded network quality context, the user can enable the "reliable notifications" option. This option ensures that notifications are properly received by the LwM2M server.

Note: Enabling this option has an impact on product consumption.

📱 **Enabling the "reliable notifications" option via the NFC IoT Configurator application:**
Go to the sensor's "CONFIGURATION" menu **=>** Select the "LwM2M Configuration" section **=>** Configure the "Reliable Notifications" parameter **=>** Apply the new configuration to the product via NFC.

💻 **Enabling the "reliable notifications" option via an LwM2M server**

The LwM2M server can enable this option by using a WRITE operation to modify the value of the "reliable notifications" resource.

URI	Object Name	Resource Name	Access Type	Unit	Description
/34450/0/36	COMFORT	Reliable notifications	R/W	-	0 = deactivated 1 = activated

5.3.1.4 Context Backup

In case of product restart, it will remember and reapply all the configured OBSERVATIONS on the server.

> 📱 **Erasing the context backup via the NFC IoT Configurator application:**
> Go to the sensor's "CONFIGURATION" menu **=>** Select the "LwM2M Configuration" section **=>** Configure the "LwM2M Context Erase" parameter **=>** Apply the new configuration to the product via NFC.

5.3.2 Configuration of Application Parameters in « PUSH » Mode

> 📌 **When to use the PUSH mode:**
> - I want to simplify the configuration of my product by applying the same scanning and transmission period to all 2 onboard sensors.
> - I want to be able to archive data from the onboard sensors.
> - I want to define a period for disabling the main functions to optimize the product's autonomy.
> - I want to manage alarms with hysteresis.

5.3.2.1 Sampling Interval Configuration

The sampling interval determines the frequency at which the COMFORT product will retrieve the temperature, humidity inside a building.

- The default sampling interval is set to 60 minutes.
- The user can choose any sampling interval between 60 and 604,800 seconds, which is 7 days.
- The minimum interval between two samples is 1 minute.
- The sampling granularity is one minute, rounded down to the nearest value (e.g., 90 seconds = 1 minute).

> 📌 Sampling interval is common to all ambient data measured by the product in order to optimize the product's autonomy.

> 📱 **Configuring the sampling interval via the NFC IoT Configurator application:**
> Go to the "CONFIGURATION" menu of the sensor **=>** Select the "APPLICATION" section **=>** Configure the Sensor Sampling Frequency parameter **=>** Apply the new configuration to the product via NFC.

> 💻 **Configuring the sampling interval via an LwM2M server**

The LwM2M server can modify the scanning interval configuration using a WRITE operation, which modifies the value of the "sensor sampling period" resource.

URI	Object Name	Resource Name	Access Type	Unit	Description
/34450/0/2	COMFORT	Sensor sampling period	R/W	Seconds	3600 seconds for the default configuration

5.3.2.2 Transmission Mode Configuration

The COMFORT product can measure temperature, humidity in a room and transmit the information using three emission modes.

Concrete use cases and associated configuration examples are provided in the User Guide Annexes.

Transmission Mode	Definition	Concrete Use Case
Periodic Emission	Periodic emission involves retrieving the values of TEMP+HUM according to the configured sampling interval, saving them, and regularly sending them for analysis over time	ANNEX **5**
Threshold-based Emission	Threshold-based emission involves regularly retrieving the values of TEMP+HUM according to the configured sampling interval and sending a notification only if a threshold is exceeded. A new notification is sent when the values return to normal	ANNEX **6**

Transmission Mode	Definition	Concrete Use Case
Periodic Emission and Threshold-based Emission	A combination of both modes allows for regularly retrieving the values of TEMP+HUM according to the configured sampling interval, saving them, and sending them regularly for long-term analysis. To be immediately alerted in case of threshold exceedance, a notification is sent as soon as a threshold is surpassed. This notification includes the last measured value of the sensor that exceeded the threshold, along with the values of all other onboard sensors. A new notification is sent upon returning to normal conditions.	ANNEX **7**

5.3.2.2 Threshold Configuration

The user can configure conditional operating rules of the type "if a condition is met, trigger an action" independently for temperature, humidity data.

These rules can be used to limit the number of transmissions made by the COMFORT product and increase its lifespan.

The available conditions are:

- Above threshold - if the measured value is above the threshold, the product will trigger a transmission of that value.

- Below threshold - if the measured value is below the threshold, the product will trigger a transmission of that value.

The following table lists all the threshold configuration parameters for the COMFORT product and their default values.

Parameters	Description	Default Configuration
High temperature threshold detection	Temperature threshold beyond which the product will trigger a transmission of the sensor measurement	0°C
Low temperature threshold detection	Temperature threshold below which the product will trigger a transmission of the sensor measurement	0°C
Temperature hysteresis	Hysteresis value for the high and low thresholds	0°C

Parameters	Description	Default Configuration
Alarm mode activation	When the alarm mode is activated, the product triggers a transmission of the temperature sensor measurement when a threshold is reached and when it returns to normal	Disabled
High humidity threshold detection	Humidity threshold beyond which the product will trigger a transmission of the sensor measurement	0%
Low humidity threshold detection	Humidity threshold below which the product will trigger a transmission of the sensor measurement	0%
Humidity hysteresis	Hysteresis value for the high and low thresholds	0%
Alarm mode activation	When the alarm mode is activated, the product triggers a transmission of the humidity sensor measurement when a threshold is reached and when it returns to normal	Disabled

> **To configure thresholds using the NFC IoT Configurator app**, go to the "CONFIGURATION" menu => Then select the "APPLICATION" section => Configure the different threshold values => Apply the new configuration to the product via NFC.

Examples of threshold configurations are provided in ANNEXES 6 and 7

5.3.2.3 Configuration of a blackout period

The COMFORT product allows the user to define a period during which the product will not send any notifications.

This allows for optimizing the product's autonomy, saving message sending and data processing costs during a period when no analysis is required (e.g., during the night).

During this blackout period, the sensor:

- Continues to measure temperature, relative humidity.
- Continues to send protocol messages (such as Lifetime).
- Disables the periodic transmission of temperature, relative humidity values.

The following table lists the parameters to be configured on the product to define a blackout period.

Parameters	Description	Default Configuration
Main Functions Blackout Period	Period during which the product does not emit any sensor values.	Disabled
Blackout Start Time	Start time of the blackout period.	10 PM

To configure a blackout period via the NFC IoT Configurator application, go to the "CONFIGURATION" menu **=>** Select the "APPLICATION" section **=>** Choose the "General" subsection **=>** Configure the "Blackout Period of the main functions" and "Blackout Start Time" **=>** Apply the new configuration to the product via NFC.

Configuring a blackout period via an LwM2M server

URI	Object Name	Resource Name	Access Type	Unit	Description
/34450/0/3	COMFORT	Blackout start time	R/W	Hour	Start time of the blackout period. Please note that the time is in UTC format.
/34450/0/4	COMFORT	Blackout duration	R/W	Hour	0 = disabled

5.4 Factory Reset

The COMFORT product can be restored to its default settings using the **NFC IoT Configurator application**.

To restore factory settings via the NFC IoT Configurator application, go to the secondary menu at the top of the "CONFIGURATION" menu **=>** Select the action "Restore Default Configuration" **=>** Apply the new configuration to the product via NFC.

5.5 Data Timestamping

Each measurement value (temperature, relative humidity) reported by the COMFORT product is automatically associated with a UTC timestamp.

The clock is synchronized remotely via the network.

The timestamp is provided in the EPOCH format.

6. REMOTE UPDATE

The COMFORT product allows for over-the-air (FOTA) firmware updates for both the application firmware and modem firmware to implement new features or remotely fix any potential bugs.

The user needs to contact the Adeunis support team to obtain the firmware update file(s) and use an LwM2M server to download the firmware to the COMFORT product using the COAP protocol.

Step 1

Perform the download of an update by writing to the "Package" resource of the standard "Firmware update" object.

URI	Object Name	Resource Name	Access Type	Unit	Description
/5/0/0	FIRMWARE UPDATE	Package	W	-	Install a firmware package on the server

Step 2

Once the firmware file is downloaded to the server, the user needs to execute the "Update" resource to start the file download to the product.

URI	Object Name	Resource Name	Access Type	Unit	Description

URI	Object Name	Resource Name	Access Type	Unit	Description
/5/0/2	FIRMWARE UPDATE	Update	Exe	-	Download a firmware package to the product

📌 The size of the application firmware for the COMFORT product is approximately 400 KB.

Depending on the network type used, it will take an average of 5 to 15 minutes to download the update file to the product.

💻 St**ep 3**

The user can be notified of the progress of the update file download to the product at any time by performing a READ operation on the "State" resource of the standard "Firmware update" object.

URI	Object Name	Resource Name	Access Type	Unit	Description
/5/0/3	FIRMWARE UPDATE	State	R	-	0 = ready for download 1 = download in progress 2 = download complete

💻 Step **4**

Once the update is fully downloaded to the product, it will automatically restart.

7. INSTALLATION

7.1. Product Mounting

Recommended positioning for use in office and home environments:

- Mount on a wall at a height of 1.5 meters from the floor, in an unobstructed area and not exceeding 2 meters.

- Place on a furniture piece at 1 meter from the floor.

The product should be installed using 2 CBLZ 2.2 x 19mm screws and 2 SX4 anchors. Use these products or equivalent ones to secure your product to a flat surface.

7.2. Product Installation Recommendations

To obtain accurate air quality measurements, we recommend following the instructions below:

- Do not use the sensor for outdoor purposes.

- Avoid positioning the sensor directly facing the sun or near a heat source, cold source, ventilation, or in an airflow.

- Maintain a minimum distance of one meter from doors or windows.

- When installed on furniture, avoid placing it in direct proximity to an individual.

- Do not install the sensor too close to the ground, less than 30 cm.

- Do not install the sensor in a dusty or poorly maintained area (garage, basement, workshop, etc.).

- Do not install the sensor in areas with regularly exceeding 95% relative humidity (bathrooms, changing rooms, spas, laundry rooms, etc.).

- Do not install the sensor in an area where it can be damaged or torn.

CAUTION

The top face of the product (allowing access to the enclosure) should be accessible with a screwdriver. Do not position it against a ceiling or under an object, as this may prevent opening the enclosure.

8. DOCUMENT HISTORY

Version	Content
V1.1.0	Creation

ANNEX 1: LwM2M PROTOCOL

The COMFORT product can be configured to use one of the following two protocols to exchange data with an IoT platform: MQTT or LwM2M.

> ⚠️ **Adeunis recommends the use of the LwM2M protocol as it is the ONLY protocol that minimizes the consumption of the COMFORT product and ensures remote operational management.**

Description of the LwM2M Protocol

Lightweight M2M (LwM2M) is a communication protocol for operational management, data reporting, provisioning, and lifecycle management of machine-to-machine (M2M) and Internet of Things (IoT) devices.

This protocol was defined in 2012 by the Open Mobile Alliance (OMA) SpecWorks organization.

Specifically designed for constrained connected devices (limited computing capacity, memory space), this protocol relies on:

- A secure data transfer standard called Constrained Application Protocol (CoAP). CoAP is an application-layer protocol similar to HTTP in its philosophy and general semantics but specifically designed to be lightweight. CoAP allows transmitting messages with low overhead - the minimum header size is only 4 bytes, enabling significant content to be sent in single, unfragmented UDP datagrams.

- A variety of ready-to-use standard objects such as the Smart Objects from the IPSO alliance, for standardized management of data models.

For more information about this protocol, visit the website

http://www.openmobilealliance.org/iot/lightweight-m2m-lwm2m

LwM2M Features Supported by the COMFORT Product and Limitations

- The COMFORT product is compatible with the LwM2M 1.1 standard (over UDP).

- The COMFORT product exposes publicly defined standard profiles by OMA or standardization organizations for the two physical quantities of its onboard sensors (Temperature, Humidity), for managing network parameters and product-related parameters.

- The COMFORT product exposes a custom profile for historization, management of the sleep period, alarm hysteresis, and LED display period.

- Bootstrap support allows the COMFORT product to securely register with an LwM2M server and communicate with it.

- The COMFORT product supports the following data formats: SENML_JSON, TLV, CBOR, SENML_CBOR.

- The COMFORT product supports remote firmware update for both the application firmware and modem firmware via OTA (the server pushes the firmware to the product using the COAP protocol).

- Communication between the COMFORT product and the LwM2M server is secured with DTLS using Pre-Shared Keys (PSK).
- The COMFORT product can be remotely managed by the LwM2M server

ANNEX 2: DATA MODEL OF THE COMFORT PRODUCT

The COMFORT product communicates with an LwM2M server, which manages and monitors the resources of the product exposed through a standardized data model (symbolic representation of its configuration and state).

Standardized Objects for the COMFORT Product

The COMFORT product exposes standard profiles for the two physical quantities of its onboard sensors (Temperature, Humidity), as well as for managing network parameters and product-related parameters.

Object name	ID	Number of instances	Object URN
LwM2M Server	1	1	urn:oma:lwm2m:oma:1
Device	3	1	urn:oma:lwm2m:oma:3
Connectivity monitoring	4	1	urn:oma:lwm2m:oma:4
Firmware update	5	1	urn:oma:lwm2m:oma:5
Temperature	3303	1	urn:oma:lwm2m:ext:3303
Humidity	3304	1	urn:oma:lwm2m:ext:3304

These objects are recognized as standard on LwM2M servers, ensuring interoperability for the COMFORT.

Custom Objects for COMFORT Product

The blackout period, alarm hysteresis, and LED display period are supported by a CUSTOM object that can be optionally used by the user (operating in PUSH mode only).

Object Name	ID	Instance	Object URN
COMFORT	34450	1	urn:oma:lwm2m:x:34450

To use this CUSTOM object, the user needs to import the corresponding XML file into the LwM2M server. The CUSTOM object can be downloaded on Adeunis website

Object Format

Object Name	Object Description
ID	Numeric identifier of the object (16-bit unsigned integer)
Instance	Unique (always has an instance with ID=0) or Multiple
Mandatory	Mandatory (must be supported by all LwM2M Client implementations) or Optional (may not be supported)
URN	urn:oma:lwm2m:{oma,ext,x}:{Object ID}

Resource Format

ID	Numeric identifier of the resource
Resource Name	Brief description of the resource
Operation	R - read-only Resource W - write-only Resource RW - writeable Resource E - executable Resource
Instance	Unique / Multiple
Mandatory	Mandatory or Optional Mandatory resources must be present in all instances on all devices. Optional resources may not be present in all instances and may not be supported at all by some devices.
Type	Data type of the resource value (or its instances in the case of multiple resources) String, Integer, Float, Boolean, Opaque, Time, Objlnk none
Range	Specification of valid values for the resource
Unit	Units in which a numerical value is given
Description	Detailed description of the resource

ANNEX 3: SINGLE TRANSMISSION IN OBSERVE MODE

The LwM2M server can request the product to return the last known value of temperature, humidity.

Block Diagram

The single transmission is performed according to the following block diagram
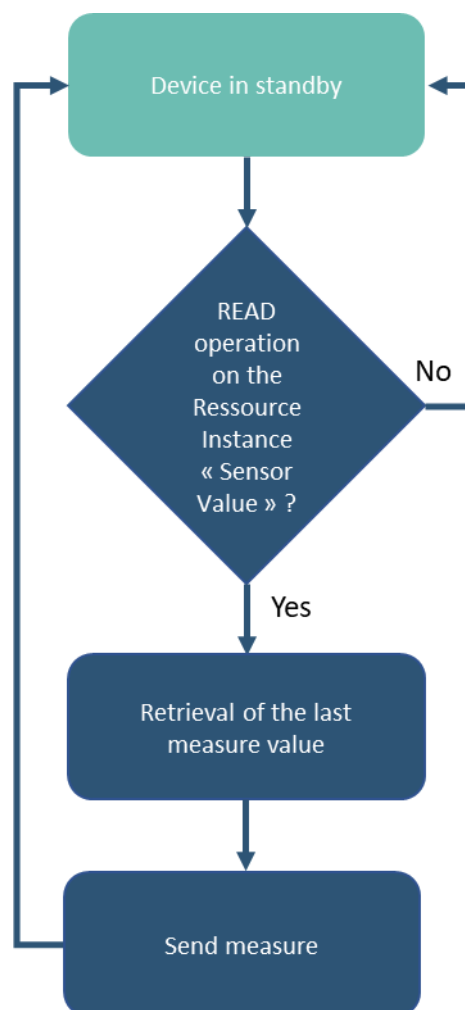
Read a Value - READ Operation

The server can request the product to return the current value of temperature, humidity, data through a READ operation for one or more of the following resources:

URI	Object Name	Resource Name	Access Type	Unit

URI	Object Name	Resource Name	Access Type	Unit
/3303/0/5700	TEMPERATURE	Temperature sensor value	R	°C
/3304/0/5700	HUMIDITY	Humidity sensor value	R	%HR

The measurement date is determined by the value of the "Sensor sampling period" resource, and the transmission period is determined by the value of the "lifetime" resource.

ANNEX 4: PERIODIC TRANSMISSION IN OBSERVE MODE

The product allows for periodic retrieval of temperature, humidity data at a certain frequency and only sends the latest measured value upon server request through an OBSERVE operation on the corresponding resource.

Block Diagram

The periodic transmission is performed according to the following block diagram
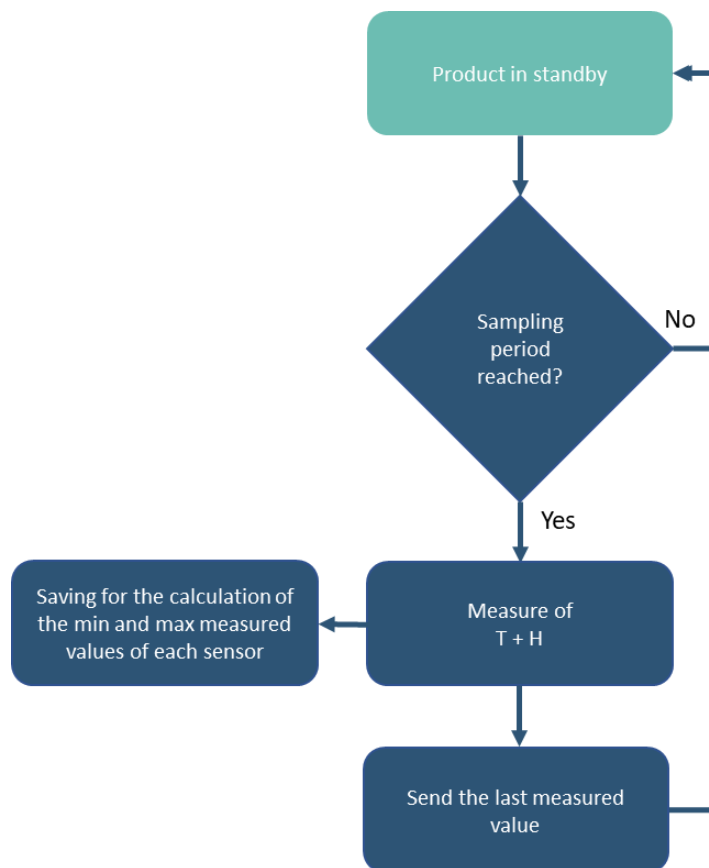
Configure Application Parameters

The user needs to configure the interval for scanning temperature, humidity values through a WRITE operation on the "sensor sampling period" resource.

URI	Object Name	Resource Name	Description	Possible Configuration
/34450/0/2	COMFORT	Sensor sampling period	Sampling period of temperature, humidity	between 60 and 604800 seconds (7 days)

📌 The scanning interval must be the same for all 2 ambient data measured by the product to optimize the product's autonomy.

Observe a Value - OBSERVE Operation

Next, the user needs to create an observation for each "Sensor Value" attribute for which the product needs to notify the server of new values.

The observation parameters for the "Sensor Value" attribute do not need to be configured for periodic transmission. The COMFORT product will automatically notify the server of new values after each sampling.

> 📌 **NOTE 1**
>
> Any configuration on the LwM2M server for attributes such as "minimum evaluation period (epmin)" and "maximum evaluation period (epmax)" in an OBSERVE operation will not be considered by the product.

Example

The LwM2M server requests the product to:

- Retrieve temperature, humidity once per hour.

Observations are configured for the server to be notified:

- By transmitting the last observed temperature value once per hour,

- By transmitting the last observed humidity value once per hour,
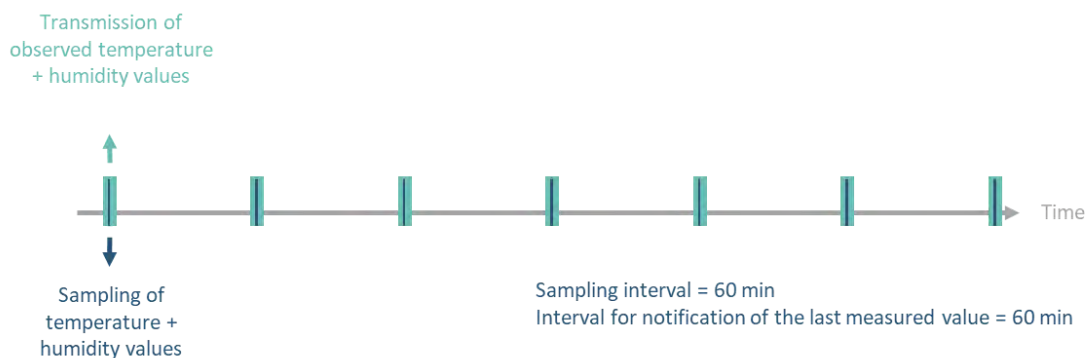
Configuration of Application Parameters to Use

URI	Object Name	Resource Name	Configuration
/34450/0/2	COMFORT	Sensor sampling period	3600 sec
/1/0/2	LwM2M server	Default minimum period	0 sec
/1/0/3	LwM2M server	Default maximum period	0 sec

Observations to Create for the "Sensor Value" Attributes

The user must then create an observation for the following attributes without configuring any observation parameters (minimum period, maximum period, minimum evaluation period, maximum evaluation period, etc.).

Observation Name to Create	Object Name	Instance	Attribute
Temperature monitoring	COMFORT/3303	0	Sensor value
Humidity monitoring	COMFORT/3304	0	Sensor value

ANNEX 5: PERIODIC TRANSMISSION IN PUSH MODE

The product allows for periodically retrieving temperature, humidity and sending this information to a server.

With the history mechanism, if the sensor sampling frequency is higher than the transmission frequency, the product will store all measured values in local memory to be transmitted later in a single message at the end of the transmission period.

📌 **Maximum number of samples per message : 144**

Block Diagram

The periodic transmission is performed according to the following block diagram
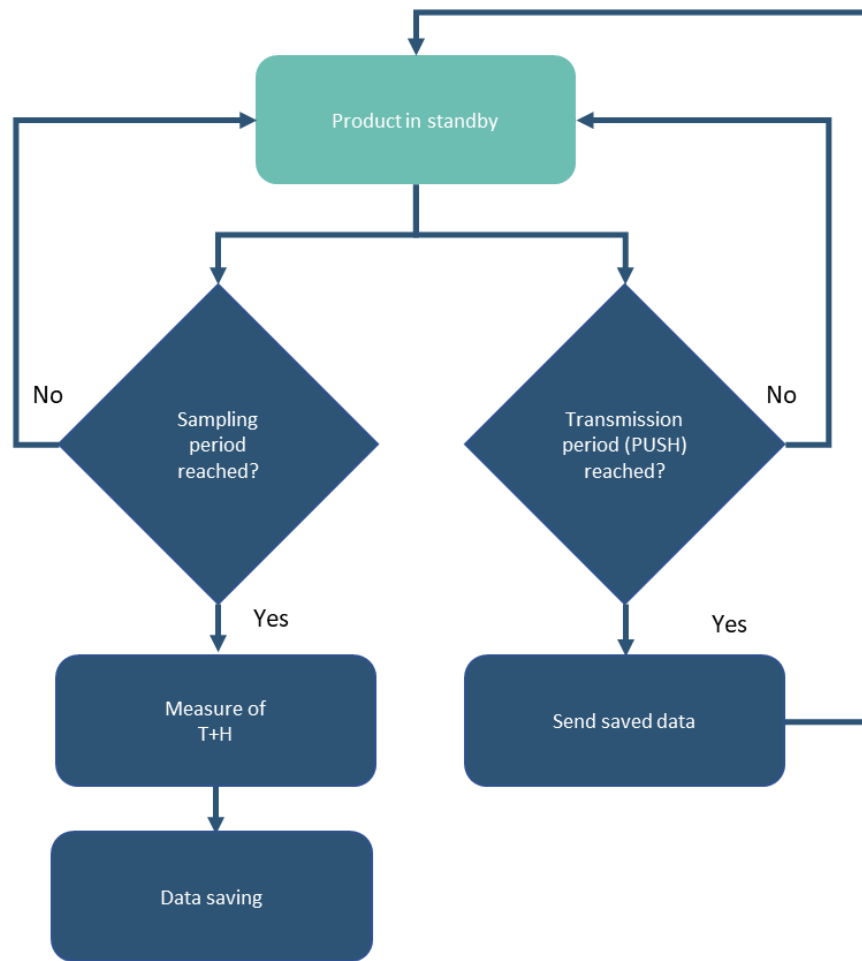
The table below lists the parameters to configure to use this transmission mode:

Parameters	Description	Default Configuration
PUSH Mode	If this mode is enabled, the product controls data transmissions to the server	Disabled
PUSH Mode Transmission Frequency	Data transmission frequency in PUSH mode	3600 seconds
Sensor Sampling Frequency	Common scanning frequency for sensors	3600

These parameters can be configured via the NFC IoT configurator application or the LwM2M server.

📌 For a transmission without history, it is sufficient to configure the transmission frequency to be equal to the sensor sampling frequency.

Example

The product retrieves temperature, humidity every 10 minutes and saves the information.

The product performs 6 saves and transmits them once per hour. These values will be considered in calculating the minimum and maximum values measured by each sensor.
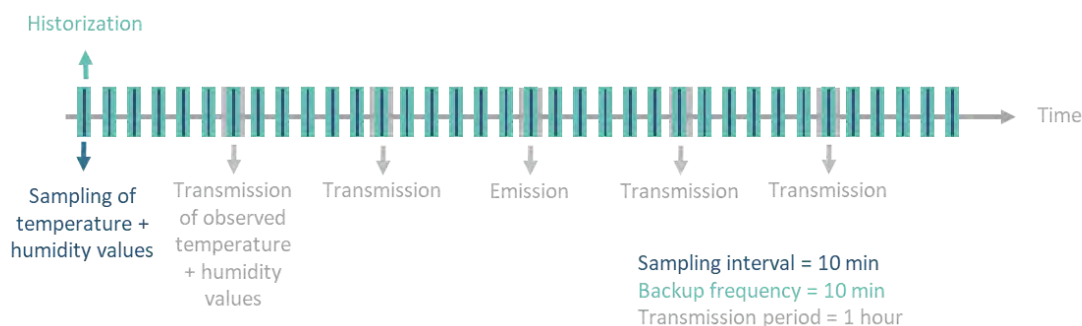
Configuration of Application Parameters to Use

Parameters	Unit	Value	Description
PUSH Mode	-	Enabled	
PUSH Mode Transmission Frequency	Seconds	3600	1 transmission per hour T+H
Sensor Sampling Frequency	Seconds	600	1 sample every 10 minutes T+H

> **Configuration via the NFC IoT Configurator App**
> Go to the "CONFIGURATION" menu of the sensor => Select the "CONNECTIVITY" section => Go to the "Protocol" subsection => Configure the "Device-Server Communication" parameter in "PUSH" mode.
> Go to the "APPLICATION" section => Configure the sensor sampling frequency to 600 seconds => Configure the transmission period to 3600 seconds => Apply the new configuration to the product via NFC.

> **Configuration via a LwM2M server**

URI	Object Name	Resource Name	Access Type	Unit	Description
/34450/0/0	COMFORT	LWM2M mode	R/W	-	1 = PUSH mode
/34450/0/1	COMFORT	PUSH period	R/W	Seconds	3600

URI	Object Name	Resource Name	Access Type	Unit	Description
/34450/0/2	COMFORT	Sensor sampling period	R/W	Seconds	600

ANNEX 6: THRESHOLD EXCEEDING TRANSMISSION IN PUSH MODE

The product allows for periodic measurement of temperature, humidity.

If the product detects a threshold exceeding (high and/or low), it sends a notification to the server to alert the user. A new notification is sent when the values return to normal.

Only the value exceeding the threshold is transmitted to the server.

Block Diagram

The transmission on threshold exceeding is performed according to the following block diagram

The table below lists the parameters to configure for using this transmission mode:

Parameters	Description	Default Configuration
PUSH Mode	If this mode is enabled, the product controls the data transmissions to the server	Disabled
PUSH Mode Transmission Frequency	Frequency of data transmission in PUSH mode	3600 seconds
Sensor Sampling Frequency	Sampling frequency of Temperature + Humidity values	3600 seconds
High Threshold Detection	Threshold beyond which the product will trigger a transmission of the sensor measurement	-
Low Threshold Detection	Threshold below which the product will trigger a transmission of the sensor measurement	-
Hysteresis	Hysteresis value for high and low thresholds	-
Threshold Status	Identifies an error in the configuration of different thresholds	-

These parameters can be configured via the NFC IoT Configurator application or the LwM2M server.

Example

The product measures temperature, humidity every 10 minutes.

Alarms are configured for the product to notify the server:

- If the temperature exceeds 25°C. This alarm will be disabled if the temperature falls below 24°C.

- If the temperature goes below 19°C. This alarm will be disabled if the temperature rises above 20°C.

- There are no alarms for humidity.

Configuration of Applicable Parameters to Use

Parameters	Unit	Value	Description
PUSH Mode	-	Enabled	-
PUSH Mode Transmission Frequency	Seconds	0	No periodic transmission of T+H
Sensor Sampling Frequency	Seconds	600	1 measurement every 10 minutes for T+H
Temperature Alarm Activation	-	Enabled	Temperature alarm activated
Temperature High Threshold Detection	°C	25	High threshold to trigger the alarm is 25°C

Parameters	Unit	Value	Description
Temperature Low Threshold Detection	°C	19	Low threshold to trigger the alarm is 19°C
Hysteresis	°C	1	Hysteresis value is 1°C
Humidity Alarm Activation	-	Disabled	Humidity alarm disabled

Configuration via the NFC IoT Configurator App

Go to the "CONFIGURATION" menu of the sensor **=>** Select the "CONNECTIVITY" section **=>** Go to the "Protocol" subsection => Configure the "Product-Server Communication" parameter in "PUSH" mode.

Go to the "APPLICATION" section **=>** Configure the sensor sampling frequency to 600 seconds **=>** Configure the transmission period to 0 seconds.

=> Go to the "TEMPERATURE" section **=>** Enable the high and low threshold alarm mode **=>** Configure the high threshold detection to 25°C, the low threshold detection to 19°C, and the hysteresis to 1°C.

=> Check the threshold status.

=> Apply the new configuration to the product using NFC.

Configuration via a LwM2M Server

URI	Object Name	Resource Name	Access Type	Unit	Description
/34450/0/0	COMFORT	LWM2M mode	R/W	-	1 = Push mode
/34450/0/1	COMFORT	Push period	R/W	seconds	0
/34450/0/2	COMFORT	Sensor sampling period	R/W	seconds	600
34450/0/19	COMFORT	Temperature: high threshold	R/W	°C	25
34450/0/20	COMFORT	Temperature: low threshold	R/W	°C	19
34450/0/21	COMFORT	Temperature: threshold hysteresis	R/W	°C	1
34450/0/22	COMFORT	Temperature: enable alarm	R/W	-	3 = activate both thresholds

URI	Object Name	Resource Name	Access Type	Unit	Description
34450/0/35	COMFORT	Consistency of threshold and hysteresis	R	-	0 = no inconsistency configuration detected 1 = inconsistency regarding the thresholds of temperature sensor 2 = for humidity

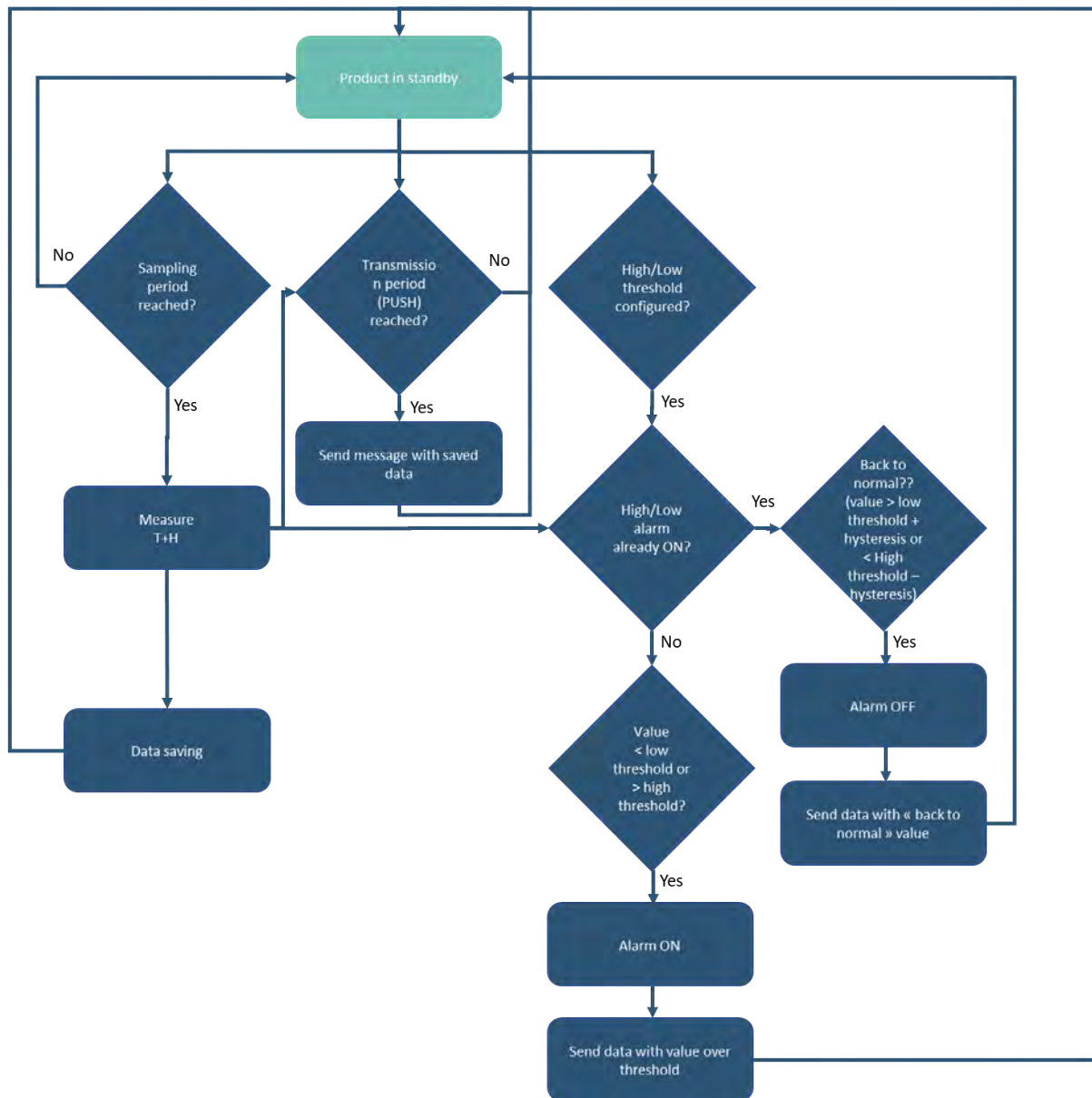# ANNEX 7: PERIODIC TRANSMISSION AND THRESHOLD EXCEEDANCE IN PUSH MODE

The product allows for periodic measurement of temperature, humidity and sends this information to a server at regular intervals.

With the history mechanism, if the sensor sampling frequency is higher than the transmission frequency, the product will store all measured values in local memory to transmit them in a single message at the end of the transmission period.

If the product detects a threshold exceedance (high and/or low) it sends a notification to the server to alert the user. A new notification is sent when the values return to normal. Only the exceeded value is transmitted to the server.

Block diagram

Periodic Transmission and Threshold Exceedance are implemented according to the following diagram:

The table below lists the parameters to configure for using this transmission mode:

Parameters	Description	Default Configuration
PUSH Mode	If this mode is enabled, the product controls the data transmissions to the server	Disabled
PUSH Mode Transmission Frequency	Frequency of data transmission in PUSH mode	3600 seconds
Sensor Sampling Frequency	Start time of the blackout period	3600 seconds
High Threshold Detection	Threshold beyond which the product will trigger a sensor measurement transmission	-

Parameters	Description	Default Configuration
Low Threshold Detection	Threshold below which the product will trigger a sensor measurement transmission	-
Hysteresis	Hysteresis value for high and low thresholds	-
Threshold Status	Identifies an error in the configuration of different thresholds	-

For non-historical transmission, simply configure the transmission frequency to be equal to the sensor sampling frequency.

> 📌 The content of a message related to periodic transmission and a message related to threshold exceedance is identical.
>
> When an alarm occurs at time t, all the stored data is sent. An alarm message is therefore a "regular" message sent before the end of the PUSH mode transmission period.
>
> After sending an alarm message, the periodic transmission timer is reset, meaning that the next periodic transmission will be sent at "t+PUSH mode transmission period".

These parameters can be configured using the NFC IoT Configurator application or via the LwM2M server.

Example

The product measures temperature, humidity every 30 minutes and saves the information. The product performs 8 backups and transmits them every 4 hours.

The 8 measured values from each of the 2 sensors over 4 hours are included in the unique message sent by the product every 4 hours.

These values are taken into account when calculating the minimum and maximum values measured by each sensor.

The product triggers an alarm if the temperature exceeds 24°C. This alarm will be disabled if the temperature drops below 22°C.

There are no alarms for relative humidity.

Configuration of Application Parameters to Use

Parameters	Unit	Value	Description

Parameters	Unit	Value	Description
PUSH Mode	-	Enabled	
PUSH Mode Transmission Frequency	Seconds	14400	1 transmission every 4 hours (T+H)
Sensor Sampling Frequency	Seconds	1800	1 measurement every 30 minutes (T+H)
Temperature Alarm Mode Activation	-	Enabled	Temperature alarm activated
Temperature High Threshold Detection	°C	24	High threshold to trigger the temperature alarm is 24°C
Hysteresis	°C	2	Hysteresis value is 2°C
Humidity Alarm Mode Activation	-	Disabled	Humidity alarm disabled

> ### Configuration via the NFC IoT Configurator App
>
> Go to the "CONFIGURATION" menu of the sensor.
> **=>** Select the "CONNECTIVITY" section **=>** Go to the "Protocol" subsection => Configure the "Product-Server Communication" parameter in "PUSH" mode.
>
> Go to the "APPLICATIVE" section **=>** Configure the sensor sampling frequency to 1800 seconds **=>** Configure the transmission period to 14400 seconds.
>
> **=>** Go to the "TEMPERATURE" section **=>** Enable the high threshold alarm mode **=>** Set the high threshold detection to 24°C and the hysteresis to 2°C.
>
> **=>** Go to the "APPLICATIVE" section **=>** Verify the threshold status.
>
> **=>** Apply the new configuration to the product via NFC.

> ### Configuration via a LwM2M server

URI	Object Name	Resource Name	Access Type	Unit	Description
/34450/0/0	COMFORT	LWM2M mode	R/W	-	1= Push mode
/34450/0/1	COMFORT	Push period	R/W	secondes	14400
/34450/0/2	COMFORT	Sensor sampling period	R/W	secondes	1800
34450/0/19	COMFORT	Temperature : high threshold	R/W	°C	24
34450/0/21	COMFORT	Temperature : threshold hystérésis	R/W	°C	2

URI	Object Name	Resource Name	Access Type	Unit	Description
34450/0/22	COMFORT	Temperature : enable alarm	R/W	-	2 = activate high threshold
34450/0/35	COMFORT	Consistency of threshold and hysteresis	R	-	0 = no inconsistency configuration detected 1 = inconsistency regarding the thresholds of temperature sensor 2 = for humidity sensor

ANNEX 8: CONFIGURING A BLACKOUT PERIOD

The COMFORT product allows the user to define a period during which the product will no longer perform periodic transmissions.

📌 **This blackout period is configurable only in PUSH mode.**

The table below lists the parameters to configure in order to define a blackout period:

rameters	Description	Default Configuration
PUSH Mode	If enabled, the product controls data transmissions to the server	Disabled
Main Functions Blackout Period	Period during which the product does not perform any sensor value transmissions	Disabled
Blackout Start Time	Start time of the blackout period	22:00 (10:00 PM)

These parameters can be configured using the NFC IoT Configurator application or the LwM2M server.

Example

The product measures temperature, humidity every 60 minutes (3600 seconds) and stores the information.

The product performs 4 backups and transmits them every 4 hours. The blackout is activated at 20:00 (8:00 PM) for a period of 10 hours (until 6:00 AM).
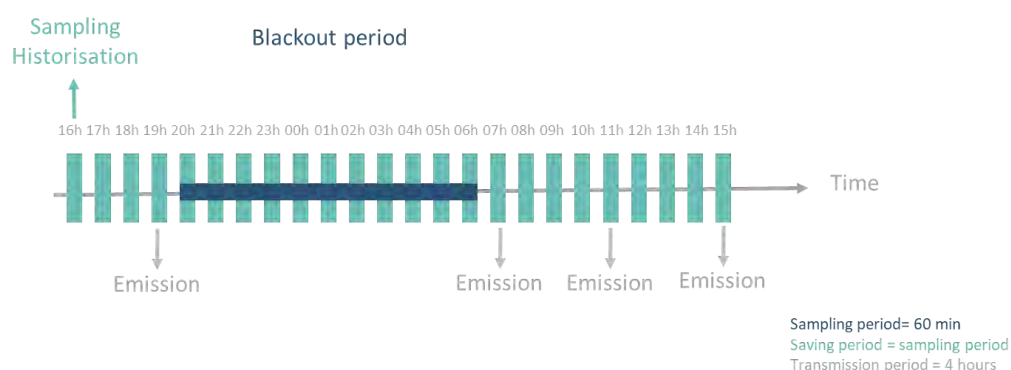
With the blackout mechanism, the product sends its last message to the server at 19:05 (7:05 PM) with the measured values at 16:00 (4:00 PM), 17:00 (5:00 PM), 18:00 (6:00 PM), and 19:00 (7:00 PM). At 20:00 (8:00 PM), the product enters the blackout period. It does not communicate until the end of the period and resumes communication at 07:05 (7:05 AM).

Configuration of Applicative Parameters to Use

meters	Unit	Value	Description
PUSH Mode	-	Enabled	
PUSH Mode Transmission Frequency	Seconds	14400	1 transmission every 4 hours (T+H)
Sensor Sampling Frequency	Seconds	3600	1 measurement every hour (T+H)
Main Functions Blackout Period	Hours	10	The product does not perform any sensor value transmissions for 10 hours
Blackout Start Time	Hours	20	The blackout period will start at 20:00 (8:00 PM)

> 📱 **Configuration via the NFC IoT Configurator application**: Go to the "CONFIGURATION" menu **=>** Select the "APPLICATION" section **=>** Configure the "Blackout Period of the main functions" to 10 hours and the "Blackout Start Time" to 20:00 (8:00 PM) **=>** Apply the new configuration to the product via NFC.

Configuration via a LwM2M server

URI	Object Name	Resource Name	Access Type	Unit	Description
/34450/0/3	COMFORT	Blackout start time	R/W	Hours	20
/34450/0/4	COMFORT	Blackout duration	R/W	Hours	10