E green Sensor user guide

Autonomous current sensor

Table content

Version history of this document

Version	Date	Description	Author	Concerned Software version /Revision
1.0	04/06/2024	Document creation	GMO	V1.0.9 / A0
1.1	02/07/2024	Additional information configurator and mobile app	GMO	V1.0.9 / A0
1.2	19/09/2024	Addition and clarification to frames, Downlink and LoRaWAN key retrieval	GMO	V1.0.9 / A0

Disclaimer

Declaration of conformity

All TCT products comply with the regulatory requirements of directive R&TT 1999/5/EC article 3 :

CE

1 Safety (Article 3.1a of Directive 1999/5/EC)

NF EN60950-1 Ed. 2006/A1:2010/A11:2009/A12:2011 (health)

EN62479: 2010 (power <20mW) ou EN62311:2008 (power > 20mW)

2 Electromagnetic compatibility (Article 3.1b of Directive 1999/5/EC)

EN 301489-3 v1.4.1, EN 301489-1 V1.9.2

3 Efficient Use of the Radio Frequency Spectrum (Article 3.2 of Directive 1999/5/EC)

ETSI EN300 220-2 v2.4.1 et EN300 220-1 v2.4.1

Environmental recommendations

Environment

Respect the storage and operating temperature ranges of the products. Failure to comply with these guidelines may disrupt the operation and even damage the equipment. This equipment is not designed for an outdoor environment! Follow the precautions and instructions below to ensure your safety and that of your environment and to prevent any damage to your device.

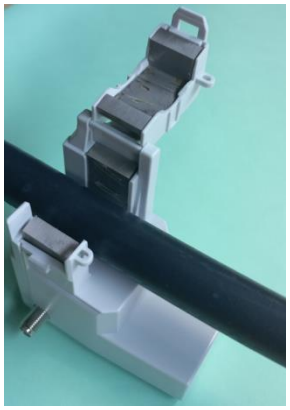
General danger *– If the instructions are not followed, there is a risk of equipment damage.*

WARNING *: Do not install the equipment near a heat source or a source of moisture.*

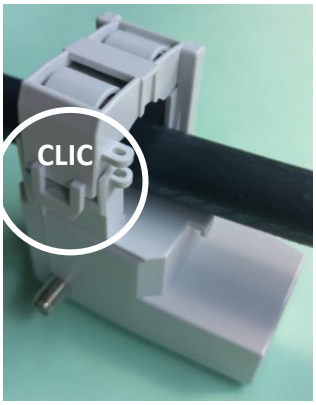
This symbol on the product or its packaging indicates that this product should not be disposed of with your other household waste. Instead, it is your responsibility to dispose of your waste at a designated collection point for the recycling of electrical and electronic equipment. Separate collection and recycling of your waste at the time of disposal will help conserve natural resources and ensure environmentally and human health-friendly recycling. For more information on the nearest recycling center, contact your local municipality, household waste disposal service, or the store where you purchased the product.

I. Installation

1. Open the mobile jaw of the sensor by lifting the tab located on the side of the sensor.



2. Position the sensor so that the conductor passes between the two legs of the magnetic circuit.



3. Close the mobile jaw until the tab clicks into its hook.

Warning: *Be sure to use the power supply on an independent phase and not on a bi-phase or three-phase cable.*

II. Identification

On the product, you can find the reference (HARV001 or HARV003).

On the product shown in the photo, HVT/05128B133 is the Bluetooth identifier, which you will find during a Bluetooth scan.

Figure 2: identification example

The QR code is in the LORA ALLIANCE format (Technical Recommendation TR005). The first character string following "LW: D0:" is the AppKey, and the next is the DevEUI.

Figure 1: QR code content example

In this example, AppKey: 70B3D59BA000004 and DevEUI: 0080E11505428B13.

Note

This DevEUI is essential for registering the product on the LoRaWAN network as it is the product's unique identifier.

III. Registering sensors on the network

A. Configuration

Frequency plan : Europe 863-870 Mhz (SF12 for RX2)

LoRaWan version : 1.0.4

Regional parameters : RP002 Regional Parameters 1.0.4

B. Activation keys

Sensors can be activated on the LoRaWAN network by OTAA ("Over The Air Activation"), and you will need three keys for this.
DevEUI : This is the unique identifier of the sensor found in the QR code on the sensor. This QR code is readable by any smartphone with a compatible application, or for simplicity, we encourage you to use the e-green monitor mobile application.

Example of DevEUI : 0080E11500547DA6

AppEUI/JoinEUI : This is the identifier of the Join server also found in the QR code on the sensor but can also be retrieved automatically via the user portal.

Example of AppEUI/JoinEUI : 70B3D59BA0000004

AppKey : This is the activation key of the sensor. It is only accessible through identification on the portal or the application for security reasons.

Example of AppKey : 5B61D286A21E1D6DE4E12BDA2BC973C

IV. User portal

Note
The mobile application and the user portal share the same informations; creating an account on the portal or through the mobile application is the same, and both are linked.

To secure the allocation of keys, a secure user portal has been created at this address:

https://egreen.tct.fr/portal/fr/

A. Account creation

You need to give a valid email address, a password and accept the general conditions.

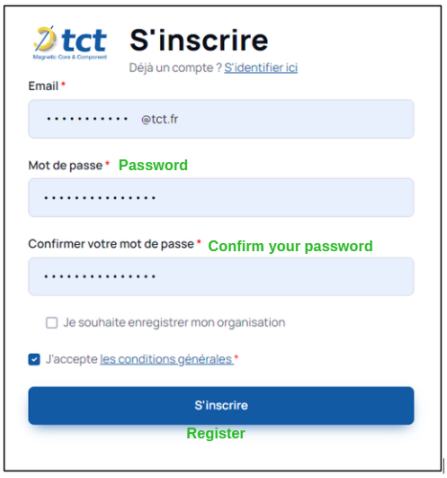


Figure 1 : Example of account creation

If you are willing to share the access of your sensors' information with your organisation, you have the possibility to create it by clicking on "I wish to register my organisation" (under Confirm your password). By doing so, the email address used for the account creation will become the email address of your organisation and you will have an interface allowing you to invite members.

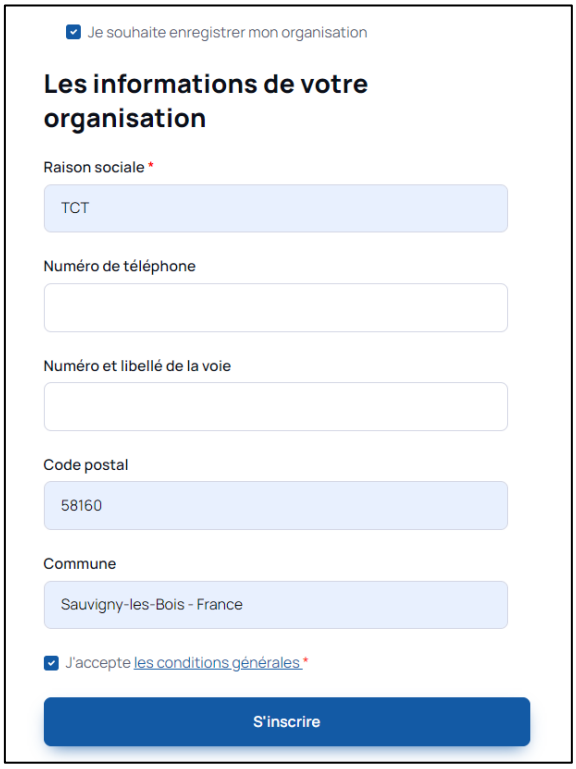


Figure 2 : Example of organisation creation

You will receive an email of confirmation to validate your registration. Check your SPAM if you don't receive the email.

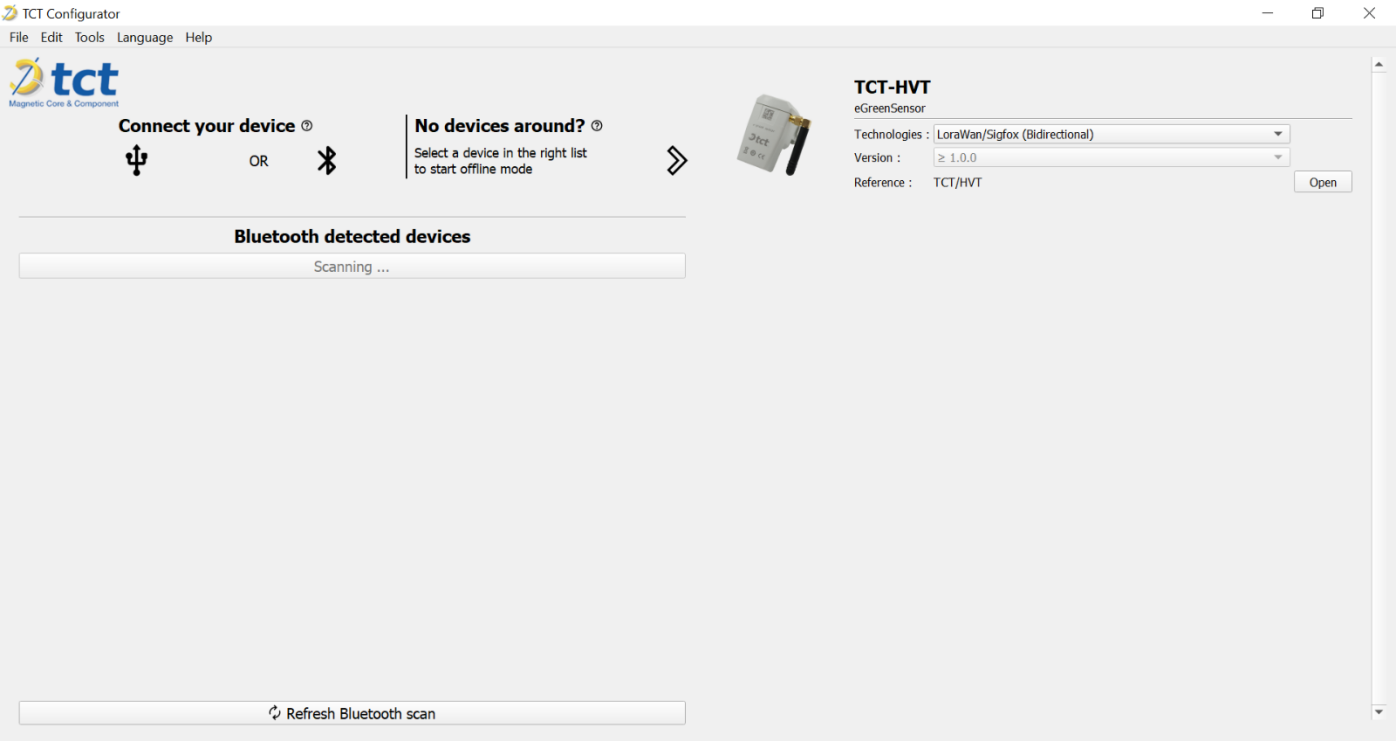
B. Retrieving LoRaWan activation keys

Once logged into the portal with the previously created username and password, you can retrieve the LoRaWAN activation keys for your sensors using the product's DevEUI.

Note
You can also retrieve the keys through the e-green monitor mobile application in a easier way.

V. Windows configurator

You can access sensor configuration through the TCT configurator available for download at this address:
setup_tct_cfg



VI. Sensor configurator

There are three options to configurate the sensor.

1. Through BLE with the mobile application

There is only the emission frequency and the number of samples that are accessible by this means.
(see Configuration/LoRaWAN emission frequency and mobile application)

Note
The configuration through BLE requires that the sensor is previously powered and that you are near in order to detect the sensor and connect to it.

2. Through BLE with the Windows configurator

Here you can access all the modifiable parameters.

Note
The configuration through BLE requires that the sensor is previously powered and that you are near in order to detect the sensor and connect to it.

To access the parameters, just click on the desired sensor from the list “Bluetooth detected devices”

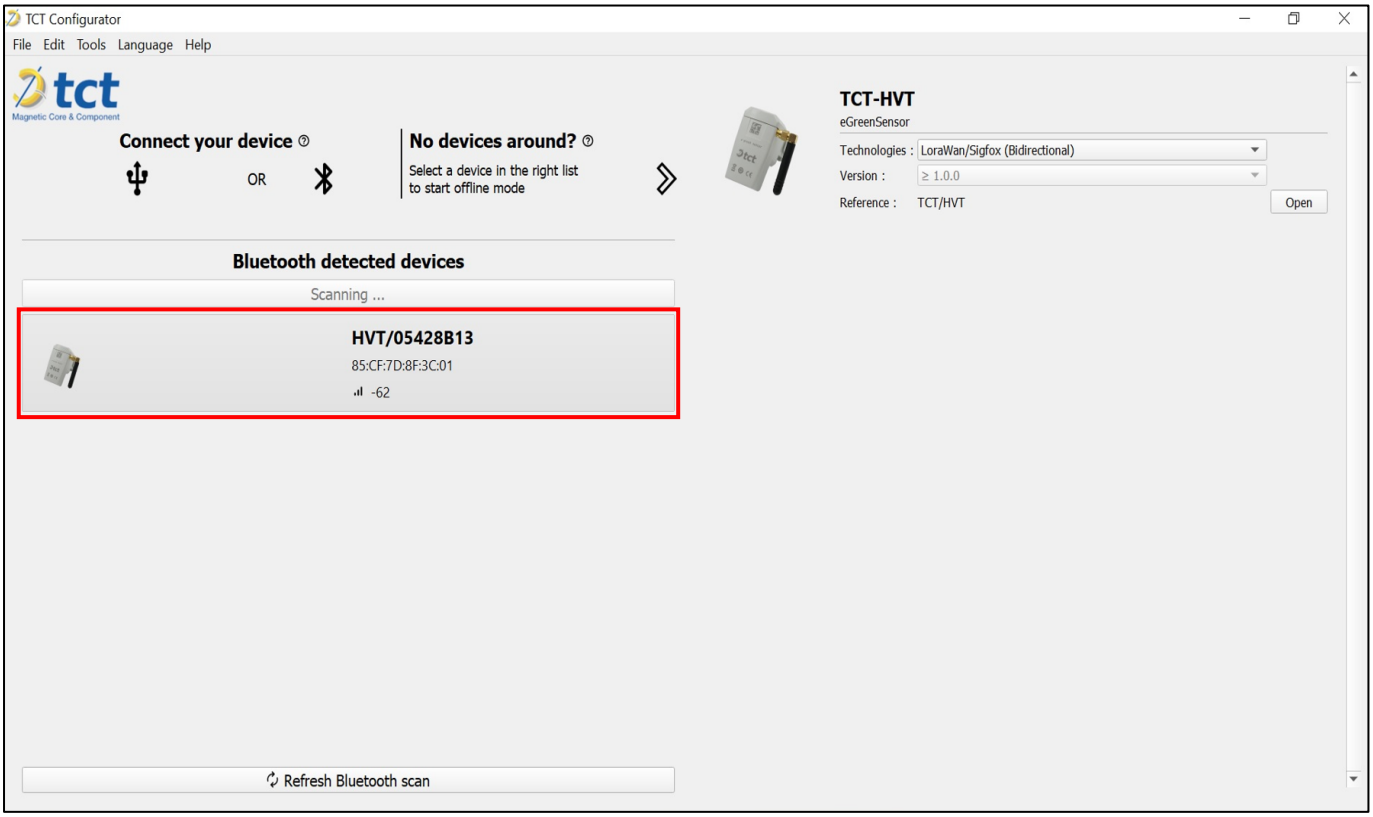


Figure 3 : Configurator homepage

You can now modify your parameters as per your needs and click on “Apply to ACW”.

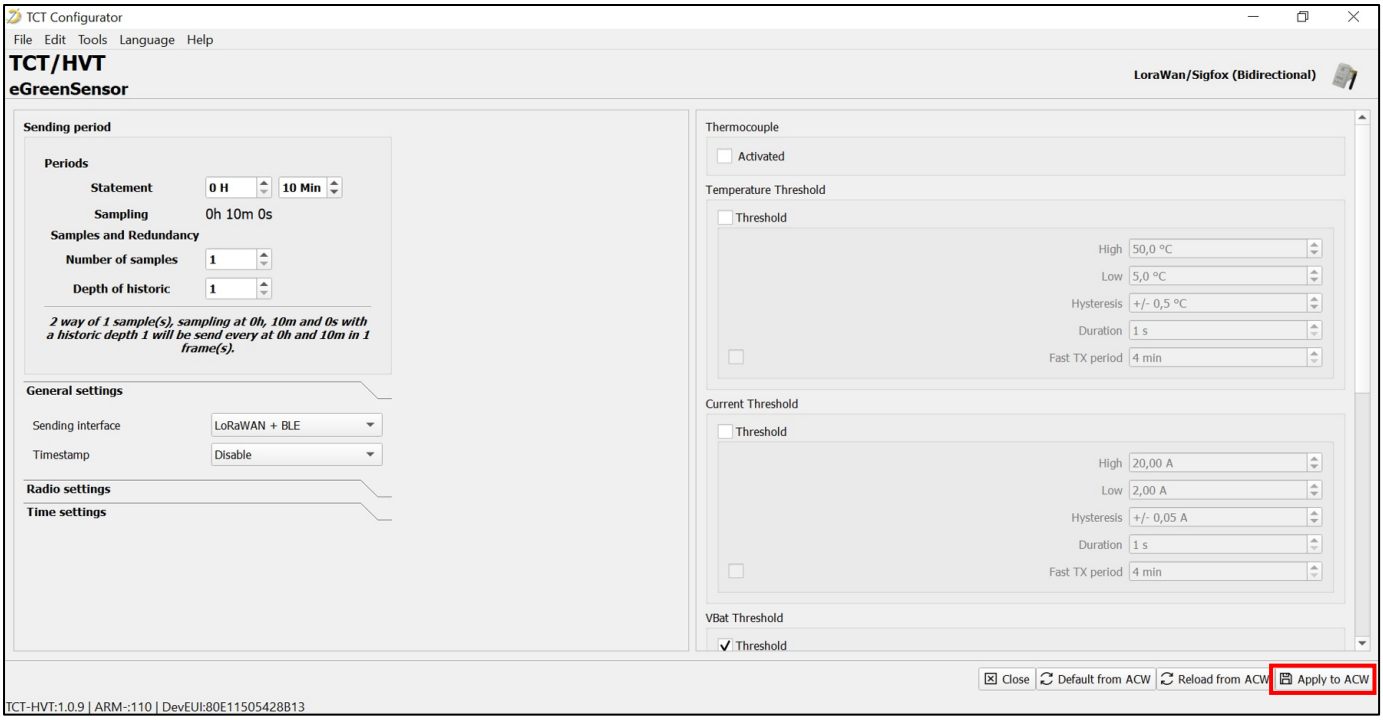
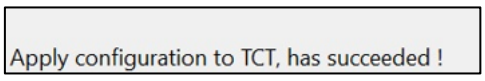


Figure 6 : Parameters window

If it worked correctly, you will see the following message at the bottom left:



3. Through Downlink

The Windows configurator allows you to simulate a sensor configuration and to export the needed frame to place the order through Downlink. For this, you need to open a virtual configuration window by clicking on “Open” at the right top of the configurator homepage.

Note

The Downlink configuration requires the sensor to be previously registered on your Gateway in order to be able to place the order.

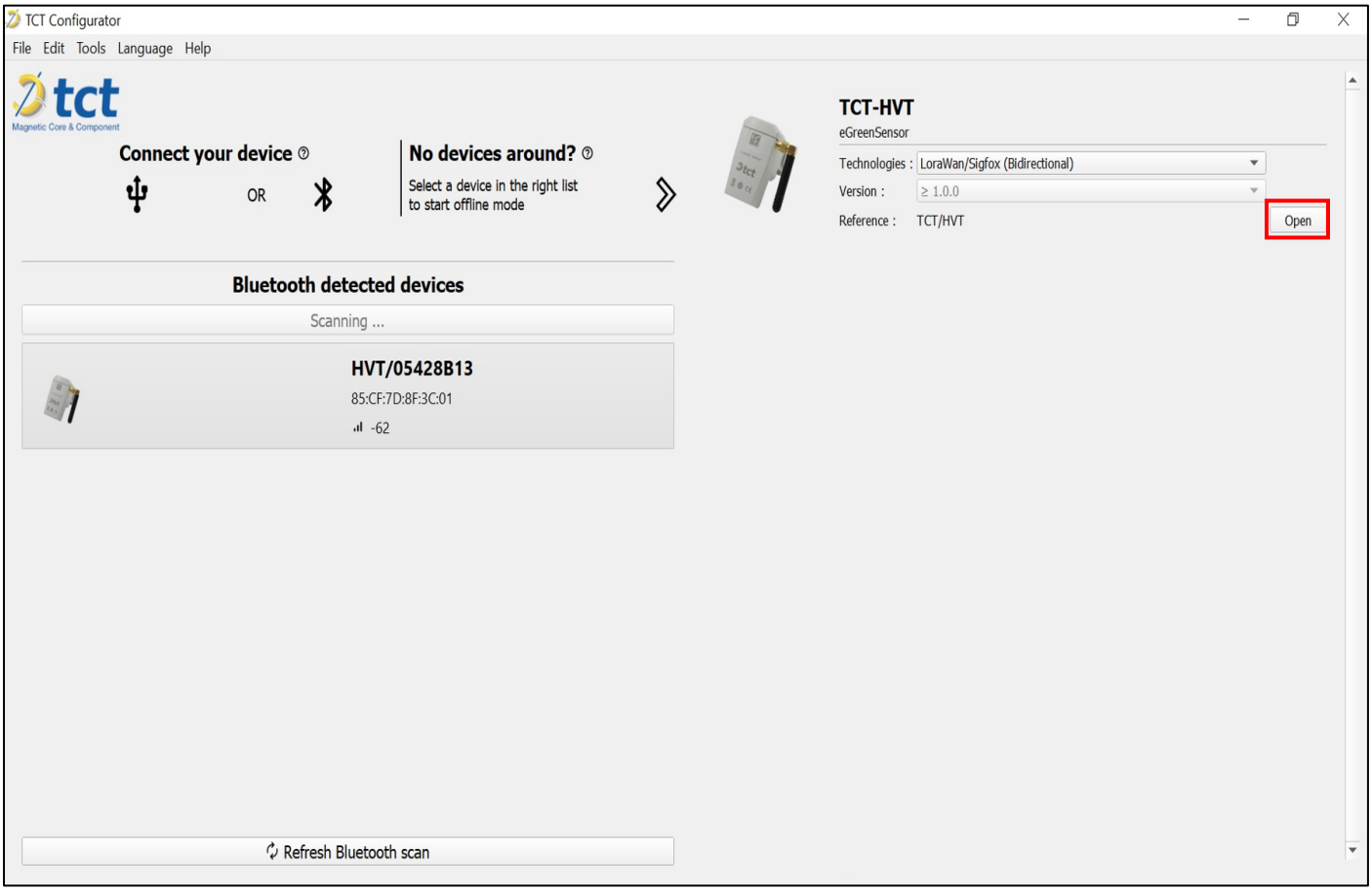


Figure 4 : Configurator homepage, open a virtual configuration window

A configuration window opens and you can then define the parameters you wish to apply.

By clicking on “Edit/Export frames”, the configurator will define the different frames (Payload) to send through Downlink.

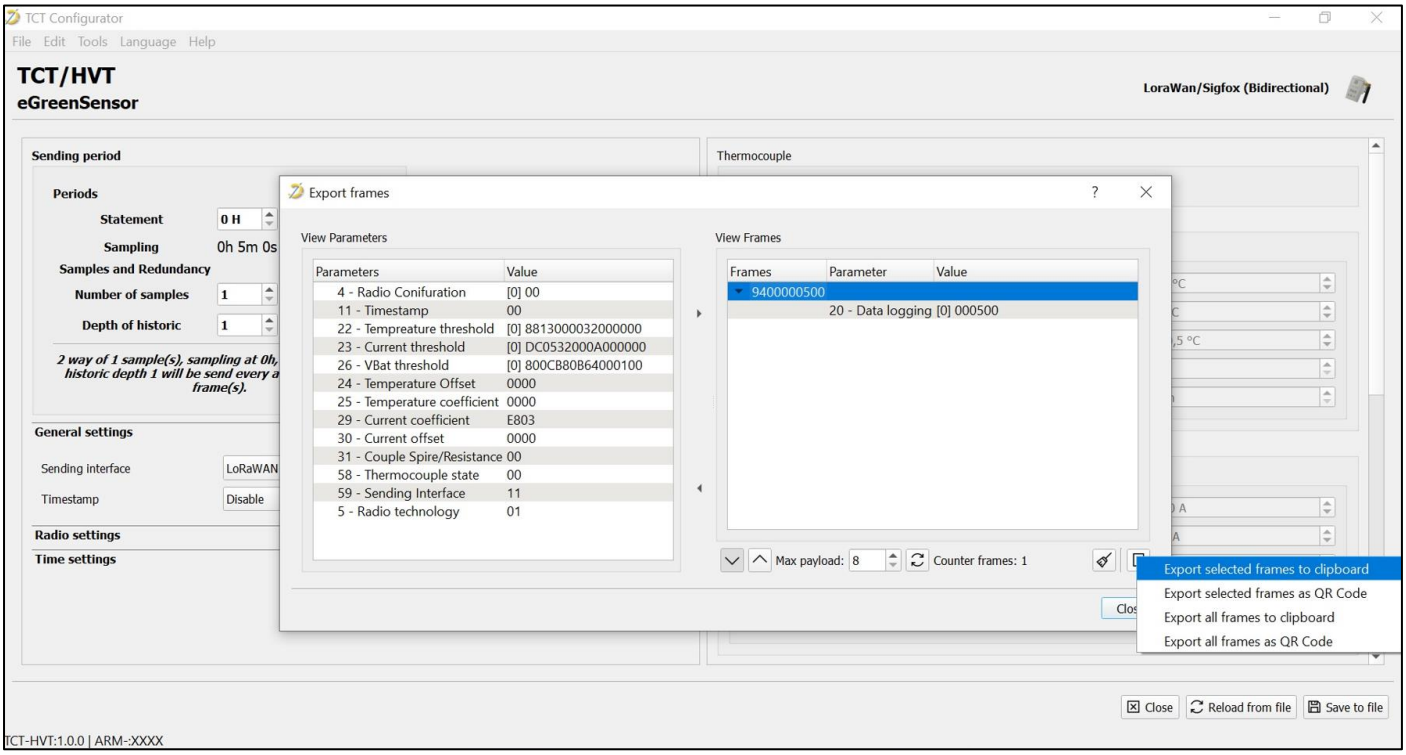


Figure 5 : Frames exportation window

1. Example of Downlink with the « Timestamp » activation

First, you need to activate the « Timestamp » in the configuration interface:

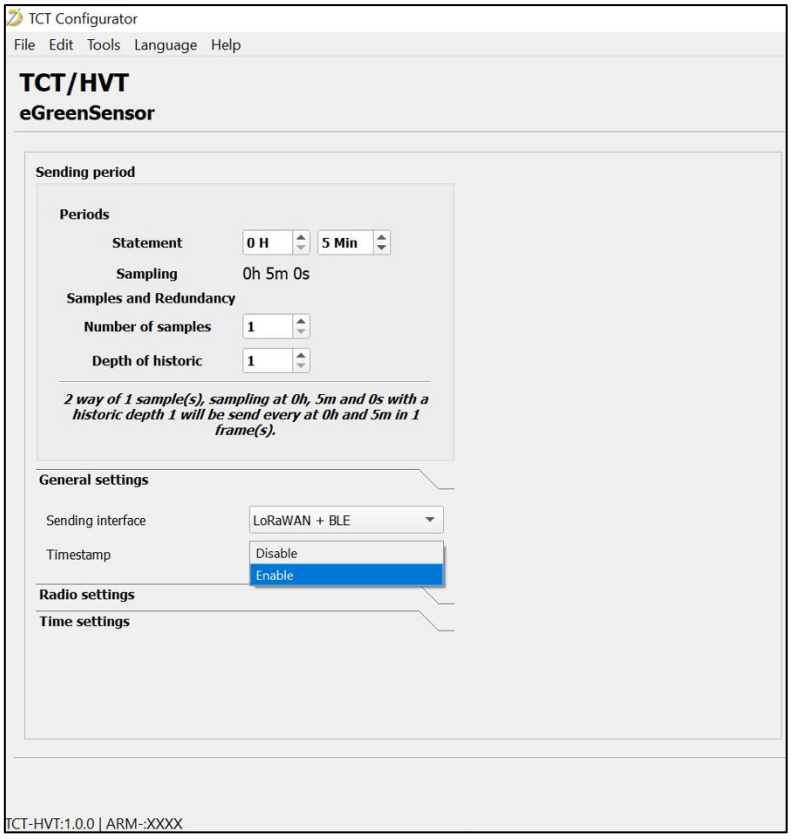


Figure 6 : Activate the Timestamp

Open the window “Edit/Export frames”. Select the parameter Timestamp and move it to “View frames” using the arrow. Then, select the frame and export it to the clipboard using the button at the bottom right.

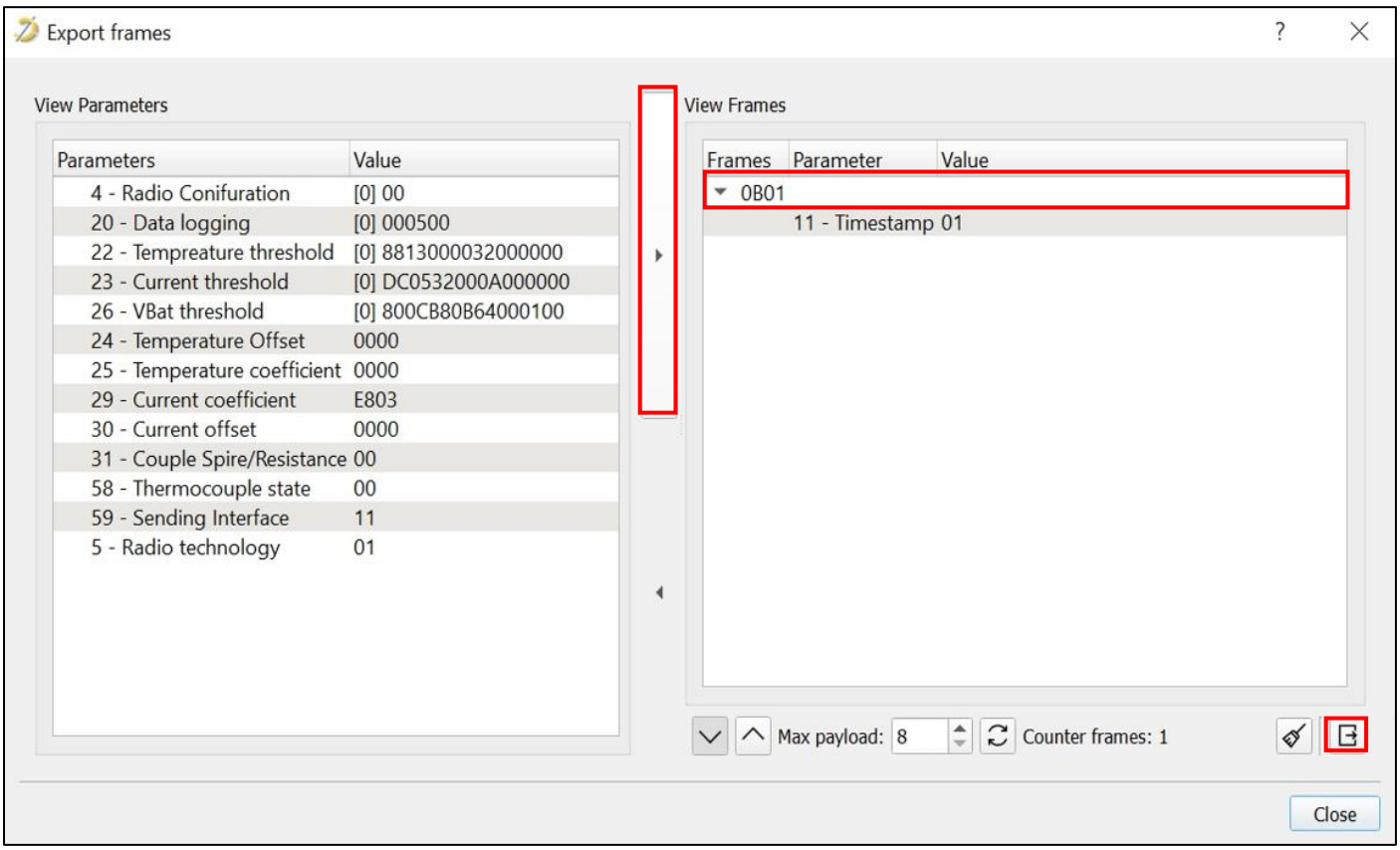


Figure 7 : Export the Timestamp activation frame

You then just need to send this frame through Downlink using your Gateway interface or application. Example on The Things Network:

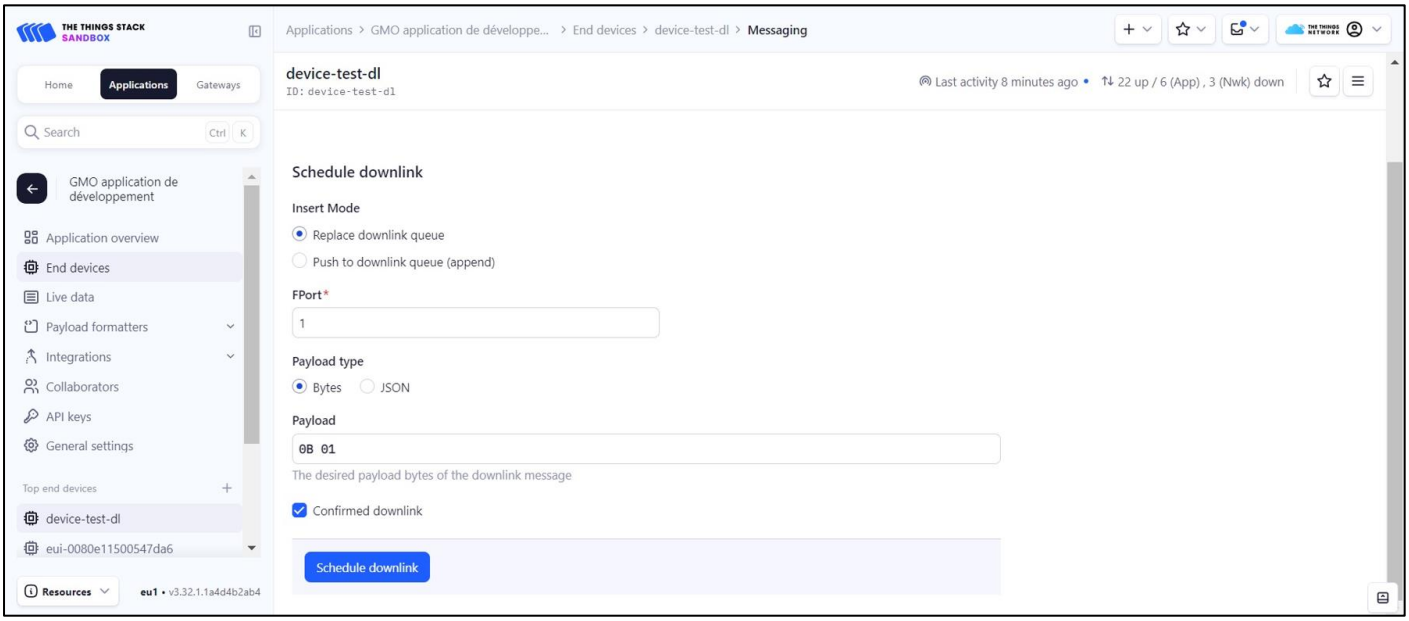


Figure 8 : TTN Interface to pass a Downlink frame

5. Different parameters correspondence

Radio configuration	Non modifiable
Timestamp	Timestamp activation
Datalogging	Configuration of the emission frequency, number of sample per emission and the depth history.
Temperature threshold	Configuration of the temperature levels alert
Current threshold	Configuration of the current levels alert
VBat threshold	Configuration of the energy storage element levels alert
Temperature Offset	Temperature offset setting (set up in factory, do not modify)
Temperature Coefficient	Temperature ratio setting (set up in factory, do not modify)
Current Coefficient	Current ratio setting (set up in factory, do not modify)
Current Offset	Current offset setting (set up in factory, do not modify)
Couple Spire/Resistance	Set up in factory, do not modify
Thermocouple State	Set up in factory, do not modify
Sending Interface	To deactivate BLE in General setting
Radio Technology	Non modifiable

Figure 9 : Correspondence between frames and parameters

VII. Configuration

A. LoRaWan emissions frequency

It is possible to set up the sending frequency of the LoRa frames. By default, the sensor sends a measurement frame every 10 minutes containing only one measurement. It is possible to modify the sending frequency from 1 min to 255 hours and to modify the number of samples by sending from 1 to 8.

For example, you can set up on sending every 15 minutes with 3 samples. You will then have one measurement every 5 minutes and the 3 measurements will be sent at once every 15 minutes.

A third parameter is accessible through the configurator. It is the depth history. By default, its parameter is 1, which means that only the last measurement is sent. If you wish to receive the measurement from the last sending, you can change the parameter to 2. And so on, up to a maximum value of 4 (the measurements of the last 3 sendings).

Warning
If the emission period is less than 4 min, the ADR (Adaptative Data Rate) will be deactivated et the product will set its Data Rate on SF9. Too many emissions can generate a too high energy consumption, incompatible with energy available by harvesting.

B. Frame Timestamp

It is possible to deactivate/activate the timestamp of all the radio frames. By default, the timestamp is deactivated.

WARNING
This option, when activated, uses 4 bytes in the frame which cannot be used for the useful data. These 4 bytes represent then the timestamp of the sensor data acquisition.

C. Communication interface

The product has two communication interfaces: LoRaWAN and BLE

It is possible to activate or deactivate the BLE interface. But it is not possible to deactivate the LoRaWAN interface.

WARNING
If the BLE interface is deactivated, it won't possible anymore to connect to the configurator. Indeed, the configurator is only accessible through BLE. You will still be able to re-configurate the product but through Downlink LoRaWAN.

D. Temperature, current and voltage threshold

The sensor executes the current measurement in the phase where it is fixed and regularly executes a voltage measurement of the energy storage element.

With a thermocouple, the product also executes a temperature measurement.

On these three values (current, voltage and temperature), it is possible to set up thresholds. The thresholds are configurable by a low and high threshold, following a configurable hysteresis and passing period. When a measurement reaches its threshold, a radio frame is sent (see the chapter Alert frame for the frame format detail). A radio frame is transmitted when the threshold is exceeded (too low or too high) but also when the value is again within the bounds.

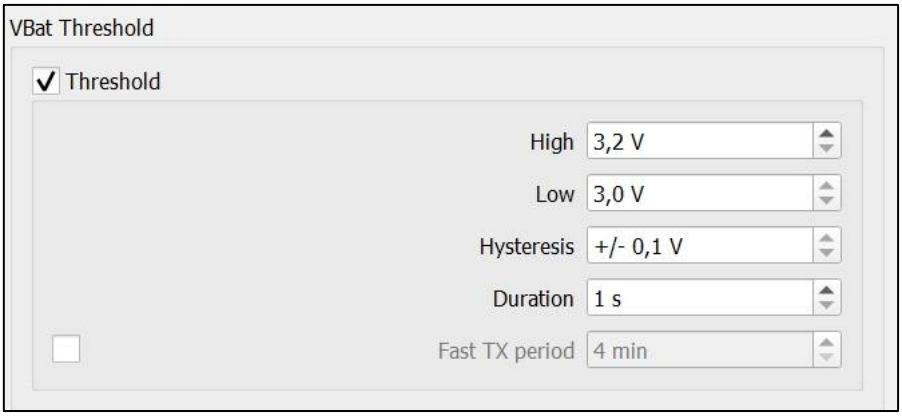


Figure 10 : Threshold parameters

E. Temperature and current measurement calibration

It is possible to calibrate the current and temperature measurement using the Offset and Coefficient. Nevertheless, the calibration is done at the factory and it is not recommended to modify it.

VIII. Lora frames

A. UPLINK frames format

1. Description

Uplink frame			
Byte 1	**Byte 2**	**. . .**	**Byte n**
Frame header	Frame specific data		

There are 3 different types of frames:

- **Classic frame**: these are for example the life frame, the error frame, the answer to the configuration frames.
- **Measurement frame:** These frames are made of the samples of the different values of each channel the sensor can notice. Before, the number of samples and the depth history are inserted in the header.

NOTE
The number of samples and the depth history are in common for all the frame channels.

- **Alert Frame (threshold exceeded)**: These frames combine a classic frame and a measurement frame. They consist of a header indicating a threshold has been exceeded followed by samples of each channel where a threshold has been exceeded.

2. Classic frame

Byte 1 - header							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
New generation = 1	Timestamp = 1 - activated 0 - deactivated	Measurement frame = 0	Reserved = 0	Type of frame (see below)			

If the Timestamp is activated, 4 bytes with the Timestamp value will be preceded by the header (byte 1).

3. Different types of frames

Type of Frame	Data size	Frame description
0x00	--	Reserved
0x01	4 bytes	Life frame
0x02	0 bytes	Downlink request for network test
0x03	--	Reserved
0x04	--	Reserved
0x05	1 bytes	Test frame with counter
0x06	Variable	(Cfg box) Answer to a configuration frame
0x07	Variable	(Cfg box) Answer to a command frame
0x08	Variable	(Cfg box) Answer to an error frame
0x09	--	Reserved
0x0a	--	Reserved
0x0b	--	Reserved
0x0c	--	Reserved
0x0d	Variable	Alert frames tracking samples of channel measurements in alert
0x0e	TBD	General error - TBD (memory, ...)
0x0f	Variable ...	Sub frame for ACW. Depending on the ACW

4. Measurement frame

Byte 1 - Header							
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
New generation = 1	Timestamp (Deactivated = 0, Activated = 1)	Measurement frame = 1	History depth (-1) Max : 4		Number of samples (-1) Max : 8		

If the Timestamp is activated, 4 bytes with the Timestamp value will be preceded by the header (byte 1).

Warning
If the field depth history or number of samples is greater than 1, the transmission period of a frame (in minutes) will be added after the header and will occupy 2 bytes (Big Endian encoding, MSB first)

For each channel, a header is inserted subsequently and is constituted as follow. The sensor actually only has one channel, therefore the channel number is 00 by default.

Byte 2 Channel header							
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Reserved = 0		Channel number		Type of measurement			

Type of possible measurement

Type of measurement	Units	Data size	Type of data	Description
0x08	T°C	2 bytes (**Big Endian - MSB**)	Complete signed	Temperature in **hundredths** of Celsius degrees • Resolution : 0.01°C • Max value : 327,67°C • Min value : -327,68°C
0x0A	mV	2 bytes (**Big Endian - MSB**)	Complete not signed	Voltage accross the supercap (in mV) • Resolution : 1mV • Max value : 65535mV • Min value : 0mV
0x0B	A	2 bytes (**Big Endian - MSB**	Complete not signed	Current measured in the cable (en **hundredths** of Amps) • Resolution : 0.01A • Max value : 655,35A • Min value : 0A

This is followed by the data from the measurement sample(s) (depending on the product configuration)

NOTE
When a frame comprises of more than one sample by channel (number of samples >1 or depth history > 1), the samples are organized from newest to oldest.

The number of bytes sent can be determined as follow:

(Size in bytes of the measurement) * (number of samples) * (depth history)

EXAMPLE
For a measurement type 0x0A (the size of a value is 2 bytes) with a history depth of 2 and a number of samples of 3, the size of the data to be read would be 12 bytes (2x2x3).

5. Measurement alert frame

Byte 1 - Header							
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
New generation = 1	Timestamp (Deactivated = 0, Activate = 1)	Measurement frame = 0	Reserved = 0	Alert frame (= 0x0d)			

If the Timestamp is activated, 4 bytes with the Timestamp value will be preceded by the header (byte 1).

For each of the alert channels, a header is inserted subsequently and is constituted as follow :

The field **Alert type** allows you to identify wether it is an exceeding of the high threshold, of the low threshold or a return between the thresholds.

Byte 2 Channel header							
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Alert type		Number of channel		Type of measurement			

These values are defined as follow:

Value	Description
0x00	Return between the thresholds
0x01	Exceeding of the high threshold
0x02	Exceeding of the low threshold
0x03	Reserved

The field type of measurement is here identical to the measurement frame (i.e 0x08, 0x0A ou 0x0B in hexadecimal).

The sample that caused the alter is then inserted in a row (with a **Big Endian** encoding – MSB first)

6. Error and general alarm frame

Byte 1 - Header							
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
New generation= 1	Timestamp = 0	Measurement frame = 0	Reserved = 0	Error frame = 0x0e			

If the Timestamp is activated, 4 bytes with the Timestamp value will be preceded by the header (byte 1).

For each error message, a header is inserted and is constituted as follow :

Byte 2 - Header Error message							
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Message index			Length of the error message				

The field **Message index** allows you to put in order the messages when several errors occurred.

The field **Length of the error message** indicates the size in bytes of the error message.

The following byte allows you to identify the nature of the error or of the alarm :

Byte 3 - Header Error message		
Error code	Error nature	Description
0x81	ERR_UNKNOWN	
0x82	ERR_BUF_SMALLER	The data table is full, impossible to add further data
0x83	ERR_DEPTH_HISTORIC_OUT_OF_RANGE	The history depth is too large or too small for the frame
0x84	ERR_NB_SAMPLE_OUT_OF_RANGE	The number of samples is too large or too small for the frame
0x85	ERR_NWAY_OUT_OF_RANGE	The number of channels in the frame header is too large or too small
0x86	ERR_TYPEWAY_OUT_OF_RANGE	The measurement type in the frame header is too large or too small
0x87	ERR_SAMPLING_PERIOD	Wrong structure of sampling time
0x88	ERR_SUBTASK_END	End of a subtask after exiting an infinite loop
0x89	ERR_NULL_POINTER	Pointer with value “NULL”
0x8A	-	-
0x8B	ERR_EEPROM	EEPROM is corrupted
0x8C	ERR_ROM	ROM is corrupted
0x8D	ERR_RAM	RAM is corrupted
0x8E	ERR_ARM_INIT_FAIL	The radio module startup failed
0x8F	ERR_ARM_BUSY	The module is already buy (possibly not initialised)
0x90	ERR_ARM_BRIDGE_ENABLE	The module is on bridge mode, impossible to send the data through radio
0x91	ERR_RADIO_QUEUE_FULL	The radio buffer is full
0x92	ERR_CFG_BOX_INIT_FAIL	Error during the black box initialisation
0x93	-	-
0x94	-	-
0x95	-	-
0x96	ERR_ARM_TRANSMISSION	A transmission has been initialised but an error occured
0x97	ERR_ARM_PAYLOAD_BIGGER	The message size is too big for the network capacity
0x98	ERR_RADIO_PAIRING_TIMEOUT	Impossible to connect to a network before the given time

Examples of frames

7. Measurement frame

With the deactivated timestamp, no history and 1 sample (Current and voltage only) :

Byte						
1	2	3	4	5	6	7
0xA0 (measurement frame new generation, no history, 1 sample)	0x0B (Channel 0, type of measurement: current)	0x03	0xA8	0x0A (Channel 0, type of measurement: voltage)	0x10	0x38

In this example, the sensor indicates values of 0x03A8 (9.36A) for the current and 0x1038 (4,152V) for the voltage.

Now with 2 samples :

Byte											
1	2 et 3	4	5	6	7	8	9	10	11	12	13
0xA1 (measurement frame new generation, no history, 2 samples)	0x00A (emission time)	0x0B (Channel 0, type of measurement: current)	0x07	0xF0	0x07	0x8C	0x0A (Channel 0, type of measurement: voltage)	0x0F	0x13	0x10	0xA7

Bytes 2 and 3 indicate the emission time, here 10 minutes (therefore a sample is measured every 5 minutes).

- The first sample is 0x07F0 (20,32A) / 0x0F13 (3,859V)
- The second is 0x078C (19,32A) / 0x10A7 (4,263V)

With the deactivated timestamp, no history, 1 sample and the thermocouple activated:

Byte									
1	2	3	4	5	6	7	8	9	10
0xA0 (measurement frame new generation, no history, 1 sample)	0x08 (Channel 0, type of measurement : temperature)	0x09	0xE8	0x0B (Channel 0, type of measurement : current)	0x03	0xA8	0x0A (Channel 0, type of measurement : voltage)	0x10	0x38

In this example, the sensor indicates values of 0x09E8 (25.36°C) for temperature, 0x03A8 (9.36A) for the current and 0x1038 (4,152V) for the voltage.

Now with 2 samples :

Byte																
1	2 et 3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
0xA1 (measurement frame new generation, no history, 2 samples)	0x00A (emission time)	0x08 (Channel 0, type of measurement : temperature)	0x09	0x34	0x09	0x79	0x0B (Channel 0, type of measurement : current)	0x07	0xF0	0x07	0x8C	0x0A (Channel 0, type of measurement : voltage)	0x0F	0x13	0x10	0xA7

Bytes 2 and 3 indicate the emission time, here 10 minutes (therefore a sample is measured every 5 minutes).

- The first sample is 0x0934 (23.56°C) / 0x07F0 (20,32A) / 0x0F13 (3,859V)
- The second is 0x0979 (24.25°C) / 0x078C (19,32A) / 0x10A7 (4,263V)

8. Measurement Alert Frame

For the exceedance of the low threshold (voltage) on channel 0, the frame will be:

Octet			
1	2	3	4
0x8D (Alert frame new generation)	0x8A (Exceeding low threshold channel 0, voltage measurement)	0x0E	0x89

The value of the sample that caused the threshold is 0x0E89 (3,721V)

9. Answer to the configuration frames

For each configuration frame, the product answers with an acknowledgement frame.

If the parameter went through correctly, its acknowledgement bit is 0 or 1.

Octet 0	Octet1							
	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Header (0x06)	Ack param7	Ack param6	Ack param5	Ack param4	Ack param3	Ack param2	Ack param1	Ack param0

If everything went fine, you will receive 0x06 00.

IX. E-green Monitor application

An Android and iOS application is available on the stores. It allows you to view the current and temperature measured by the sensor, configure them and retrieve the LoRaWan activation keys in a simple way.

A. Download and installation

1. Android application (Play store)

On the Android Play store, search for the application E-green Monitor. It is developed by Integral System and is represented by a TCT logo. Click on « Install ».

2. iOS application (Apple Store)

Coming soon

B. First use

When the application opens, you have two options:

- You can search for the sensors nearby and visualize the measurements done by the sensor without any connection.
- Or connect yourself to a user account. The connection through a user account allows you to save your configuration and to share it on multiple devices (tablet, smartphone). It also allows you to retrieve the LoRaWan activation keys.

The account creation is necessary to save the configuration you have chosen but also to retrieve the LoRaWan activation keys for the application. Indeed, the application is synchronised with the portal and it will allow you to retrieve your configuration if you use a different smartphone. As a reminder, the LoRaWan activation keys are also available on our internet portal at the following address:

https://egreen.tct.fr/portal/fr/

An account creation is also necessary on the portal to secure the keys allocation. The account created on the application is the same as on the portal. We recommend you create one as soon as possible and to associate it to your organization.

C. Retrieving the LoRaWAN activation keys with the application

If you are connected with your account, it is possible to retrieve the activation keys without the sensor to be powered. You just need to scan the QR code marked on the sensor by clicking on the QR code symbol on the top left of the application.

Figure 11 : Application homepage

Figure 12 : Screen for the retrieve of LoRaWAN usernames

You can scan several QR codes in a row and click on “retrieving the LoRaWAN usernames” to generate a shareable .csv file, which will contain the DevEUI, AppEUI/JoinEUI and AppKey.

D. Sensor search and addition

Click on: *search for sensors*

Note
At first use, you will need to authorise the application to use BLE and localisation.

The operating sensors will appear in the list:

You just need to click on the sensor you wish to communicate with. The application will retrieve the sensor configuration and add the selected sensor in “My e-green sensors”.

Figure 13 : Example of sensor detection

E. Measurements

To carry out measurements, just click on the sensor you wish to use from the « My e-green sensors » list. Then, click on the Bluetooth symbol when you are on the below screen.

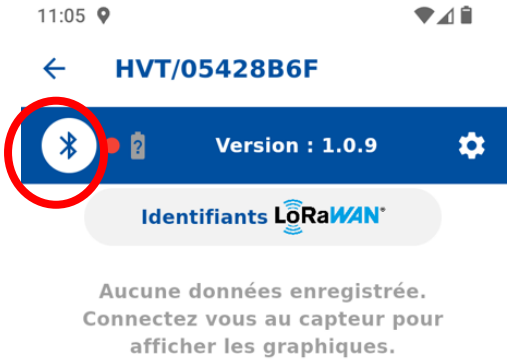


Figure 14 : BLE pairing

Once connected to the sensor, the measurements are automatic. The green dot near the Bluetooth symbol indicates that the application is connected to the sensor. You can also see the last data reception.

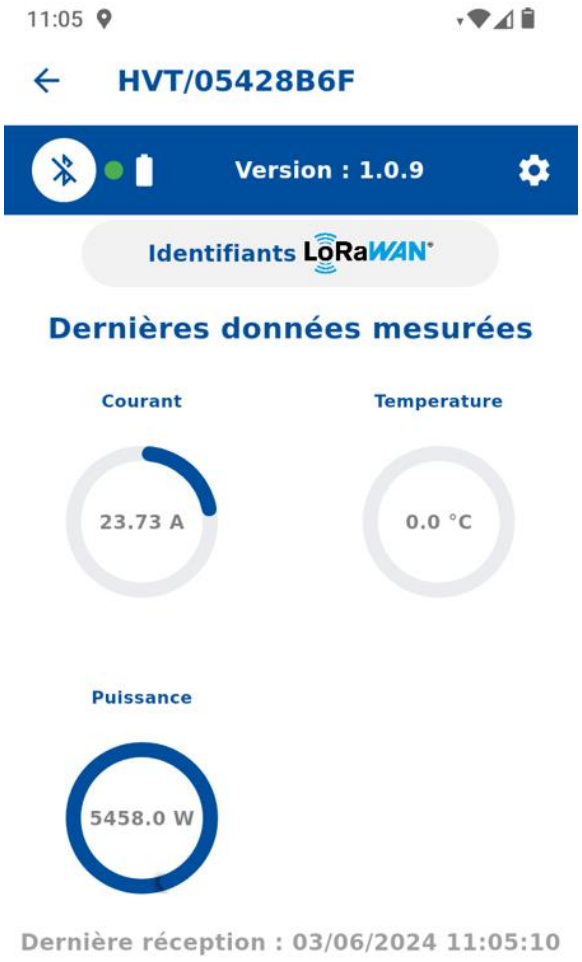


Figure 15 : Measurements screen

F. Configuration

In the configuration section, accessible via the gear symbol, you can modify the name of the sensor for a better recognition.

- In the calculation parameters: you can modify the voltage in the phase, measured by the power calculation.
- In the graphs parameters: You can select which data to display and define the maximum values for the layout.
- In the alerts parameters: You can create a condition for the data layout.
- In the LoRaWAN configuration: You can modify the LoRaWAN frames emission frequency and the number of samples per frame.
- Reset the sensor enables the restart of the sensor

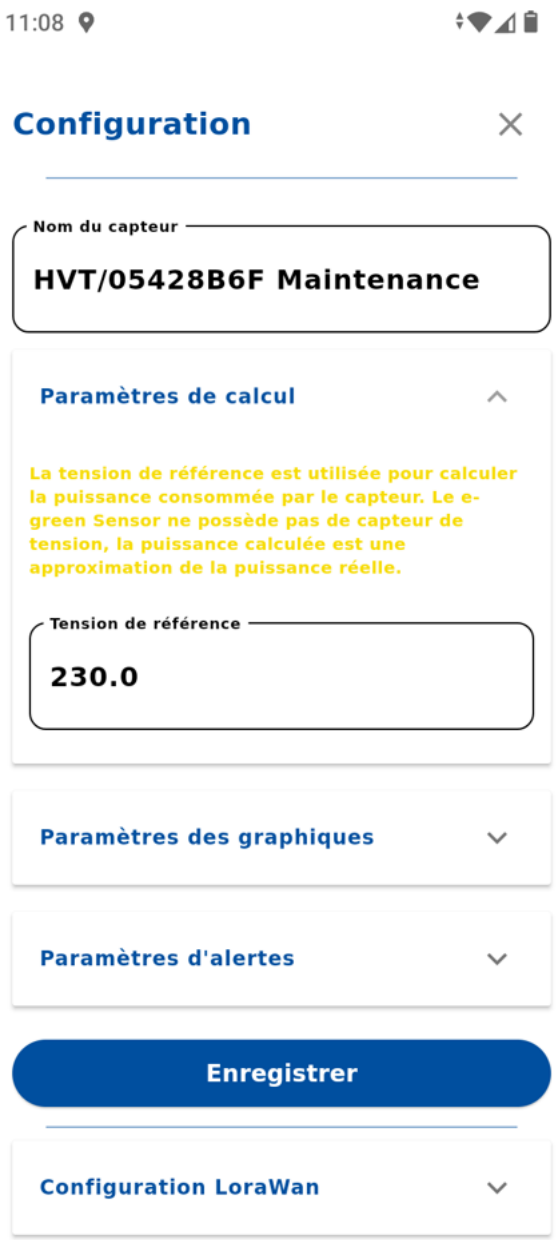


Figure 16 : Configuration screen 1

Figure 17 : Configuration screen 2

You will have a personalised layout:

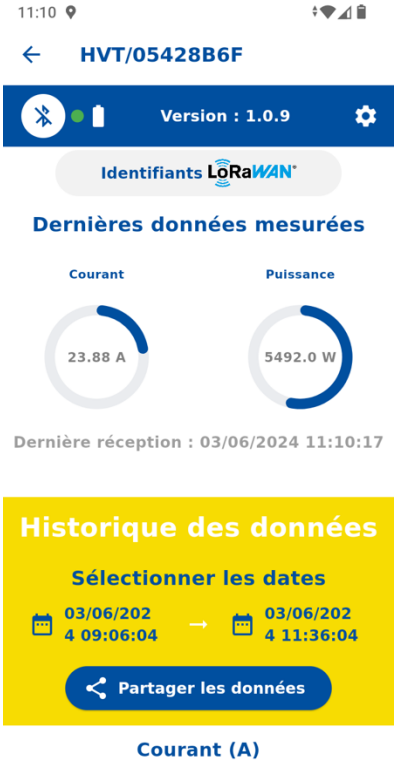


Figure 18 : Personalized layout

G. Data history and sharing

As long as you are connected to the sensor, data will be reported.

Figure 19 : Date history

It is possible to share the data by selecting the requested time period and by clicking on Share the data. The data will be then shared under the format of a .csv file.

H. Creating a group of sensors

It is possible to create a group of sensors in order to carry out several measurements simultaneously. Click on:

You need to name the group of sensors. Then select the sensors you want to include and choose the data you want to see.

Figure 20 : Create a group of sensors

Click on create and the group will be displayed on the main screen:

Figure 21 : Homepage with the group of sensors

From there, if you select the group, you can carry out measurements simultaneously on each sensor in the group and export them.

Figure 22 : Measurements on a group of sensors

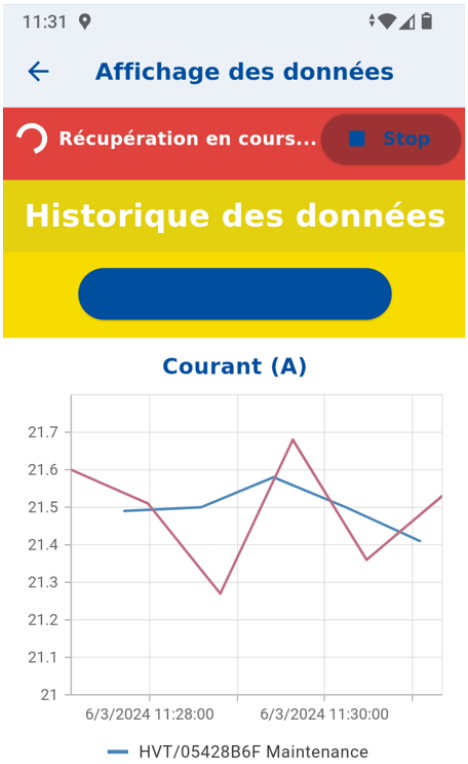


Figure 23 : Data history on a group of sensors

X. BLE command

If you prefer to use the BLE functionality outside the supplied application, we can provide the existing BLE commands for you own development, upon request.