



**Commissioning of the EP5000-L (LoRa) probe**

Ver	Date	Modification / Update
V1	04/01/2020	Initial Version
V2	20/01/2020	Flickering added
V3	01/6/2020	Dimming LEDs removed, Byte numbering corrected, Lux range extended

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## 1. Overview

The EP5000L (powered) and E5000AL (autonomous with indoor light supply) probe communicates by radio in LoRaWAN. This document describes how to commission the probe on the LoRaWAN network and describes the content of the telegrams.

## 2. Memory security accessible by NFC

The NFC chip has a password to protect it in read and / or write.

Thus the serial number, radio ID and other parameters to be secured cannot be modified by a third party.

The settable data (parameters) can only be accessed from the manufacturer's application containing the passwords to avoid any hacking or corruption of data by people using standard NFC chip reading and writing software.

## 3. Download the setting application

The setting of parameters and the reading of data is compatible with Android smartphones (not IOS because Apple does not allow the use of the on-board NFC of their smartphone for purposes other than payment).

You can go to the Google store and search for NanoSense. You will see a list of applications: Select the application corresponding to the IAQ probe model and download it.

You can also access the NanoSense website and download the App.

## 4. Smartphone type and settings

Make sure your Android smartphone has an integrated NFC function.

Activate NFC in the settings section.

## 5. Reading the Dev EUI with the NFC application

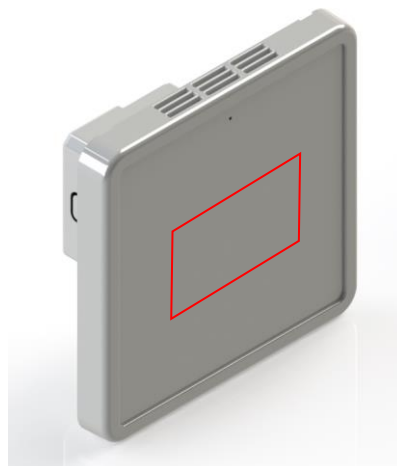
Open the NFC configuration App and approach the back of the smartphone from the center of the front face of the probe (the antenna is located in the middle).

Reading by NFC does not require the unit to be powered or even mounted. It is even possible to read the NFC memory through the cover of the box (a marking on the box indicates the location of the NFC antenna)

The power supply for the front panel comes from the smartphone via NFC. When the NFC antenna on the probe responds, you should hear a Beep on the phone.

You can read the unique DevEUI key. To do this, click on the "Read" button in the application.

The DevEUI can now be copied for recording in the network.



NFC antenna location



## 6. Join a network

By default, the probe is in public mode. For private mode, you must use the dedicated smartphone application and activate this function by NFC. Do not confuse private mode and private network. Private mode exchanges longer keys.

Select OTAA mode in the web page of the LoRaWAN network or of the gateway used.

Enter the following keys:

Key	Bits	Byte	Contend	Contend in hexadecimal for input
Device EUI	64	8	“Unique”	Contained in the NFC chip
Application EUI	64	8	IAQ-Data	49 41 51 2d 44 61 74 61 (Provided by the manufacturer)
Application Key	128	16	“Unique”	Provided by the manufacturer.

The keys are confidential and sent by email to the buyer in the form of a table.

The EUI Dev is available via the NFC chip (see previous chapter).

Copy the DevEUI key as well as other keys.

At startup, the radio module will be automatically recognized by the LoRa or LoRaWAN network.

When the radio module is connected to the LoRaWAN network, The Joined green LED in the upper part of the front panel remains on.



Joined LED

Be careful, recording on an operated network may require several radio transmission cycles.

### 6.1. Setting the LoRa emission rate

The transmission rate depends mainly on the operator and the contract with him. It is generally allowed to transmit on average at most every 10 minutes in an operated network. In a private network, the rate may be faster.

By default, the cadence of the Radio LoRa module is 10 minutes.

The transmission rate can be configured by NFC and by the downlink for powered EP5000Ls.

The following command must be sent:

0x01 0xdd 0xdd

0x01: command number for time cycling change. (See chapter 2.2.2)

0xdd 0xdd is the delay between two frames in minutes, it will be taken into account after the next emission.

## 7. LoRaWAN Payload

### 7.1. Contend of LoRaWAN Payload

Regularly, the LoRa module sends a set of measurements distributed over its emission rate. This message can be timestamped on receipt. It belongs to a gateway or the database that archives the recordings to time stamp the data.

### 7.2. LoRa messages format

#### 1.1.1. Uplink

EP5000 LoRa Telegram:

Presence sensor	Probe Frm	LoRa Module Frm	BITE	Emission rate	RH	T°	PM	Noise	CO2	TCOV	Formaldehyde	Benzene	Atmospheric pressure	Lux	Color T°	Flickering
1 Byte	1 Byte	1 Byte	2 Bytes	2 Bytes	1 Byte	9 bits	27 bits	20 bits	13 bits	2 Bytes	2 Bytes	2 Bytes	14 bits	1 Byte	1 Byte	1 Byte

physiological Effects	Building Effects
3 Bytes	1 Byte

Total 32 Bytes

**Detail of the sensor presence byte (byte 1).**

Bit	
0	1 = T°, RH active
1	1 = PM active
2	1 = Bruit active
3	1 = CO2 active
4	1 = TCOV active
5	1 = Formaldehyde active
6	1 = Benzene active
7	1 = Lux & light T° active

**Detail of EP5000L probe Firmware version and LoRa stack software bytes (byte 2 and byte 3)**

Byte 2							
Probe Firmware Version							
7	6	5	4	3	2	1	0

Byte 3							
LoRa Stack Firmware Version							
7	6	5	4	3	2	1	0

Bits 4 to 7 : integer

Bits 0 to 3 : tenth

Valid range: 1.0 to 16.16

**Detail of BITE (Built In Test Equipment) bytes (byte 4 and byte 5)**

The 2 bytes of the BITE identify the FRU (**F**iled **R**eplaceable **U**nit) to be changed.

Bit	
0	LoRa front panel board.
1	Single band CO2 sensor module.
2	Dual band CO2 sensor module
3	VOC sensor module
4	Motherboard with LoRa firmware.
5	Interconnection board.
6	Particles sensor board
7	Radio version power supply board.
8	Multiple failures.
9	Perishable sensor arrived at end of life.
10 to 16	Reserved

**Detail of the 2 Transmission rate bytes (byte 6 and byte 7)**

Emission rate in minutes

By default, the value is zero which corresponds to an emission rate of 10 minutes. Note that values greater than 720 also correspond to the default value of 10 minutes.

Therefore, the range goes from 1 minute to 12h.

Valid range: 0-720 minutes (12 hours)

**Detail of the RH byte**

Byte 8							
RH							
7	6	5	4	3	2	1	0

Valid range: 0/200 LSB  
 Range of measurement 0 to 100%RH  
 Resolution: 0,5%/LSB

**Detail of Temperature**

Byte 9								Byte 10							
Temperature															
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0

Valid range: 0/511 LSB  
 Range of measurement 0 to +51°C  
 Resolution: 0,1°C/LSB

**Detail of PM**

Byte 10								Byte 11								Byte 12								Byte 13							
PM 10								PM 2.5								PM 1															
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0

Valid range: 0/511 LSB  
 Range of measurement 0 to 511 µg/m³  
 Resolution: 1 µg/m³/LSB

**Detail of Noise**

Byte 13								Byte 14								Byte 15							
Bruit moyen								Bruit pic															
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0

valid Range pic & average: 0/1023 LSB  
 Range of measurement 17.7 to 120 dBa  
 Resolution: 0,1 dBa

**Detail of CO2**

Byte 16								Byte 17											
CO2																Reserved			
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0				

Concentration:  
 Valid Range: 0/8191 LSB  
 Range of measurement 0 to 5000ppm  
 Resolution: 1ppm / LSB

**Detail of TVOC**

Byte 18								Byte 19							
Concentration TVOC															
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0

Concentration:  
 Valid Range: 0/65 535 LSB  
 Range of measurement 0 to 65 520 µg/m³  
 Resolution: 28 µg/m³ / LSB

**Detail Formaldehyde:**

Byte 20								Byte 21							
Concentration Formaldéhyde															
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0

Concentration:  
 Valid Range: 0/65535 LSB  
 Range of measurement 0 to 655.35 µg/m<sup>3</sup>  
 Resolution: 0,01 µg/m<sup>3</sup> / LSB

**Detail Benzene:**

Byte 22								Byte 23							
Concentration Benzène															
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0

Concentration:  
 Valid Range: 0/65535 LSB  
 Range of measurement 0 to 655.35 µg/m<sup>3</sup>  
 Resolution: 0,01 µg/m<sup>3</sup> / LSB

**Detail of Atmospheric Pressure:**

Byte 24								Byte 25							
mbar / hPa															
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0

Atmospheric Pressure:  
 Valid Range: 0/16 384 LSB  
 Range of measurement 0 to 1638.4 mbar  
 Resolution: 0,1 mbar / LSB

**Detail Lux:**

Byte 25							Byte 26								
							Lux								
7	7	6	5	4	3	2	1	0	6	5	4	3	2	1	0

Luminosity:  
 Valid Range: 0/255 LSB  
 Range of measurement 0 to 4096 Lux  
 Resolution: 4 lux / LSB

**Detail Light color Temperature:**

Byte 27							
T° de la lumière en Kelvin							
7	6	5	4	3	2	1	0

light color Temperature:  
 Valid Range: 0/255 LSB  
 Range of measurement 1 635°K to 7 500°K  
 Resolution: 23°K / LSB

**Detail Light flickering:**

Byte 28							
Flickering in %							
7	6	5	4	3	2	1	0

Flickering of the light:



Valid Range: 0/128 LSB  
 Range of measurement 0 to 100%  
 Resolution: 1% / LSB

### Physiological Effects

Byte 29								Byte 30								Byte 31							
Health Index								Cognitivity Index								Sleeping Index							

### Building Effects

Byte 32							
Building Index							

Conversion of physical values:

Parameters measured	Size	Range	Resolution	Physical Values
CO2	13 bits	0...5000	1 LSB = 1 ppm	0...5000 ppm
Humidity	1 Byte	0...200	1 LSB = 0.5%	0...100 %RH
Temperature	1 Byte	0...255	1 LSB = 0.2°C	0...+51 °C
COV	2 Bytes	0...65535	1 LSB = 10 µg/m <sup>3</sup>	0...65535 µg/m <sup>3</sup>
PM10, PM2.5, PM1	9 bits per value	0...511	1 LSB = 1 µg/m <sup>3</sup>	0...511 µg/m <sup>3</sup>
Average and pic Noise	2 x 10 bits	0...1023	1 LSB = 0.1dBA	17.7...120
Pressure	14 bits	0...1023	1 LSB = 0,1 mBar	0...1638.4 mBar
Lux	1 Byte	0...1020	1 LSB = 4 Lux	0...4096 lux
color T°	1 Byte	0...255	1 LSB = 2°K	1 635°K to 7 500°K
Flickering	1 Byte	0...200	1 LSB = 0.5%	0...100 %
Health Index	1 Byte	0...100	1 LSB = 1%	0...100 %
cognitivity Index	1 Byte	0...100	1 LSB = 1%	0...100 %
Sleeping Index	1 Byte	0...100	1 LSB = 1%	0...100 %
Building Index	1 Byte	0...100	1 LSB = 1%	0...100 %

## 7.2.1.1. Time stamp

It is up to the gateway which receives the telegram to time stamp the measurements.

## 7.2.2. Down Link

The transmission of the configuration data is done on port 2.

Byte 1	Byte 2	Byte 3
Command Code		
0x01	Emission rate in minutes	

Total 2 Bytes

### Emission rate command 0x01

This command is used to set the transmission rate.

The two Bytes of rate are a delay between two frames expressed in minutes, it will be taken into account after the next transmission.

By default, the value is at zero which corresponds to a transmission rate of 10 minutes. Note that values greater than 720 also correspond to the default value of 10 minutes.

The range goes from 1 minute to 12 hours.