

# BLE RANGE USER GUIDE



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## 1 GENERAL INFORMATION ABOUT BLUETOOTH LOW ENERGY

**Bluetooth Low Energy** technology is also called **LE** or **BLE Bluetooth**. This technology appeared in 2010 with the release of version 4.0 of the Bluetooth Core Specification.

Bluetooth Low Energy is an alternative to "classic Bluetooth". By "classic Bluetooth", we mean all versions of Bluetooth released before Core Specification 4.0.

Low Energy Bluetooth technology operates in the free band **ISM 2.4 GHz**. This technology relies on a **frequency hopping radio**. 40 physical channels are allocated and separated from each other by 2 MHz and used according to the FDMA. Three of them consist in **advertising channels** (they might be considered as signalization) and all the others are data channels. In contrast, conventional Bluetooth uses 80 channels separated from each other by 1 MHz.

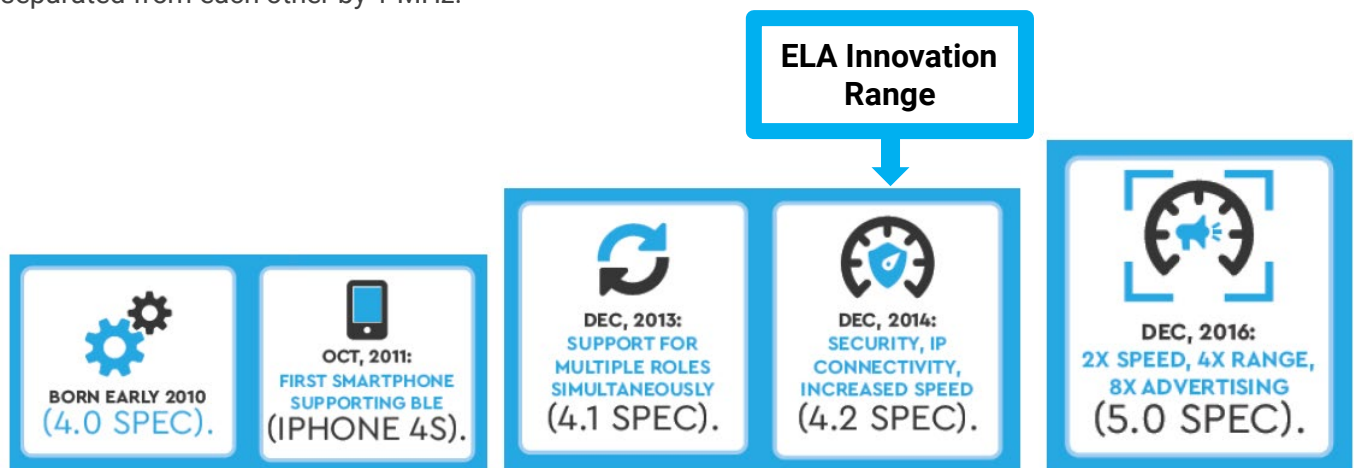


Figure 1: Evolution of Bluetooth Low Energy versions

**Bluetooth SIG** is the current standard in terms of information and specifications. The **Bluetooth Special Interest Group**, known as **SIG**, is the body that oversees the development of Bluetooth specifications, manages the various technology qualification processes and grants the needed licenses of the Bluetooth brand and technology to manufacturers.

Bluetooth SIG website	<a href="https://www.bluetooth.com/bluetooth-technology">https://www.bluetooth.com/bluetooth-technology</a>
BLE Specification	<a href="https://www.bluetooth.com/specifications">https://www.bluetooth.com/specifications</a>
BLE Services and features	<a href="https://www.bluetooth.com/specifications/gatt">https://www.bluetooth.com/specifications/gatt</a>

## 2 BLUETOOTH LOW ENERGY PRODUCTS BY ELA INNOVATION

<i>DESIGNATION</i>	<i>PRODUCT REFERENCE</i>	<i>DESCRIPTION</i>
<b>Blue</b> PUCK <b>ID</b>	IDF25240x	Tag Bluetooth PUCK Format with Identifier Option – iBeacon – Eddystone
<b>Blue</b> PUCK <b>BUZZ</b>	IDF25245x	Tag Bluetooth PUCK format with Identifier Option – Buzzer
<b>Blue</b> PUCK <b>T</b>	IDF25241x	Tag Bluetooth PUCK Format with integrated temperature sensor
<b>Blue</b> PUCK <b>T EN12830</b>	IDF30241x	Tag Bluetooth Format PUCK, integrated temperature sensor, EN12830 (2018) certified
<b>Blue</b> PUCK <b>T PROBE</b>	IDF25250x	Tag Bluetooth Format PUCK external temperature probe, EN12830 (2018) certified
<b>Blue</b> PUCK <b>RHT</b>	IDF25242x	Tag Bluetooth PUCK Format with humidity and temperature sensor option
<b>Blue</b> PUCK <b>MAG</b>	IDF25243x	Tag Bluetooth PUCK Format with magnetic sensor option
<b>Blue</b> PUCK <b>MOV</b>	IDF25244x	Tag Bluetooth PUCK Format with motion sensor option
<b>Blue</b> PUCK <b>PIR</b>	IDF25249x	Tag Bluetooth PUCK format with presence detection sensor
<b>Blue</b> PUCK <b>DI</b>	IDF24246x	Tag Bluetooth PUCK Format with digital input option
<b>Blue</b> PUCK <b>DO</b>	IDF25247x	Tag Bluetooth PUCK Format with digital output option
<b>Blue</b> PUCK <b>AI</b>	IDF25248x	Tag Bluetooth PUCK Format with analog input option
<b>Blue</b> COIN <b>ID</b>	IDF10240x	Tag Bluetooth Format COIN with Identifier option – iBeacon – Eddystone
<b>Blue</b> COIN <b>T</b>	IDF10241x	Tag Bluetooth COIN Format with temperature sensor option
<b>Blue</b> COIN <b>MAG</b>	IDF10243x	Tag Bluetooth COIN Format with magnetic sensor option
<b>Blue</b> COIN <b>MOV</b>	IDF10244x	Tag Bluetooth COIN Format with motion sensor option
<b>Blue</b> SLIM <b>ID</b>	IDF03240x	Tag Bluetooth SLIM Format with Identifier option– iBeacon – Eddystone
<b>Blue</b> LITE <b>ID</b>	IDF28240x	Tag Bluetooth LITE Format with Identifier option– iBeacon – Eddystone
<b>Blue</b> WATCH <b>ID</b>	IDP27240x	Tag Bluetooth WATCH Format with Identifier option– iBeacon – Eddystone

## 3 BLUE RANGE OPERATIONS BY ELA INNOVATION

### 1.1. REGULAR OPERATING MODE

- **Advertising mode**

Frames are disseminated through "**Advertising**". Packets are sent periodically at a configurable recurrence comprised within the [0.1s; 10s] interval.

User data size is of 29 bytes. Data content are sensor information or fixed identifier, according to product (Identifier or Sensor).



See [chapter 5 ADVERTISING DATA CONTENT](#) for more information on data sent in "**Advertising**" mode.

In some cases, a "**Scan Response**" frame may follow the "**Advertising**" frame:

- Battery level below 15%: battery level service available in the Scan Response section.
- A 15-character "Name" added in iBeacon or Eddystone UID format: "*Complete Local Name*" available in the "*Scan Response*" section.

- **Connected Mode**

The BLUE product range by ELA Innovation uses several functions in "Connected Mode". A link is set up between two devices and only these devices can communicate and exchange with each other.

You may establish a connection using a smartphone or a mobile application, or with a PC equipped with the ELA "*Device Manager*" application (provided you activated Bluetooth or connected a BLE dongle to the PC).

- The *Advertising Recurrence* must be less than or equal to 3 seconds to be able to establish a connection.
- Once you enter "*Connected Mode*", "**Advertising**" is stopped by default.
- It is possible to send commands to the tag to perform special actions or read data.
- It is possible to get a record of saved data (**Datalogger**) using *Connected Mode*. This datalogger will contain sensor data saved at a defined period with a timestamp for each data.

## 1.2. SPECIFIC OPERATING MODES: MAG, MOV, PIR & DI

**MAG, MOV, PIR and DI** formats provide the **fast event frame functionality**.

- This frame sends data to a **faster recurrence** (equal to one tenth of the advertising tag recurrence set in NFC). Data contained in this frame is the same as that contained in the simple advertising frame, but its recurrence varies.
- **Fast frames** appear during a period equal to the advertising period, and with a recurrence equal to one tenth of it. Thus, there are **10 frames**.

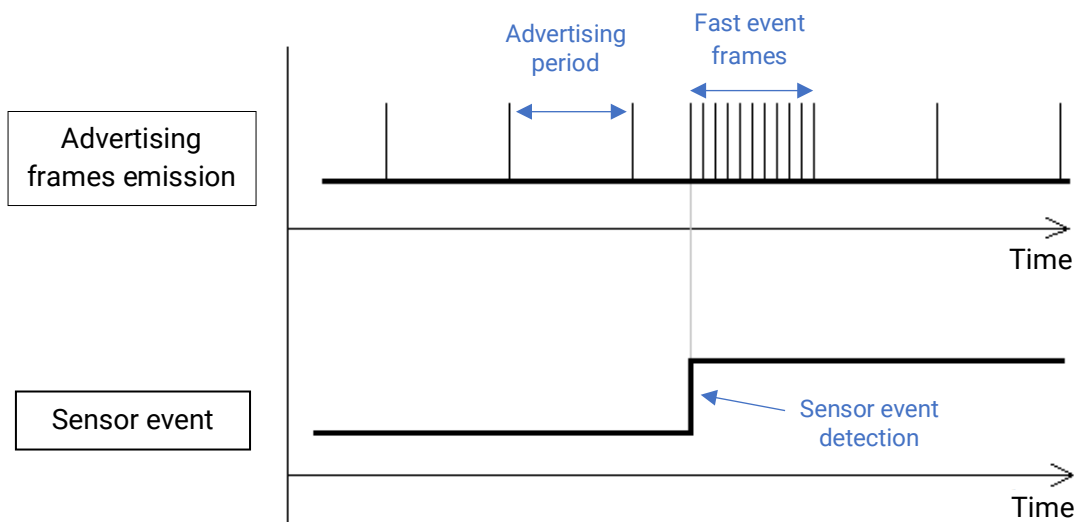


Figure 2: Demonstration diagram of fast event frames occurring during an event.

These **fast frames** emission takes place at each sensor event:

- For **MAG format**: With each new magnet detection state (present and absent)
- For **MOV format**: At the beginning and end of each movement (depending on the submitted threshold)
- For **DI format**: With each new digital input state (logical state 1 or 0)
- For **PIR format**: with each movement detected (sensor state stay at 1 during movement and falls to 0 few seconds after last movement)

In addition to these fast frames, the MAG, MOV and DI formats data also contains an event counter. This counter is incremented at each “rising edge” event detected by the sensor:

- For **MAG format**: With each new magnet detection (magnet present)
- For **MOV format**: At the beginning of each movement (depending on the submitted threshold)
- For **DI format**: With each new logical state 1 of digital input (input shorted)
- For **PIR format**: With each new infrared movement detected

The counter overflow value is 32767 (maximum counter value before reset to zero). The counter resets when a *Connected mode* command **“RAZ\_COUNT”** is sent, or when the tag reboot.

## 4 ELA INNOVATION BLUE RANGE CONFIGURATION

ELA Innovation BLUE range products are equipped with a NFC chip used for tag configuration. This chip, used with Device Manager suite, allows to write operating parameters, among the following fields:

PARAMETER	POSSIBLE VALUES	ACTION	AVAILABILITY
Name	Maximum 15 characters [0-9 ; A-Z ; a-z ; SPACE, _ , -]	Definition of the tag <i>Name</i> , transmitted by <i>Advertising</i>	Complete <i>Blue</i> range
Enable	True / False	<i>True</i> : Enable product operation. <i>False</i> : Turn OFF the product.	Complete <i>Blue</i> range
Power	[-40, -20, -16, -12, -8, -4, 0, +3, +4]	Definition of the product BLE power emission, unit is dBm	Complete <i>Blue</i> range
Format	[Id, T, RHT, MAG, MOV, ANG, iBeacon, Eddystone, Analog IN, Digi IN, Digi OUT, PIR]	Definition of BLE data sent	According to product
Advertising interval	[0.1 -> 10]	Definition de la periode d'emission des trames BLE en secondes	Complete <i>Blue</i> range
UUID (iBeacon)	32 characters [0-9 ; A-F]	Definition of iBeacon <i>UUID</i> , transmitted by <i>Advertising</i>	<i>Id</i> products with iBeacon
Major (iBeacon)	4 characters [0-9 ; A-F]	Definition of iBeacon <i>Major</i> , transmitted by <i>Advertising</i>	<i>Id</i> products with iBeacon
Minor (iBeacon)	4 characters [0-9 ; A-F]	Definition of iBeacon <i>Minor</i> , transmitted by <i>Advertising</i>	<i>Id</i> products with iBeacon
NID (Eddystone)	20 characters [0-9 ; A-F]	Definition of the Eddystone <i>NID</i> , transmitted by <i>Advertising</i>	<i>Id</i> products with Eddystone
BID (Eddystone)	12 characters [0-9 ; A-F]	Definition of the Eddystone <i>BID</i> , transmitted by <i>Advertising</i>	<i>Id</i> products with Eddystone
Log Interval	[10 -> 86400]	Definition of the sensor data saving period for <i>datalogger</i> feature	<i>Blue</i> products with sensors
Logger enable	True / False	<i>True</i> : Enable datalogger feature. <i>False</i> : Disable datalogger feature.	<i>Blue</i> products with sensors
Acc. threshold	[32 ;8000]	Definition of the acceleration threshold for MOV format, unit is mg	<i>MOV</i> products
MOV sensor sensitivity	High sensitivity / Energy saving	<i>High sensitivity</i> : configure accelerometer with high sensitivity mode – <b>12,5Hz acquisition frequency</b> <i>Energy saving</i> : configure accelerometer with energy saving mode – <b>1,6Hz acquisition frequency</b>	<i>MOV</i> and <i>ANG</i> products with <i>firmware vers. &gt;2.2.0</i>
MAG sensor reactivity	Reactive / Energy saving	<i>Reactive</i> : configure MAG sensor with reactive mode – <b>acquisition is made in real-time</b> <i>Energy saving</i> : configure MAG sensor with energy saving mode – <b>data sampling every 1.5 seconds</b>	<i>MAG</i> products with <i>firmware vers. &gt;2.2.0</i>
PIR sensor sensitivity	[0,1,2,3]	<i>Sensitivity level for the PIR sensor: define the maximum detection distance</i> 0: 50cm 1: 1m 2: 2m 3: 5m	<i>PIR</i> products with <i>firmware vers. &gt;3.0.1</i>

PARAMETER	POSSIBLE VALUES	ACTION	AVAILABILITY
Mfr. Data Enable	True / False	<i>True</i> : Enable data transmission in <b>Manufacturer Specific Data</b> mode. <i>False</i> : Enable data transmission in <b>Service Data</b> mode.	Complete <i>Blue</i> range
MFR. Data ID	12 characters [0-9 ; A-F]	Definition of an hexadecimal identifier used in Id format when <b>Manufacturer Specific Data</b> are enabled.	Only used in <i>Id</i> products
Battery voltage presence	True/false	<i>True</i> : Enable <b>Battery voltage transmission into Scan Response</b> frame. See related section of this document.	All products with <i>firmware vers. &gt;3.0.0</i>

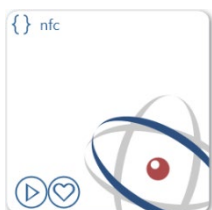
## 2.1. TAG CONFIGURATION USING DEVICE MANAGER PC SOFTWARE

1. Connect a **NFC reader** to your desktop (example: NFC R/W 01 - ref. ACIOM177)

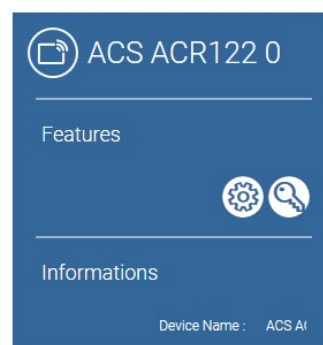
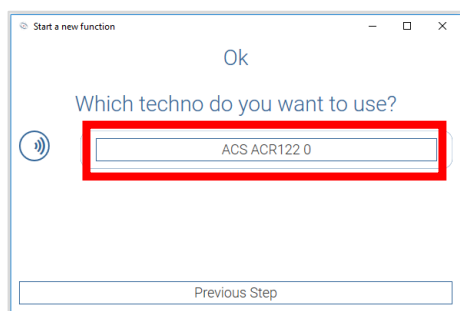
2. Start the "Device Manager" of your desktop



3. Dans le panneau principal de l'application, lancer le **widget « NFC »**



4. Choose the available **NFC reader** by **clicking** on the button

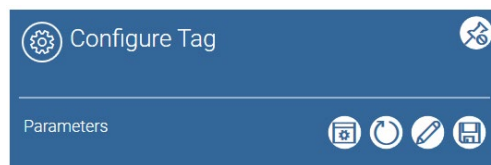



Once reader is selected,  
this window appears

## 5. Place the tag on the NFC reader



6. Click on the **"Configuration"** pictogram  to bring up the tag configuration window:



7. Click on « Refresh »  to bring up the current configuration read from the tag.

Configuration example

Parameters	
Firmware Version :	2.2.0
Name :	BE_BLUE_LITE
Enable :	True
Power BLE :	0
Format :	MOV
Advertising interval :	3
Log interval :	10
Logger Enable :	False
Acc. Threshold :	500
MOV Mode :	1
Mfr. Data Enable :	False
Mfr. Data ID :	010203040506



: Factory settings parameters



: Read and refresh tag configuration



: Write the configuration to the tag



: Display datalogger options (when applicable to the tag)



: Display tag security options (when applicable to the tag)



: Save of the configuration

*Configuration example, the fields are displayed according to the tag configuration.*

### 2.2. TAG CONFIGURATION USING A SMARTPHONE



### 2.3. SETTINGS RESTRICTIONS

#### 4.3.1 Restrictions applying to the "Name" field

- Name must include **less than or up to 15 characters**
- Name **should not contain special characters** (but rather only letters, numbers, spaces, dash - and underscore \_).

#### 4.3.2 Datalogger restrictions

- When the "**Logger Enabled**" field of the NFC settings located under the device manager is **disabled**, the **tag reboots** and you will **lose all registered data** contained in the data logger.
- If you proceed to a **complete re-setting** of the tag by NFC, **data** contained in the **data logger is erased** from the tag memory.

#### 4.3.3 Connected mode restrictions

- If the tag is connected to a device and is approached by a NFC field, the tag will disconnect and reboot.

#### 4.3.4 Other restrictions

- **iBeacon format**
  - You must fill in the complete UUID field of the iBeacon format: 32 characters ([0-9]; [A-F]).
  - You must fill in the complete Major field of the iBeacon format: 4 characters ([0-9]; [A-F]).
  - You must fill in the complete Minor field of the iBeacon format: 4 characters ([0-9]; [A-F]).
- **Eddystone format**
  - You must fill in the complete NID field of the Eddystone format: 20 characters ([0-9]; [A-F]).
  - You must fill in the complete BID field of the Eddystone format: 12 characters ([0-9]; [A-F]).

## 2.4. TAG NFC-CHIP PASSWORD PROTECTION

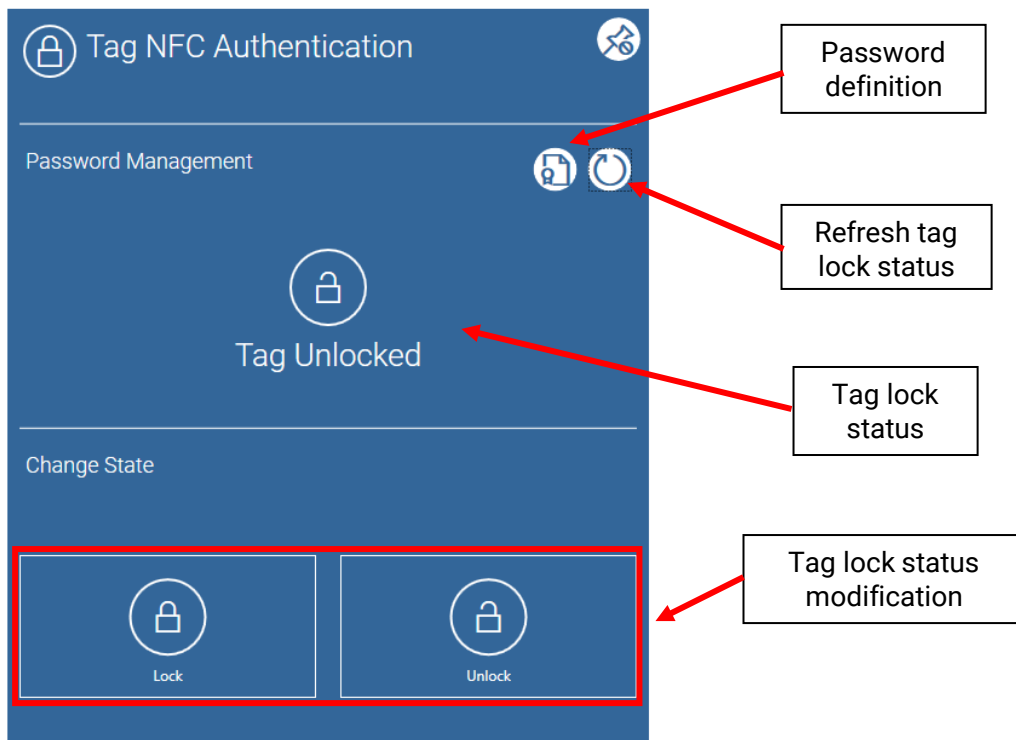
Starting from firmware version 2.1.0, it is possible to protect the tags NFC-chip writing by a password. The functionality is accessible on **Device Manager**, on the **Programmers** section:



*The Authentication functionality is accessible via the Key pictogram*



1. Display the tag authentication window by clicking on the Key pictogram:



## 2. Click on **Define password**



- NFC password must have exactly **8 hexadecimal characters**.
- Pack NFC validate the authentication of the tag but has no consequence on the password modification. It is recommended to leave it to its defaults value: 0x**FAFB**.

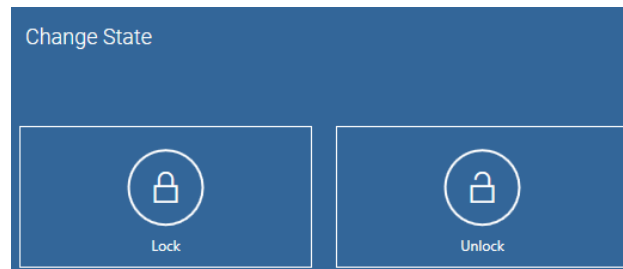
*Note: It is not possible to recover a lost password. If you forgot your password, it will be necessary to return the product to ELA Innovation.*

## 3. Click on **Update state**



to read the current lock status of the tag (locked / unlocked)

Into the **Change State** area, the transition from a *Lock/Unlock* or *Unlock/Lock* state is done by clicking on the **Lock** or **Unlock** icons:



*Note: If the password set in step 2. Is not correct, the Unlock command will have no effect on the tag.*

## 2.1. TEMPERATURE CALIBRATION NFC CONFIGURATION

Starting from firmware version 3.0.0, it is possible to configure a 2<sup>nd</sup>-polynomial calibration that can be used to correct temperature sensor value, to adjust measurement precision.

### General Information

Calibration uses the format  $aT^2+bT+c$ , where **a**, **b** and **c** are configurable coefficients (T being the original temperature value measured by the sensor). These coefficients may only be written with tag configuration via NFC. The coefficients may be read in *connected mode*.

They are transmitted in the format **XeY**, where **X** is an integer between -32768 and 32767, followed by a exponent **Y** from -128 to 127. **XeY** is equivalent to  $X \cdot 10^Y$ . Examples:

- 125e-5 = 0.00125
- 1e-2 = 0.01
- 12e-1 = 1.2

Examples of complete calibration procedure:

- Sensor reading before calibration = 25.00°C. Calibration polynomial [c, b, a]: [ 5e-1, 1e0, 0e0 ]. The calculated value is therefore:  $T_{cal} = 25.5^\circ\text{C}$
- Sensor reading before calibration = 25.00°C. Calibration polynomial [c, b, a]: [ 0e0, 101e-2, 0e0 ]. The calculated value is therefore:  $T_{cal} = 25.25^\circ\text{C}$

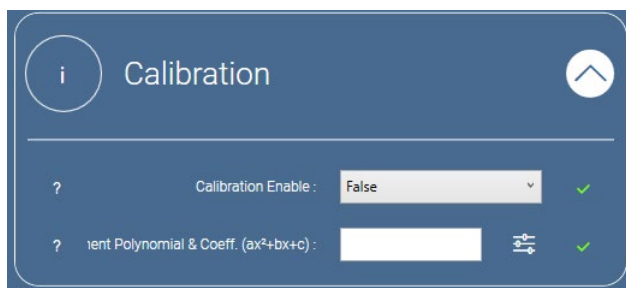
You may not change the calibration state (activated/deactivated) in connected mode when datalogging is running.

You may only define a first-degree polynomial ( $bT + c$ ), or a 0-degree polynomial (only **c**, which can be used for testing). Coefficients are always sent in the following order: [c, b, a].

### NFC Configuration

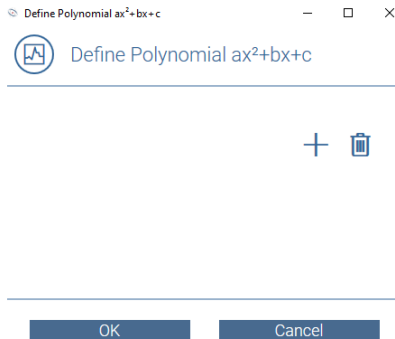
The fields for calibration and the calibration report are configured using the Device Manager application.

The window for configuring the fields is accessible via the “**Calibration**” icon.



Here you can enable the calibration and also configure polynomial coefficients.

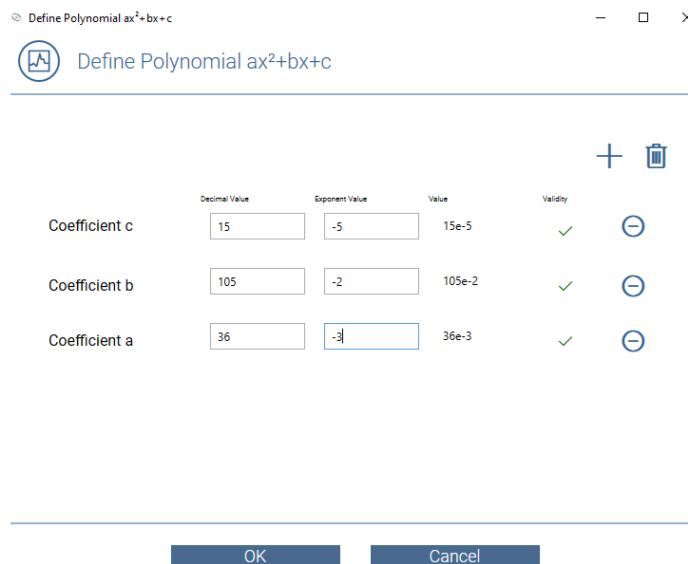
Click on the  button to pop the Polynomial value configuration window :



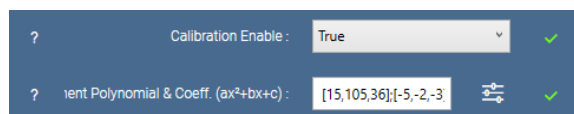
You can add a calibration coefficient by clicking on the button. You can add up to 3 coefficients.



The window will check the coefficients and exponent values for integrity.



Click on **OK** when the values are set. They will appear on the previous window:

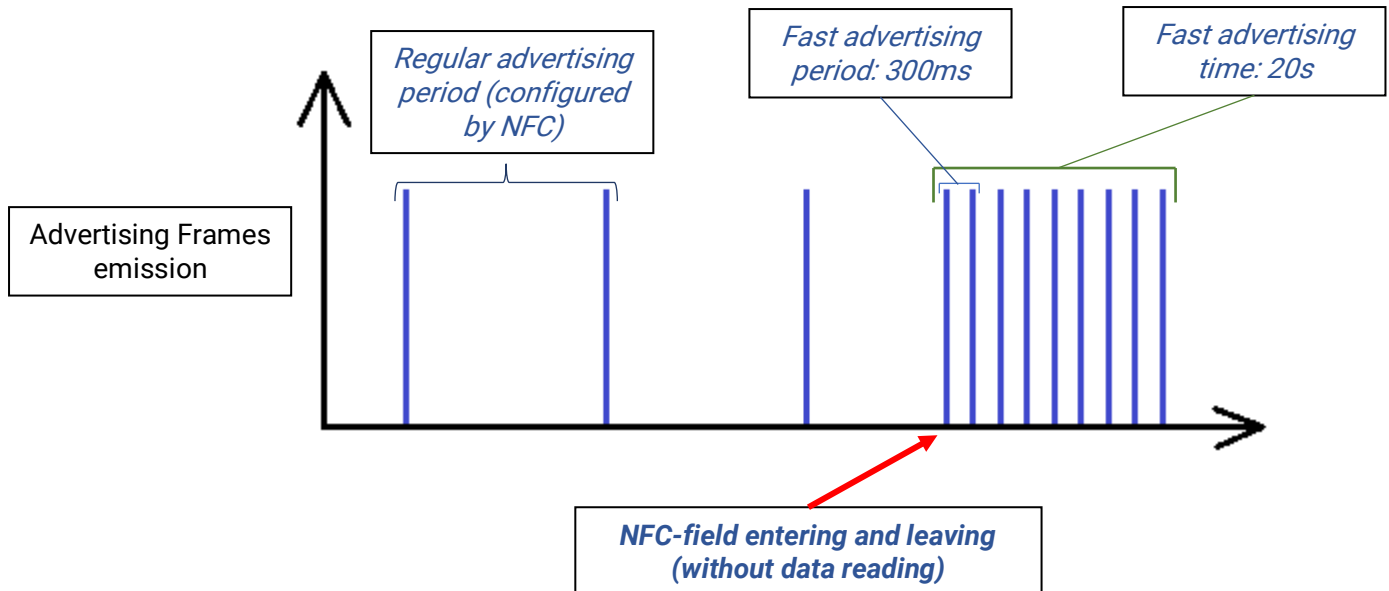


Do not forget to write the NFC configuration to the tag.



## 2.2. FAST ADVERTISING AFTER NFC-FIELD DETECTION

Starting from firmware version 3.0.0, the tag advertising period will be modified right after you approach an NFC-field to the tag.



After 20 seconds, the advertising period will come back to its normal value if there is not any connection to the tag. There is no need to read the NFC memory to activate this function, any field leaving will trigger it.

This behaviour also happen when the tag reboot, after a reconfiguration for example.

This behaviour can allow easier connection to tags which advertising period is configured with a value greater than 3 seconds.

Note: The advertising is stopped when the tag is on an NFC-field, thus the advertising will resume right after the tag leave the field.

## 5 CONTENT OF ADVERTISING DATA

Based on the sensor information obtained during configuration, the tag creates the frame that will be transmitted. It is possible to send sensor or identification data through “**Service Data**” or through “**Manufacturer Specific Data**”. These « **Mfr data** » are company-specific BLE frame fields, which can be used to transmit data in *advertising* packets. If the **Manufacturer Specific Data** are not enabled, all sensor data are sent through **Service Data**.

It is possible to find the detailed *BLE frame specification* in the ELA download area:

- <https://elainnovation.com/downloads.html>

### 3.1. SENSOR DATA IN « SERVICE DATA » FRAME

- « T », « T EN » and « T Probe » formats example:

Raw data:

0x02010605166E2AAB0A1009425055434B5354  
3830304131324E41

Details :

LEN.	TYPE	VALUE
2	0x01	0x06
5	0x16	0x6E2AAB0A
11	0x09	0x425055434B53543830304131324E41

0x6E2A : Temperature service

T° data:

- 0xAB : LSB

- 0x0A : MSB

T° = 0AAB = 2731 \* 0.01 = 27.31°C

Name (ASCII)

Note: For a negative temperature, data is sent in 2-complement: for example, -27.31°C is 6E2A55F5

- « MAG » format example:

Raw data:

0x0201060516062AFB0A1009425055434B535438  
30304131324E41

Details :

LEN.	TYPE	VALUE
2	0x01	0x06
5	0x16	0x062AFB0A
11	0x09	0x425055434B53543830304131324E41

Name (ASCII)

0x062A : Alert Status service

MAG data:

- 0xFB : LSB

- 0x0A : MSB

Hexa.	0	A	F	B
Binary	0000	1010	1111	1011

⇒ 1: instantaneous sensor state (magnet present)

⇒ 1010 1111 101: event counter value on 15 bits, 1405 in this example

- « MOV » format example:

Raw data:

0x0201060516062AFB0A1009425055434B5354  
3830304131324E41

Details :

LEN.	TYPE	VALUE
2	0x01	0x06
5	0x16	0x062AFB0A
11	0x09	0x425055434B53543830304131324E41

Name (ASCII)

0x062A : Alert Status service

MOV data:

- 0xFB : LSB
- 0x0A : MSB

Hexa.	0	A	F	B
Binary	0000	1010	1111	1011

- ⇒ 1 : instantaneous sensor state (movement detection)
- ⇒ 1010 1111 101 : event counter value on 15 bits, 1405 in this example

- « ANG » format example:

Raw data:

0x0201060516A12A05FF0AFBC90755434B53  
543830304131324E41

Details :

LEN.	TYPE	VALUE
2	0x01	0x06
5	0x16	0xA12A05FF0AFBC907
11	0x09	0x55434B53543830304131324E41

Name (ASCII)

0xA12A : Magnetic 3D service

ANG data:

- 0x05 : X-axis LSB
- 0xFF : X-axis MSB
- 0x0A : Y-axis LSB
- 0xFB : Y-axis MSB
- 0xC9 : Z-axis LSB
- 0x07 : Z-axis MSB

X-axis : 0xFF05 => -251 mg acceleration on X-axis  
Y-axis : 0xFB0A => -1270 mg acceleration on Y-axis  
Z-axis : 0xFF05 => +1993 mg acceleration on Z-axis

Note: Values are coded on 16-bits with 12 significant bits and 4 sign bits. The values are expressed in mg (+2g/-2g). Negative data are sent in 2-complement.

- « RHT » format example:

Raw data:

0x0201060516E2A5E0A004166F2A3010094  
25055434B53543830304131324E41

LEN.	TYPE	VALUE
2	0x01	0x06
5	0x16	0xE2A5E0A004166F2A30
11	0x09	0x55434B53543830304131324E41

Name (ASCII)

0x6E2A : Temperature service

0x6F2A : Humidity service

RH data:

- 0x30 : RH data i.e. 48% relative humidity

T° data:

- 0x5E : LSB
- 0x0A : MSB

T° = 0A5E = 2654 \* 0.01 = 26.54°C

Note: For a negative temperature, data is sent in 2-complement

- « DI » format example:

Raw data:

0x0201060516062A0A0004163F2A020E0942  
455F544553545F544F52494E

Details :

LEN.	TYPE	VALUE
2	0x01	0x06
5	0x16	0x062A0A00
11	0x09	0x42455F544553545F544F52494E

Name (ASCII)

0x062A : Alert Status service

DI data:

- 0x0A : LSB
- 0x00 : MSB

Hexa.	0	0	0	A
Binary	0000	0000	0000	1010

- ⇒ 0 : instantaneous input state (input state OFF)
- ⇒ 0000 0000 0000 101 : event counter value on 15 bits, 1405 in this example

Note: In this example, the DI data is 0x000A, i.e. counter is at 4 increments (transition from state 0 to state 1 on digital input), and the instantaneous input state is 0 (input in OFF state).

- « Analog IN » format example:

Raw data:

0x0201060516582AAC0B1009425055434B5354  
3830304131324E41

LEN.	TYPE	VALUE
2	0x01	0x06
5	0x16	0x582AAC0B
11	0x09	425055434B53543830304131324E41

Name (ASCII)

0x582A : Analog Output service

Analog IN data:

- 0xAC : LSB
- 0x0B : MSB

Analog voltage measure: 0x0BAC = 2988mV

Note: Analog input voltage measure are in mV unit.

- « PIR » format example:

Raw data:

0x0201060516782A1B001109425055434B5354  
3830304131324E41

LEN.	TYPE	VALUE
2	0x01	0x06
5	0x16	0x782A1B00
11	0x09	425055434B53543830304131324E41

Name (ASCII)

0x282A : Rainfall service

PIR data:

- 0x1B : LSB
- 0x00 : MSB

Hexa.	0	0	1	B
Binary	0000	0000	0001	1011

- ⇒ 1 : instantaneous sensor state (infrared movement detected)
- ⇒ 0000 0001 101 : event counter value on 15 bits, 13 in this example

## 3.1. SENSOR DATA IN « MANUFACTURER SPECIFIC DATA » FRAME


- 1) ELA Innovation *Company Identifier (CIN)* is 0x0757.
- 2) In *ELA\_ID* and *Digi OUT* formats, it is possible to configure a hexadecimal number (max. 0xFFFFFFFFFFFF) which will be sent in advertising frame. This field is named “**Manufacturer Data ID**” in the NFC configuration. This number is called “MFR\_ID” in this document frame formats.

In « *Manufacturer Specific Data* », sensor data are encoded the same way as in “Service Data” mode, only the “data type” in hexadecimal is modified:

- 0x16: for « **Service data** »
- 0xFF: for « **Manufacturer Specific Data** »

*Manufacturer Specific Data* are transmitted as follows:

ELA CIN	DataInfo	Data
---------	----------	------

 Here is an example with a « T » format frame:

Raw data:

0x02010606FF5707124D0A0B09425055434B  
53543830304131324E41

Details :

LEN.	TYPE	VALUE
2	0x01	0x06
5	0xFF	0x5707124D0A
11	0x09	0x425055434B53543830304131324E41

Name (ASCII)

**0x5707 => ELA CIN** : ELA Innovation *Company Identifier number*

- **0x07** : LSB
- **0x57** : MSB

Soit 0x**0757**.

**0x12 : DataInfo** : Indicate the following data :  
Temperature data here

**Data** : T° data:

- **0x4D** : LSB
- **0x0A** : MSB

T° = 0A4D = 2637 \* 0.01 = 26.37°C

All sensor data are listed in the table below:

Field		Length	Description
<b>Temperature data (T)</b>	DataInfo	1 byte	0x12 (bit7-4=1 et bit3-0=2)
	Data	2 bytes	Temperature on 16 signed bits / 0,01°C step
<b>Humidity data (RH)</b>	DataInfo	1 byte	0x21 (bit7-4=2 and bit3-0=1): Relative Humidity
	Data	1 byte	Humidity on 8 unsigned bits / 1 % step RH de 0 à 100 %
<b>Magnetic data (MAG)</b>	DataInfo	1 byte	0x32 (bit7-4=3 and bit3-0=2)
	Data	2 bytes	Event (state change) counter on the 15 (unsigned) MSB Instantaneous state on LSB
<b>Movement data (MOV)</b>	DataInfo	1 byte	0x42 (bit7-4=4 and bit3-0=2)
	Data	2 bytes	Event counter (threshold overflow) on the 15 (unsigned) MSB Instantaneous state on LSB
<b>Infrared movement data (PIR)</b>	DataInfo	1 byte	0x92 (bit7-4=9 and bit3-0=2)
	Data	2 bytes	Event (infrared movement detected) counter on the 15 (unsigned) MSB Instantaneous state on LSB
<b>Accelerometer data (ANG)</b>	DataInfo	1 byte	0x56 (bit7-4=5 and bit3-0=6)
	Data	6 bytes	X-axis acceleration on 16 signed bits (range +/-2G) Y-axis acceleration on 16 signed bits (range +/-2G) Z-axis acceleration on 16 signed bits (range +/-2G)
<b>Digital Input data (DI)</b>	DataInfo	1 byte	0x62 (bit7-4=6 and bit3-0=2)
	Data	2 bytes	Event (input state change) counter on the 15 (unsigned) MSB Instantaneous input state on LSB
<b>Analog Input data (AI)</b>	DataInfo	1 byte	0x72 (bit7-4=7 and bit3-0=2)
	Data	2 bytes	Voltage measured in mV on 16 unsigned bits

Identifiers format data (*ID* and *DO*) offer to transmit an identifier configured by NFC:

<b>ID format data</b>	DataInfo	1 byte	0x06 (bit7-4=0 and bit3-0=6)
	Data	6 bytes	<i>MFR_ID</i> configured by NFC
<b>Digital output data (DO)</b>	DataInfo	1 byte	0x86 (bit7-4=8 and bit3-0=6)
	Data	6 bytes	<i>MFR_ID</i> configured by NFC

BLE frame specification is available in the ELA download area:

- <https://elainnovation.com/downloads.html>

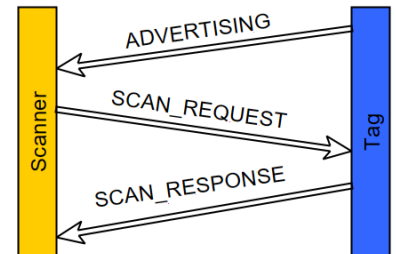
## 3.2. SCAN RESPONSE FRAME

In some formats and versions, the tag can send a frame called « Scan Response frame ».

Once an advertising packet has been received by a scanner, further information can be requested. Then the tag responds with the "scan response" frame.

This frame is located right after the advertising frame, and contains different data depending on the version and format.

The data sent in "Scan response" frame is also formatted either in Service mode or in Manufacturer Specific mode.



## 3.3. BATTERY INFORMATION

### Battery capacity

ELA Innovation's tags are based on the transmission of battery information in the Scan Response when the capacity of the battery falls below 15%. The formatting of the information is as follows:

Frame type		Service Data	Service Data	Mfr. Spec. Data
Version		1.0.0, 2.0.0, 2.1.x	≥2.2.0	≥2.0.0
Transmission		Batt. capacity < 15%	Batt. capacity < 15%	Batt. capacity < 15%
Frame bytes	1	Length : 0x04	Length: 0x04	Length : 0x05
	2	Type : 0x16	Type : 0x16	Type : 0xFF
	3	Battery Serv. LSB : 0x0F	Battery Serv. LSB : 0x19	ELA_CIN_LSB : 0x57
	4	Battery Serv. MSB : 0x18	Battery Serv. MSB : 0x2A	ELA_CIN_MSB: 0x07
	5	Batt. data (%)	Batt. data (%)	BATT_DATA_ID: 0xF1
	6	Not used	Not used	Batt. data (%)
	7	Not used	Not used	Not used

### Battery voltage

From version 3.0.0 onwards, it is possible to transmit battery voltage information for all formats. For this purpose, the "**Battery voltage presence**" option must be configured in the NFC memory.

**When the option is activated, the tag no longer transmits battery capacity information below 15%.**

help	value	valid
?	Advertising Name : ELA_ID	✓
?	TAG Enable State : True	✓
?	TAG Power : 0	✓
?	TAG Format : Id	✓
?	Battery voltage presence : 0	✓

Once the option is enabled, the battery voltage information is transmitted in the "Scan Response" frame with the following formatting:

Frame type		All
Version		≥3.0.0
Transmission		Battery voltage presence = 1
Frame Bytes	1	Length : 0x06
	2	Type : 0xFF
	3	ELA_CIN_LSB : 0x57
	4	ELA_CIN_MSB: 0x07
	5	BATT_DATA_ID: 0xF2
	6	Batt. voltage (mV) LSB
	7	Batt. voltage (mV) MSB

Frame examples showing battery information:

Received frame: ELA ID, Service Data, v3.0.0 Battery voltage presence = 0			Received frame: ELA T, MFR Spec. Data, v3.0.0 Battery voltage presence = 0		
Name	BE_BATTERY		Name	BE_BATTERY	
			Measured temp.	27.12°C (0x0A98)	
Battery cap.	13% (0x0D)		Battery cap	13% (0x0D)	
Raw data:			Raw data:		
<div>0x0201060B0942455F424154544552590 416192A0D</div>			<div>0x02010606FF570712980A0B0942455F4 241545445525905FF5707F10D</div>		
Details:			Details:		
LEN.	TYPE	VALUE	LEN.	TYPE	VALUE
2	0x01	0x06	2	0x01	0x06
11	0x09	0x42455F42415454455259	6	0xFF	0x570712980A
4	0x16	0x192A0D	11	0x09	0x42455F42415454455259
			5	0xFF	0x5707F10D

T° Data

Name

Battery cap.  
(SR Frame)

In Eddystone and iBeacon formats, the battery information is located before the Tag Name :

Received frame : iBeacon, v2.1.0			Received frame: Eddystone, v3.0.0 Battery voltage presence = 0		
Name	BE_BATTERY		Name	BE_BATTERY	
Battery cap.	13% (0x0D)		Battery cap.	13% (0x0D)	
Raw data:			Raw data:		
<div>0x0201061AFF4C0002150102030405060708090A0B0C0D0E0F10020B010AC404160F180D0B0942455F42415454455259</div>			<div>0x0201060303AAFE1716AAFE00ED0102030405060708090A010203040A0B00000416192A0D0B0942455F42415454455259</div>		
Details:			Details:		
LEN.	TYPE	VALUE	LEN.	TYPE	VALUE
2	0x01	0x06	2	0x01	0x06
26	0xFF	0x4C0002150102030405060708090A0B0C0D0E0F10020B010AC4	3	0x03	0xAAFE
4	0x16	0x0F180D	23	0x16	0xAAFE00ED0102030405060708090A010203040A0B0000
11	0x09	0x42455F42415454455259	4	0x16	0x192A0D
			11	0x09	0x42455F42415454455259

Received frame: iBeacon, v3.0.0 Battery voltage presence = 1		Received frame: ELA T, Service Data, v3.0.0 Battery voltage presence = 1																															
Name	BE_BATTERY	Name	BE_BATTERY																														
Batt. voltage	2.478V (0x09AE)	Measured temp	21.87°C (0x088B)																														
		Batt. voltage	2.988 V (0x0BAC)																														
Raw data: <div>0x0201061AFF4C0002150102030405060708090A0B0C0D0E0F10020B010AC406FF5707F2AE090B0942455F42415454455259</div>		Raw data: <div>0x02010605166E2A8B080B0942455F4241545445525906FF5707F2AC0B</div>																															
Details: <table><tr><th>LEN.</th><th>TYPE</th><th>VALUE</th></tr><tr><td>2</td><td>0x01</td><td>0x06</td></tr><tr><td>26</td><td>0xFF</td><td>0x4C0002150102030405060708090A0B0C0D0E0F10020B010AC4</td></tr><tr><td>6</td><td>0xFF</td><td>0x5707F2AE09</td></tr><tr><td>11</td><td>0x09</td><td>0x42455F42415454455259</td></tr></table>		LEN.	TYPE	VALUE	2	0x01	0x06	26	0xFF	0x4C0002150102030405060708090A0B0C0D0E0F10020B010AC4	6	0xFF	0x5707F2AE09	11	0x09	0x42455F42415454455259	Details: <table><tr><th>LEN.</th><th>TYPE</th><th>VALUE</th></tr><tr><td>2</td><td>0x01</td><td>0x06</td></tr><tr><td>5</td><td>0x16</td><td>0x6E2A8B08</td></tr><tr><td>11</td><td>0x09</td><td>0x42455F42415454455259</td></tr><tr><td>6</td><td>0xFF</td><td>0x5707F2AC0B</td></tr></table>		LEN.	TYPE	VALUE	2	0x01	0x06	5	0x16	0x6E2A8B08	11	0x09	0x42455F42415454455259	6	0xFF	0x5707F2AC0B
LEN.	TYPE	VALUE																															
2	0x01	0x06																															
26	0xFF	0x4C0002150102030405060708090A0B0C0D0E0F10020B010AC4																															
6	0xFF	0x5707F2AE09																															
11	0x09	0x42455F42415454455259																															
LEN.	TYPE	VALUE																															
2	0x01	0x06																															
5	0x16	0x6E2A8B08																															
11	0x09	0x42455F42415454455259																															
6	0xFF	0x5707F2AC0B																															

## 3.4. INFORMATION ABOUT IBEACON AND EDDYSTONE FORMATS

- Description of owner formats such as Apple (iBeacon) and Google (Eddystone)



iBeacon

- Tags settings available in iBeacon format
- Compliance with Apple specific data such as:  
**Flags – Length – Type - Company ID - Beacon Type - Proximity UUID - Major - Minor**
- You can add an additional "Name", which is send it in the "Scan Response" BLE frame and configure it in the "Name" field from the Device Manager
- Specification: <https://developer.apple.com/ibeacon/>



Eddystone

- Tags settings available in Eddystone UID format
- Compliance with specific Google Data Eddystone UID format such as:  
**A unique, static ID with a 10-byte Namespace component and a 6-byte Instance component**
- You may add an additional "Name", which is send in the "Scan Response" BLE frame and configure it in the "Name" field
- Specification: <https://developers.google.com/beacons/overview>

## 3.5. DATA VIZUALISATION USING DEVICE MANAGER

The ELA Innovation *Device Manager* application can perform BLE scans in order to view advertising data from BLE ELA Innovation products:

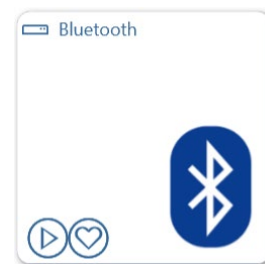
1. **Enable internal Bluetooth** or connect a Bluetooth device (typ. Dongle) to your PC



2. Launch the “**Device Manager**” desktop application



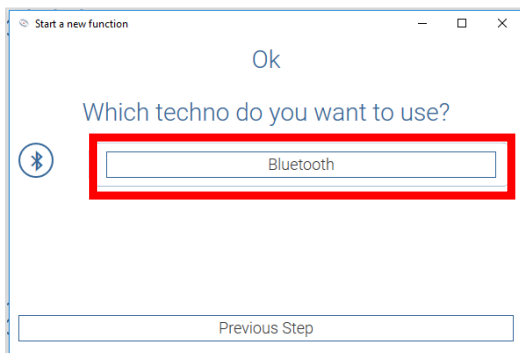
3. Start the “**Bluetooth**” widget by clicking  button



4. Start the **BLE device search**

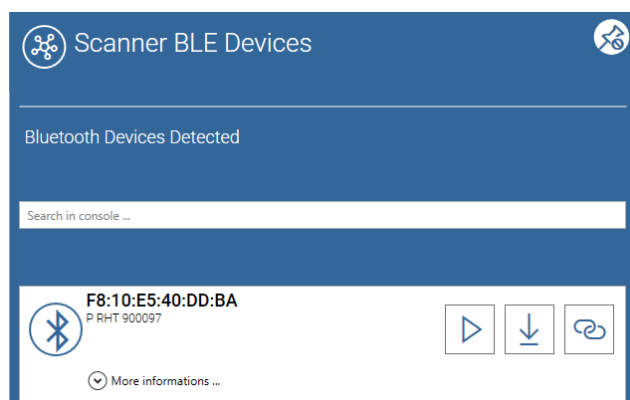


5. Click on the found device. The **Bluetooth** windows appears

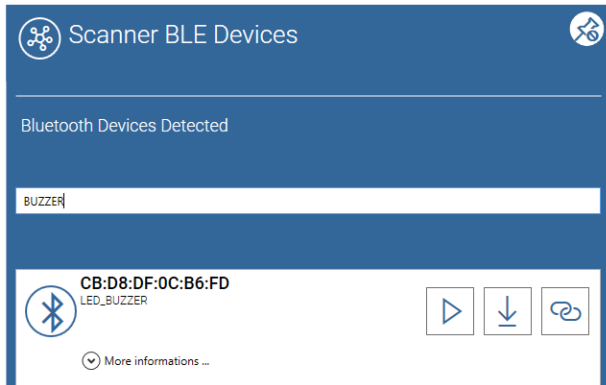


Once reader has been chosen, this window appears

6. Start the **BLE Device scanner**



*On this window, it is possible to search for a Name or MAC Address from the entire drop-down list (see next page)*



*Tag name has been filtered*

7. Click on the **Tag info visualization** button.



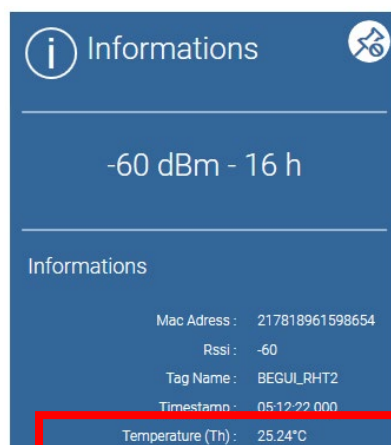
This window opens:



8. It is possible to view the tag data with the Information button. displaying tag Name, RSSI and MAC address:



This opens a window



## 6 CONNECTED MODE OPERATION

In "**Connected Mode**", a link is established between two devices and only they can communicate and exchange with each other. You may establish a connection using a smartphone or a mobile application, or with a PC equipped with the ELA "*Device Manager*" application (provided you activated Bluetooth or connected a BLE dongle to the PC).

- The *Advertising Recurrence* must be less than or equal to 3 seconds to be able to establish a connection.
- Once you enter "*Connected Mode*", "**Advertising**" is stopped by default.
- It is possible to send commands to the tag to perform special actions or read data.
- It is possible to get a record of saved data (**Datalogger**) using *Connected Mode*. This datalogger will contain sensor data saved at a defined period with a timestamp for each data.

### 4.1. CONNECTED MODE LIST OF COMMANDS

COMMANDS	ACTIONS	MINIMUM FIRMWARE VERSION
LED_ON	Turn ON the LED (infinite Blink)	≥1.0.0
LED_OFF	Turn OFF the LED	≥1.0.0
LED_ON XX	Turn ON the LED (for XX seconds)	≥2.0.0
BUZZ_ON	Turn ON the buzzer (Repeated beep)	≥1.0.0
BUZZ_OFF	Turn OFF the buzzer	≥1.0.0
BUZZ_ON XX	Turn ON the buzzer (for XX seconds)	≥2.0.0
DIGI_ON	Turn Digital Output to "ON" state	≥2.1.0
DIGI_OFF	Turn Digital Output to "OFF" state	≥2.1.0
DIGI_ON XX	Turn Digital Output to "ON" state for XX seconds	≥2.1.0
RAZ_COUNT	Counter reset	≥2.0.0
LOG_DL	Download datalogger values	≥2.0.0 (non-EN12830)
LOG_RST	Erase datalogger values and timestamp	≥2.0.0 (non-EN12830)
GET_BATT_VOLTAGE	Return battery voltage in mV	≥2.1.0
GET_SENSOR_DATA	Return the last measured sensor value	≥2.2.0

## 4.2. SIMPLE DATALOGGER

Ela innovation sensor tags can operate the “*Datalogger*” feature. The datalogger is a record of saved data, memorized while advertising, with each value associated with a time stamp, to be able to recover the moment when it was measured.

The datalogger can be retrieved in *Connected mode* using the “**LOG\_DL**” command. The simple datalogger (non-EN12830) formatting for a temperature sensor with a log interval of 30 seconds is the following:

<b>Temperature LOG:</b> <b>DATA_START</b> <b>0d0h0m30s:2712</b> <b>0d0h1m0s:2730</b> <b>0d0h1m30s:2695</b> ... <b>1d3h25m30s :1505</b> <b>END_OF_DATA</b>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 20px;">             Temperature measured 30 seconds after the tag has booted (here 27.12°C)           </div> <div style="border: 1px solid black; padding: 5px;">             Temperature measured 1 day, 3 hours, 25 minutes and 30 seconds after the tag has booted (here 15.05°C)           </div>
--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

The simple datalogger formatting is the same for all ELA Innovation sensor products (xxdxxhxxmxxs followed by sensor data). The sensor data is the same as the one transmitted in advertising frames. The “**LOG\_RST**” command is used to delete datalogger data content.

## 4.3. BLUE PUCK T EN12830 (2018) & BLUE PUCK T PROBE DATALOGGER

The EN12830 firmware has several new features:

- EN12830 Datalogger
- Calibration by 2<sup>nd</sup>-degree polynomial of temperature values
- Saving tag calibration values (Target values – measured values)

These EN12830 (2018) dedicated functionalities are protected by a BLE password. This password is inserted by the NFC configuration. The EN12830 tag configuration options are only available from *Device manager* version 1.3.0.

The PUCK T EN12830 dedicated documentation can be found in the download area:

- <https://elainnovation.com/downloads.html>

## 4.4. CONNECTED MODE RESTRICTIONS

During a **complete NFC re-configuration**, **datalogger data is erased** from the tag memory.

- If the tag is in *Connected Mode* and goes under an **NFC-field**, then the tag will restart.

## 4.5. CONNECTING TO A BLE ELA INNOVATION TAG

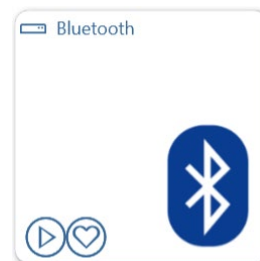
1. Enable internal **Bluetooth** or connect a Bluetooth device (typ. Dongle) to your PC



2. Launch the **"Device Manager"** desktop application



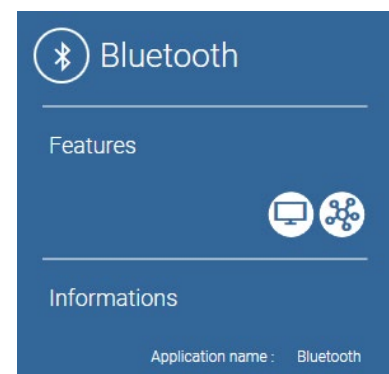
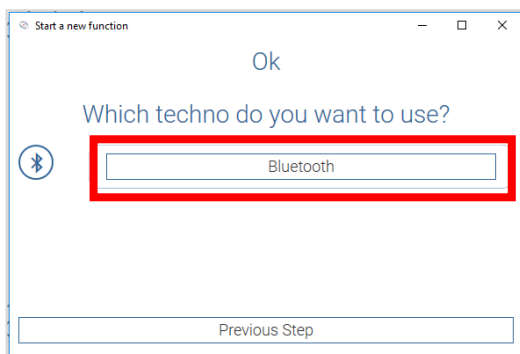
3. Start the **"Bluetooth" widget** by clicking button



4. Start the **BLE device search**

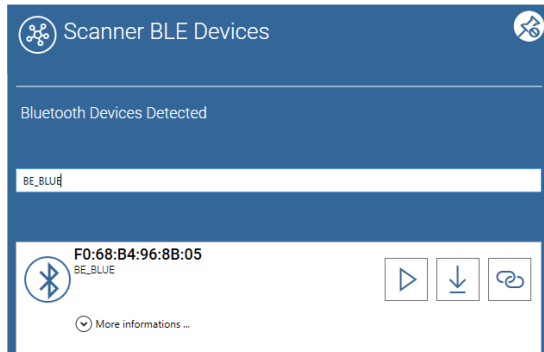


5. Click on the found device. The **Bluetooth** windows appears:



Once reader has been chosen, this window appears

## 6. Start the BLE Device scanner

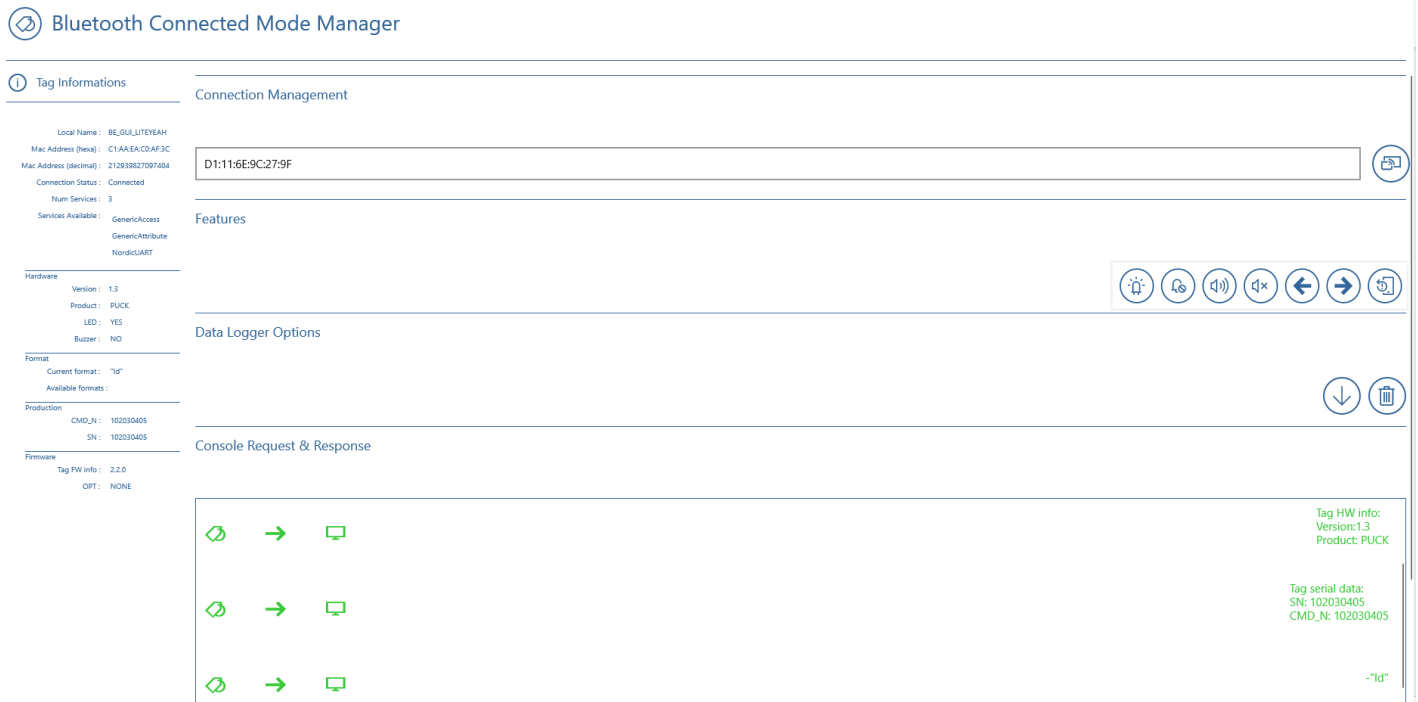


*On this window, it is possible to search for a Name or MAC Address from the entire drop-down list (see example)*

## 7. Start the connection by pressing icon




. The *Device Manager Connector* window opens:



- **Features:** Commands to send to the tag (see next page for commands syntax and use)
- **Informations :** Name –Mac Adress – Connection status – Available services
- **Hardware – Format - ...:** Services details and tag options

## « Commands » description



ICONS	COMMANDS	ACTIONS
	LED_ON	Turn ON the LED (infinite Blink)
	LED_OFF	Turn OFF the LED
	BUZZ_ON	Turn ON the buzzer (repeated beep)
	BUZZ_OFF	Turn OFF the buzzer
	DIGI_ON	Turn Digital Output to “ON” state
	DIGI_OFF	Turn Digital Output to “OFF” state
	RAZ_COUNT	Counter reset (for MAG, MOV and DI formats)
	LOG_DL	Download datalogger values
	LOG_RST	Erase datalogger values and timestamp



- LED & BUZZER commands:**

For lifetime constraints, LED and BUZZER commands cannot be turned ON at the same time.

- Datalogger download :**

The « **LOG\_DL** » command is used to download the recorded log data.  
Detailed Data according to sensor can be found on the application note on the ELA website.

### **7 PRODUCT OPERATION**

#### *4.6. OTAP FUNCTIONNALITY*

OTAP (Over-The-Air Programming) is a method used to update a software, data or settings of a product without having to disassemble it and do it in a completely wireless way.

Ela Innovation products programmed with firmware version >3.0.0 can use OTAP Mechanism to update the tag embedded firmware, which can be done without having to return the product to ELA Innovation.

The OTAP procedure is secured by 2 methods:

- The switch into OTAP mode of ELA Innovation products is protected by a password that can be set by the user with NFC configuration
- The firmware update package is signed by a SHA256 private key.

The OTAP procedure and material requirements are described on the OTAP Application Note, available on the ELA Innovation Website.

## 8 NORMS & STANDARDS

### FCC Statement

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference; and
2. This device must accept any interference received, including interference that may cause undesired operation.

### Industry Canada Statement

This device complies with ISED's licence-exempt RSSs. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

- CE Mark



- FCC Mark



- RoHS Certified



- Bluetooth 4.2

