

User Guide

EG-IoT Demonstrators



EG-IoT-40B1 EG-IoT-4281 EG-IoT-4EA6 EG-IoT--4AB1 EG-IoT-4E81
EG-IoT-80B1 EG-IoT-8281 EG-IoT-8AA6 EG-IoT-8AB1

Reference : EG-IoT_UG_demonstrator_006_UK

Rev.	Modifications	Author	Date	Validation	Date
000	Creation of preliminary version	YST/EFO	02/08/2017		
001	Evolution LoRa frame format	PBR	21/08/2017		
002	Additional info. Identifier management LoRa/Sigfox, demo telemetering/counting/hour meter	EFO/PBR	21/08/2017		
003	Details about USB Addition example of display	LGO	01/09/2017		
004	Addition TCP	EFO	11/09/2017		
005	Addition UDP, adjustment LoRa configuration	EFO	27/11/2017	MSU	01/12/2017
006	Additional information	YST	07/12/2017		

The main modifications in this document compared to its previous version are easily identifiable by the blue color of the text.

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Preliminary

Warning

- This document contains the commissioning information for engineering samples **EG-IoT_xxxx** based on an embedded demonstration application.
 - ERCOGENER cannot be held responsible for:
 - Problems arising from improper use of the **EG-IoT xxxx**.
 - Problems arising from improper configuration
 - Dysfunctions arising from the absence or poor coverage of GSM, GPRS, UMTS, LTE Cat.M1, GNSS, LoRa, Sigfox networks
 - Dysfunctions if the product is used for the monitoring of physical persons where human life is at stake.
 - ERCOGENER reserves the right to modify the functionalities of its products "**EG-IoT xxxx**" without prior notice.
- **When the equipment is open, do not carry out any operations other than those provided for in this document.**
- No internal parts can be repaired by the user. The **EG-IoT xxxx** must be returned to the factory for repairs.
- In order to ensure electromagnetic compatibility, the length of the serial link cable, the power cable and the input / output cable must not exceed a length of 3 meters.
- The **EG-IoT xxxx** must not be powered directly by the mains, a voltage adapter must be used.



DISPOSE OF BATTERIES AND USED BATTERIES IN ACCORDANCE WITH USUAL INSTRUCTIONS.

Symbols used

The following symbols are used to highlight important information in the manual.



Essential information for the integration and performance of the module.



Warning indicating actions that could harm or damage the module

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1 Presentation of the demonstrator products

Products from the **EG-IoT-xxxx** family are suitable for harsh outdoor environments. They are all waterproof and resistant to mechanical shocks.

Compact, with integrated long-range antennas and a long battery life, they are easy to implement.

The ability to have **two communication technologies** LPWAN+3G allows to have a product dedicated to critical applications.

These products are intended for use in various applications such as geolocation, remote control, metering, remote supervision ...

This document presents the general characteristics and the implementation of functional demonstrators.

Table 1 : General Presentation

Product EG-IoT	LPWAN	Cellular	GNSS	BLE	Ana.	Input Opto	M8 interface					P.supply
							Conta ct	One Wire	Out	RS485	Pwr	
40B1	LoRa	-	-	✓	2	-	2	1*	-	-	-	Battery
4281	LoRa	-	✓	✓	-	-	-	-	-	-	-	Battery
4AA6	LoRa	2G/3G	✓	✓	-	2	-	1*	Co	1*	1	Ext./Lithi um Bat.
4AB1	LoRa	2G/3G	✓	✓	2	-	2	1*	-	-	-	Battery
4E81	LoRa	LTE Cat.M1	✓	✓	-	-	-	-	-	-	-	Battery
80B1	Sigfox	-	-	✓	2	-	2	1*	-	-	-	Battery
8281	Sigfox	-	✓	✓	-	-	-	-	-	-	-	Battery
8AA6	Sigfox	2G/3G	✓	✓	-	2	-	1*	Co*	1*	1	Ext./Lithi um Bat.
8AB1	Sigfox	2G/3G	✓	✓	2	-	2	1*	-	-	-	Battery

* Currently under development

LPWAN	Sigfox LoRa	868MHz Class 0 14dBm 868MHz Class A 14dBm	BLE	BLE V4.2
Cellular	3G 2G	800/850 900/1900 2100 MHz 850/900 1800/1900 MHz	Power supply	Ext. 8-30 VDC Battery Li-SOCI2 3.6V – 6Ah Lithium Bat. 1 A.h 3.7Vdc
	LTE CAT.M1	800/1800 MHz	Out	Led Co Open collector
GNSS	GPS / GLONASS			

These products are supplied with a simple demo application allowing you to make preliminary tests. As this application is evolvable, our technical support will be able to provide its evolutions. See the paragraph « Demonstration application » to know the restrictions of use linked with the demonstration application version.

2.1 Packaging

Figure 1 : Packaging

Delivered with

- A product **EG-IoT - xxxx**
- A 8-wire cable equipped with a M8 connector (see Table 1 : General Presentation)
- A M8 sealing plug for products equipped with a M8 connector.
- Installation instructions



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3 Technical characteristics

3.1 General

Table 2 : General characteristics

Operating temperature	• With internal battery	-30°C to +75°C
	• With external power supply and internal lithium battery	-20°C to +60°C
Storage temperature	• With internal battery	-40 °C to +85 °C
	• With external power supply and internal lithium battery	-20°C to +35°C (+60°C max 1 month)
Dimensions		90 x 65 x 35 mm
Waterproof casing		IP67 - IP69K

3.2 Accelerometer, Magnetometer

Table 3 : Accelerometer / Magnetometer characteristics

Specifications	
Magnetic Dynamics	± 50 gauss
Accelerometer Dynamics	±2 / ±4 / ±8 / ±16 g

The X, Y and Z axes are identical for the accelerometer and the magnetometer.



4 Operating modes

Deep sleep	The product is delivered in this mode.
Configuration / Software Update	Application configuration mode. This is done via <ul style="list-style-type: none"> • The USB/TTL link with the corresponding cable • The Bluetooth link (future)
Service	The product is active according to the configuration.

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5 Configuration via internal serial link

5.1 Opening the casing

Tools : Screwdriver TORX T10.
Tape
Screwdriver or coin.

1 – Using the TORX T10 screwdriver, remove the 4 screws under the casing.

2 – Optional. Stick the adhesive tape to the bottom of the M8 connector.

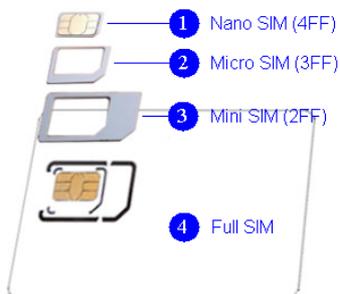
3 – Use the flathead screwdriver or a coin to remove the upper part from the lower part using the notch provided for this purpose.

4 – Rotate the upper part, taking as the axis of rotation the base of the casing on the M8 connector side. The duct tape will avoid from pulling on the connections.

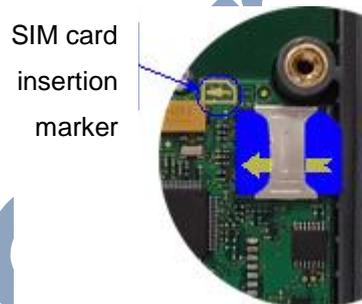
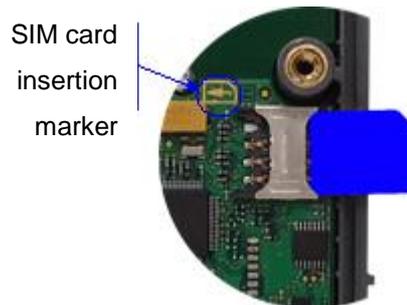


5.2 Installation of SIM card

- 1 – After having opened the casing (§ **Erreur ! Source du renvoi introuvable. Erreur ! Source du renvoi introuvable.** the casing), Insert the Micro SIM card (format 3FF, format N°2 on below picture).



- 2 – Push the Micro SIM card to the end.



5.3 Power supply connection

The product is delivered with its power supply connected. It is in deep sleep mode.

The product wakes up for a configuration:

- When the converter cable USB/TTL is connected to the terminal,
- At each transmission of character when the product is in sleep mode



If the power supply is disconnected, the product loses its activation capacity as its configuration will be altered.

5.4 USB/TTL cable connection

- 1 – Carefully separate the upper part from the lower part, using as the rotation axis the opposite side of the M8 connector.



- 2 – Connect the 4-pin USB –TTL cable to the board connector.
Ref. ercogener : 4440Z00025

The USB/TTL converter component is situated inside the molded part of the cable.



Preliminary

5.5 Access to configuration menu

By default, the product is supplied with a demonstration application. This application allows to make tracking or to read temperature and status of IN1 and IN2 digital inputs.

Use a Command Prompt software in order to communicate with the product.

The link between the product and the terminal is done with a USB/TTL cable: 115200,8,N,1.



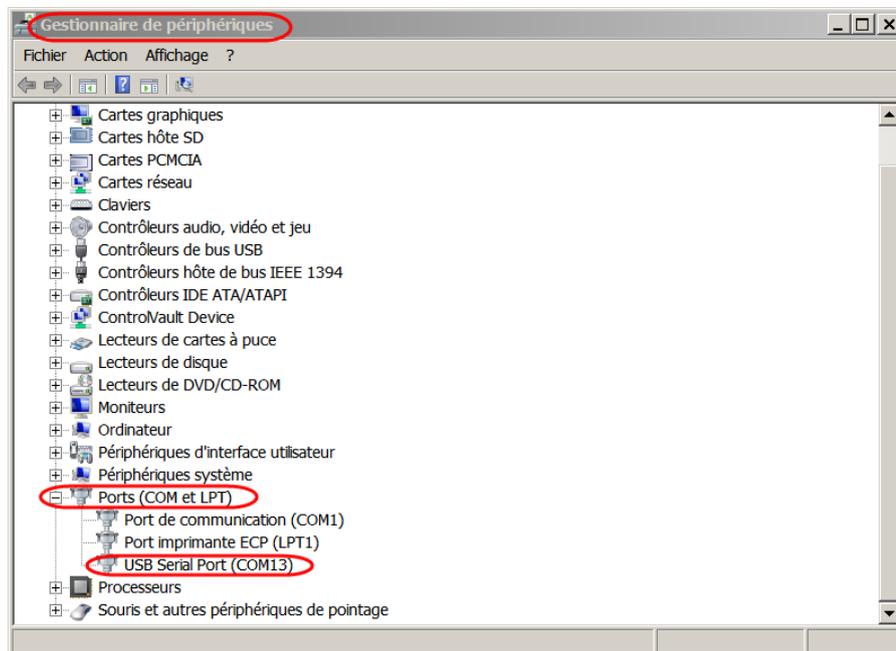
Use only the USB/TTL cable recommended by ercogener (Ref. 4440Z00025).

Connect the product to the terminal.

Wait for the installation of the USB driver.

Once the driver installed, open the Device Manager to know the corresponding COM port.

Example:



Launch the terminal with the corresponding communication port.

Send the character "Carriage Return" 0D in hexa.

The following menu appears (example):

Menu with Tracking mode	Menu with Remote Reading mode
<pre> AT&D4 READY EG1114 version [8AB1] LPWAN: "SIGFOX", Cellular: "3G", GNSS: "GPS+GLO+GAL", BT: "BLE" Vbat:3.599V ,Bat capacity: 0%, Tint: 26°C ----- EG-IoT_DEMO - V2.03b4 - 20/11/2017 16:01:29.20 CONFIGURATION MENU: D: Mode [0:Tracking] 1: Date ("dd/mm/yyyy") [06/12/2017] 2: Hour ("hh:mm"24H) [16:58] 3: Start activation delay (0-1440mn) [0mn] 4: Keep alive time ("I,mn";"F,[0-7],hh:mm") [I,2] 5: Alert cyclic wakeup ("HH:MM:SS") [00:10:00] 6: Transmission mode [4:Sigfox + GSM] 7: GSM/GPRS configuration IMEI [357520072362771] SMS destination phone number [] PIN code [] APN server [] APN username [] APN password [] protocol [TCP] TCP server [] TCP port [0] TCP ack [] I: SIGFOX ID A: Accelerometer [1:Enable] F: GNSS Geofencing radius [0m] G: GNSS Geofencing reference (lat, long) [,] Z: Erase memory R: Restore default values U: Update application S: Save E: Exit </pre>	<pre> AT&D4 READY EG1114 version [8AB1] LPWAN: "SIGFOX", Cellular: "3G", GNSS: "GPS+GLO+GAL", BT: "BLE" Vbat:3.597V ,Bat capacity: 0%, Tint: 26°C ----- EG-IoT_DEMO - V2.03b4 - 20/11/2017 16:01:29.20 CONFIGURATION MENU: D: Mode [1:Remote Reading] 1: Date ("dd/mm/yyyy") [06/12/2017] 2: Hour ("hh:mm"24H) [16:58] 3: Start activation delay (0-1440mn) [0mn] 4: Keep alive time ("I,mn";"F,[0-7],hh:mm") [I,2] 5: Alert cyclic wakeup ("HH:MM:SS") [00:10:00] 6: Transmission mode [4:Sigfox + GSM] 7: GSM/GPRS configuration IMEI [357520072362771] SMS destination phone number [] PIN code [] APN server [] APN username [] APN password [] protocol [TCP] TCP server [] TCP port [0] TCP ack [] I: SIGFOX ID N: IN1 (Type, Rest state, Value, Threshold) [0,0,0,65535] O: IN2 (Type, Rest state, Value, Threshold) [0,0,0,65535] ?: Read inputs state T: Temperature threshold (Low, High) [-30°C, 60°C] Z: Erase memory R: Restore default values U: Update application S: Save E: Exit </pre>



For more details, see the paragraph «Demonstration Application».

This menu allows to set:

- The operating mode
- The date **and then** the time (this order must be respected)
- The timeout before its activation
- The period of transmission of the Keep Alive frame
- The period of transmission of frames in alert mode
- The kind of transmission activated
- The identifiers and the transmission modes depending on the communication technology available on the product
 - For cellular : the IMEI number is the one of the EG-IoT internal module
 - For Sigfox, the Sigfox ID and the PACID can be read with the configuration application when entering the character « i ».
 - For LoRa (use of OTAA connections) :
 - The DevEUI (8 digits : HWEUI of the embedded module)
 - The AppEUI (8 digits : 6572636F67656E65)
 - The AppKEY (16 digits : 4552434F47454E45522D454731313134).These keys can be modified in the configuration menu.
- For the tracking mode
 - The geofencing circular zone
 - The reference position
- For the mode telemetering / pulse counting / Hour meter
 - The alert thresholds for high and low temperature
 - The modes of use of each digital input :
 - Pulse counting
 - Hour meter
 - Detection of status change
 - Alert threshold on each digital input
 - The initialization value of meters

The character has to be entered at the beginning of the line in order to activate the corresponding setting: enter 1 to modify the date for example, and follow the instructions.

Example of display		Observation
D: Mode	[0:Tracking]	Transmission mode [0]: 0: Tracking 1: Remote Reading The menu will adapt depending on the selected mode.
1: Date ("dd/mm/yyyy")	[01/01/2000]	Date ("dd/mm/yyyy") [01/01/2000] Réglage date
2: Hour ("hh:mm"24H)	[00:00]	Time ("hh:mm" 24H) [00:00]: Time setting
3: Start activation delay (0-1440mn)	[0mn]	Start activation delay (0-1440mn,0: not activated): "0mn" Activation timeout
4: Keep alive time ("I,mn";"F,[0-7],hh:mm")	[I,480]	("I,mn";"F,[0-7],hh:mm") Example : "I,1440" => Interval Time keep alive every 1440mn [1-1440mn] Example : "F,0,12:00" => Fix Time keep alive everyday at 12:00 Example : "F,2,23:59" => Fix Time keep alive every Tuesday at 23:59 Example : "F,7,01:00" => Fix Time keep alive every Sunday at 01:00 [I,480]: Timeout for transmission of regular frame
5: Alert cyclic wakeup ("HH:MM:SS")	[00:10:00]	Cyclic wakeup ("HH:MM:SS") [00:10:00]: Cyclical alert
6: Transmission mode	[0:GSM/GPRS]	Transmission mode [0]: 0: GSM/GPRS 1: LoRa 2: Sigfox 3: LoRa + GSM/GPRS backup 4: Sigfox + GSM/GPRS GSM/GPRS Mode requires SIM card The menu will adapt depending on the transmission modes selected
7: GSM/GPRS configuration	IMEI [xxxxxxxxxxxxxxxx]	Access to parameters below.
	SMS destination phone number []	SMS destination phone number: "" Enter phone number:
	PIN code []	PIN Code: "" Enter PIN Code (if requested):
	APN server []	APN server: "" Enter APN server:
	APN username []	APN username: "" Enter APN username:
	APN password []	APN password: "" Enter APN password:
	protocol [TCP]	Transfert protocol: "UDP" Enter protocol "T":TCP, "U":UDP
	TCP server []	TCP server: "" Enter TCP server:
	TCP port [0]	TCP port: "0" Enter TCP port:
	TCP ack []	TCP ack: "" Enter returns acknowledge string:
I: SIGFOX ID		\$I0-FRW: "AX-Sigfox 1.1.0-ETSI" \$I2-HWL: "8F" \$I3-HWH: "51" \$I4-FWH: "1" \$I5-FWL: "1" \$I7-VAR: "ETSI" \$I8-VCS: "0" \$I9-LIB: "UDL1-1.8.7" \$I10-ID : "00192F6E" \$I11-PAC: "4DEDEAFA03481A22"
A: Accelerometer	[1:Enable]	A: Accelerometer (0:Disable , 1:Enable): "1:Enable"
N: IN1 (Type, Rest state, Value, Threshold)	[0,0,0,65535]	IN1 (Type, Rest state, Value, Threshold)

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		Type : 0=Disable / 1=Pulse Counter / 2=Minutes Meter / 3=Edge Detection Rest state : 0=Low / 1=High [0,0,0,65535]:
F: GNSS Geofencing radius	[0m]	GNSS Geofencing Radius (0: not activated) : "0m"
O: IN2 (Type, Rest state, Value, Threshold)	[0,0,0,65535]	IN2 (Type, Rest state, Value, Threshold) Type : 0=Disable / 1=Pulse Counter / 2=Minutes Meter / 3=Edge Detection Rest state : 0=Low / 1=High [0,0,0,65535]:
G: GNSS Geofencing reference (lat, long)	[,]	GNSS Geofencing reference (lat, long): "0.00000,0.00000"
?: Read inputs state		IN1: 0,IN2: 0
Z: Erase memory		Do you want to erase memory ? (Y-N)
T: Temperature threshold (Low, High)	[-30°C,60°C]	Temperature threshold (Low, High) in °C (To disable thresholds events : low = -30°C, High = 60°C) [-30,60]:
R: Restore default values		Do you want to restore default values ? (Y-N)
U: Update application		Are you sure to enter in Bootloader mode ? (Y-N)
S: Save		Config saved
E: Exit		Exit menu



If the application does not receive any character after a timeout of 2 mn, the product goes back to deep sleep mode.
To wake it up, a new character has to be entered.
Each wakeup of the application means a reset, so consequently, the actions programmed during this status change are processed (Restart of start activation).



Once the configuration is done, enter '**S**' to save the parameters. The activation of the product will be active after the timeout defined in line 3 of the menu '*Start activation delay (0-1440mn)*'.



If you enter '**U**' to update the application, you enter in bootloader mode. The application is not available anymore and the product is waiting for a new application without going back to a deep-sleep mode.
The power supply must be disconnected and reconnected in order to go back to the configuration menu if the update is not done immediately.

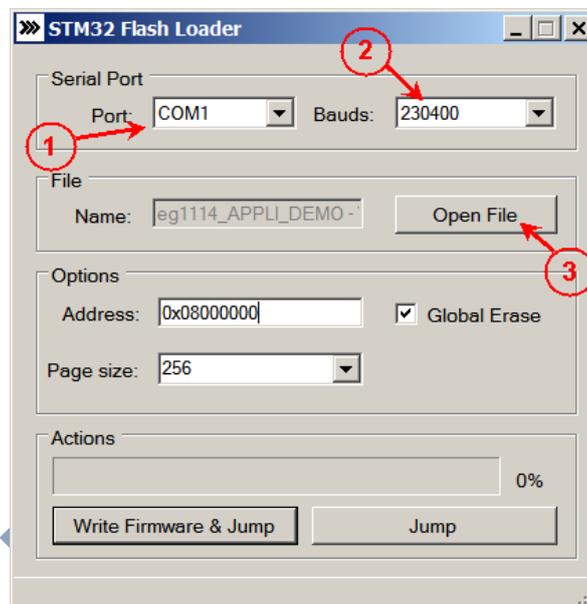
5.6 Update of embedded software via Boot loader

For this, you must have the application **STM32 Flash Loader.exe** with its dll : **STBootLib.dll**

You also must have the new (latest) application to be installed: **EG-IoT_Traceur_Vx.xx.bin (example)**

Start the program **STM32 Flash Loader.exe**

- 1) The following window appears:
Select the port corresponding to the cable
- 2) Select the port speed, other than 115 200 bauds:
- 3) Select the file



Select a port speed other than 115 200 bauds.

The software is ready to load the new application.

From the configuration menu
Enter Z and then Y (strongly advised)
Enter U and then Y

```

z
Do you want to erase memory ? (Y-N)
Y
In progress...
...
u
Are you sure to enter in Bootloader mode ? (Y-N)
Y
Bootloader waiting for STM32 Flash Loader...
    
```

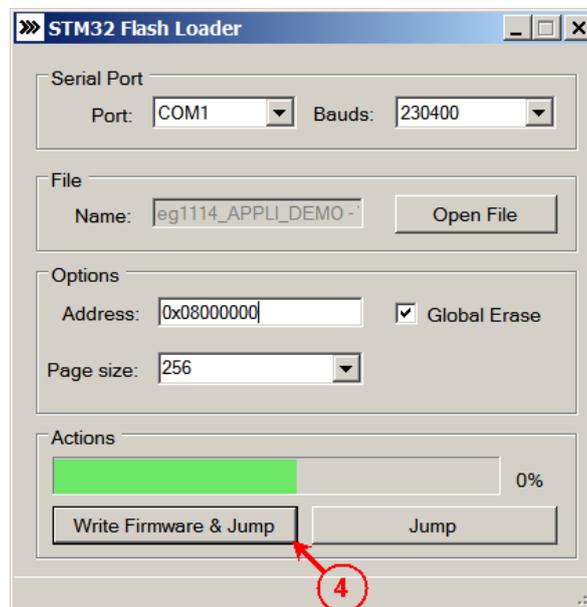
Close the COM port currently used

In the window of the STM32 Flash Loader, select « Write Firmware & Jump »

The message » Erasing » appears

The message « Programming » appears

The message « Success » appears



The new software version is automatically launched.

To check it, open the COM port with the terminal software and from the menu, enter « V ».

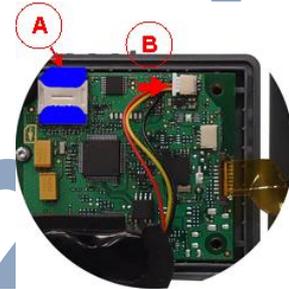
In case the menu does not appear, disconnect the battery, wait a few seconds and reconnect it.

5.7 Closing the casing

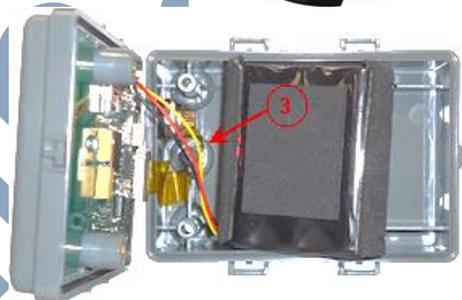
- 1 – Connect the Lexan in case it has been disconnected
 - A – Carefully unlock the connector.
 - B – Insert the Lexan.
 - C – Carefully lock the connector.



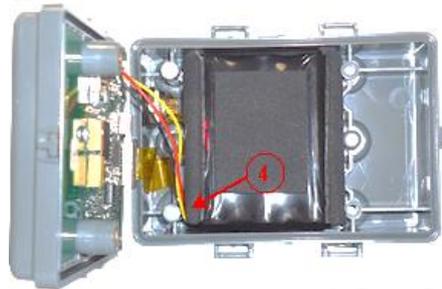
- 2 – Connect the battery or the lithium battery in case it has been disconnected.
 - A – Check the presence of the SIM card.
 - B – Connect the battery or the lithium battery.



- 3 – While placing the battery or the lithium battery, check that the Lexan is not folded.



- 4 – After having installed the battery or the lithium battery, check that the wires are positioned according to this picture.



- 5 – Close the housing. Check the presence of the seal on the 4 screws to ensure the waterproofness.

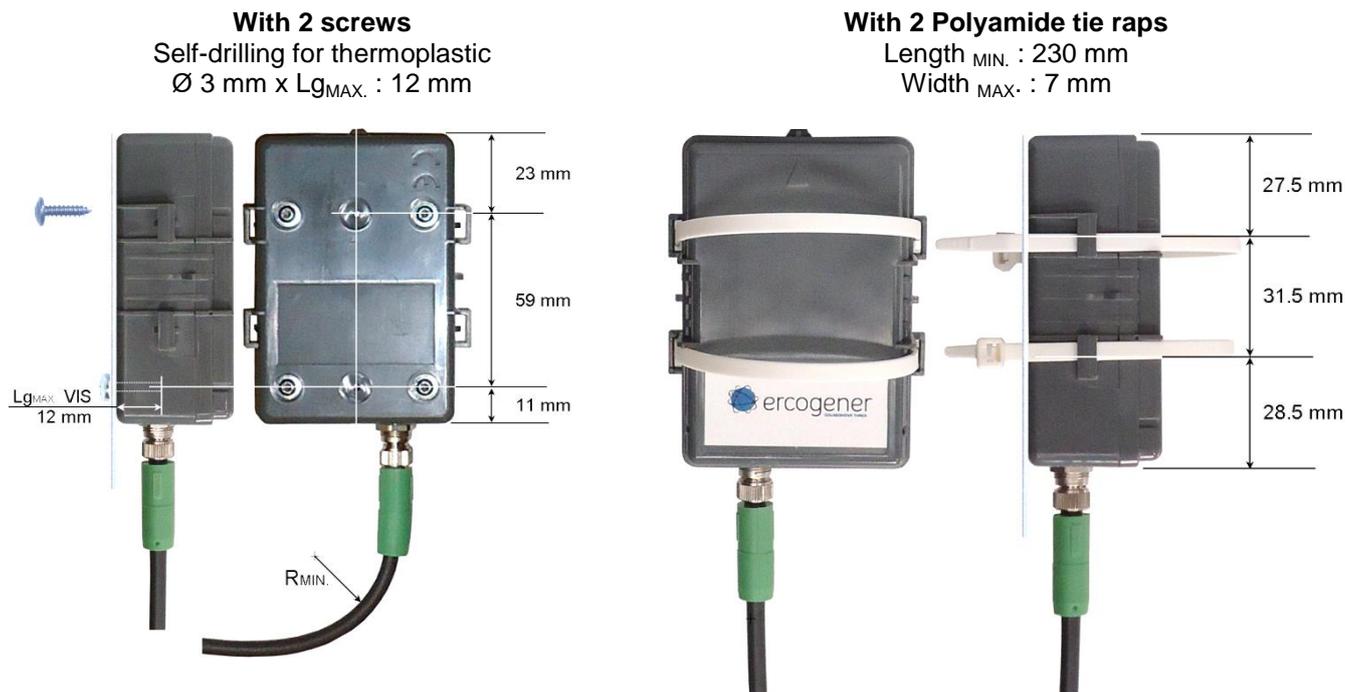


- 6 – With the TORX T10 screwdriver, place the 4 screws under the housing. Once the screws stop, make an additional quarter turn to ensure the waterproofness.



5.8 Fixing

5.8.1 Standard



Minimum bending radius of the cable
 Fix position $R_{MIN.} = 25,5 \text{ mm}$
 Flexible position $R_{MIN.} = 51 \text{ mm}$

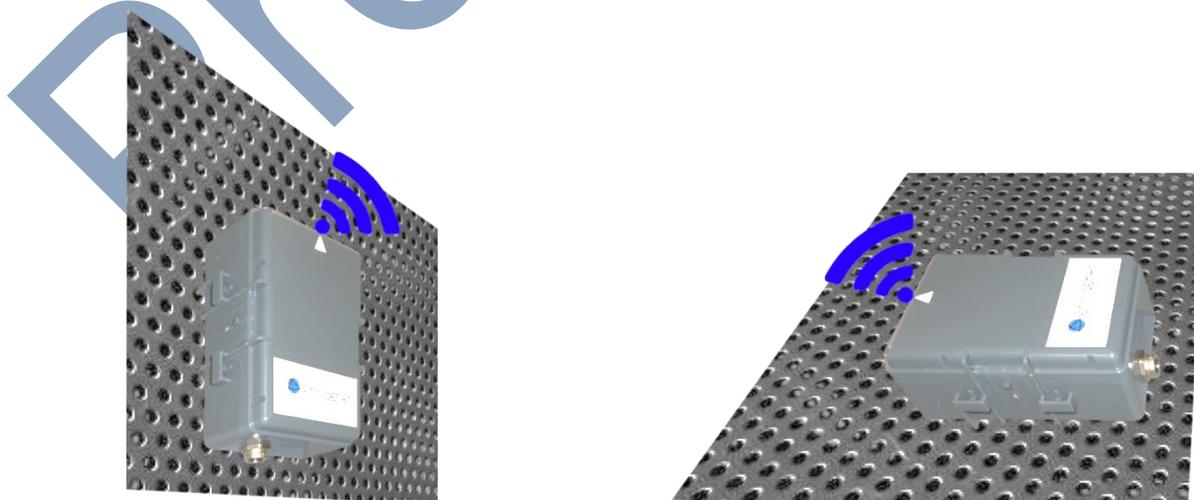
5.8.2 Installation



For optimum conditions of transmission and reception

- The arrow must be positioned upwards (see figure below)
- Avoid any obstacle on and in front of the product.
- **If the M8 cable is not connected, the cap must be placed on the connector of the product in order to ensure its waterproofness**

Figure 2 : Installation / Position



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6 Demonstration application:

This application will allow you to test the product for different cases of use.

This application will have evolutions and in this case, updates will be communicated.

1114_DEMO_V1.00	Tracking only, LoRa, Sigfox, SMS
1114_DEMO_V2.00	Addition telemetering/counting/hour meter (IN1, IN2, T°C), LoRa, Sigfox, SMS
1114_DEMO_V2.01	Addition management of TCP protocol TCP in 3G
1114_DEMO_V2.03b4	Optimization of LoRa driver, addition UDP, addition LTE CAT.M1 management, addition estimation of battery remaining capacity
Not available yet	datalogger, ANA inputs management, magnetometer, BLE, RS485, 1W

6.1.1 Principle

This version of demonstration is unidirectional for the transmission of information to a server and the SMS transmission.

The features taken into account are:

- Management of internal serial port for configuration
- Management of date and time
- Management of timeout between the configuration and the activation
- Management of keepalive frame
- Management of ways of transmission : LoRa, Sigfox, 2G/3G, LTE CAT.M1 for transmission of SMS and/or TCP/UDP frame
- Management of internal temperature reading
- For tracking
 - Management of position report
 - Management of entry/exit of a circular zone
 - Management of movement detection
 - Management of alert upon entry/exit of a zone
 - Management of alert upon start of movement and stop of movement
 - Management of cyclical transmission of frame during movement
- For telemetering
 - Management of the 2 digital inputs
 - Management of pulse counting on each of the 2 inputs
 - Management of hour meter on each of the 2 inputs
 - Management of thresholds for counting (high level) and temperature (low level and high level)
 - Management of alert upon status change of an input (upwards or downwards from the normal level of reference)

The main limits of this application are visible in the configuration menu of each parameter. The fixed limits not indicated in the menu are :

- The time is a UTC time
- Hysteresis of zone entry/exit (geofencing) : 50m
- Hysteresis around temperature threshold : 2°C
- Resolution of pulse counting : $F_{max} = 20\text{Hz}$, $T_{on} \text{ mini} = 12\text{ms}$
- Resolution of hour meter : duration mini 1s, resolution 1mn, duration max 65535mn, corresponding to 45 days
- Detection of movement (vehicle transport mode) : start of movement constant during 2s, stop of movement after 3 mn of immobilization
- LPWAN networks coverage:
 - Sigfox : <https://www.sigfox.com/en/coverage>
 - LoRa Objenius : <http://objenious.com/reseau/>
 - LoRa LiveObject : not communicated

To save power, the product wakes up:

- At the Keep alive frequency or at the alert cyclical frequency
- Upon an asynchronous event: movement or front detection
- There is no asynchronous event for the temperature threshold overrun. The first alert is sent depending on the keep alive frequency.

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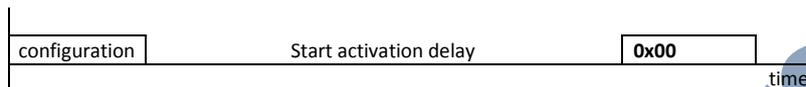
6.1.2 Application in tracking mode:

6.1.2.1 Operating chronogram and kind of frame

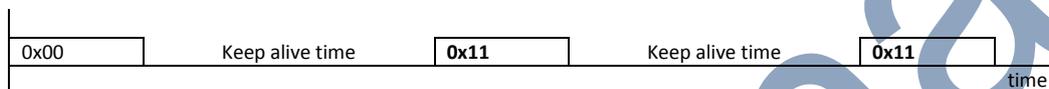
The application is able to send several kinds of frame, each frame has an identifier called Opcode.

- The first frame of activation:
 - **Opcode 0X00** in tracking mode
 - It is sent to indicate that the activation is functional.
 - It is sent after the timeout set at line 3 of the configuration menu '**Start activation delay**'

Example of chronogram



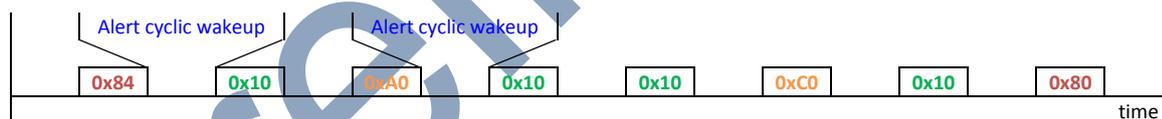
- The cyclical frame of KeepAlive (**Opcode 0x11**)
 - It is cyclically sent according to the parameters set at line 4 of the configuration menu '**Keep alive time**'.



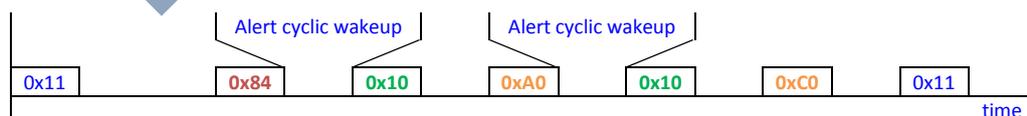
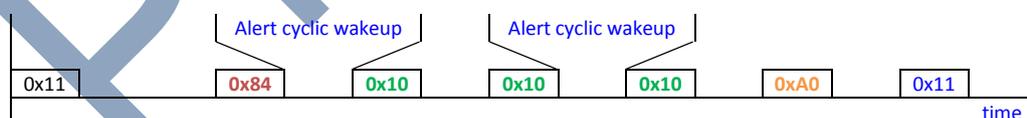
- A **frame of alert** is sent if the product detects a start of movement (**Opcode 0x84**), then the product cyclically sends a movement frame (**Opcode 0x10**) set at line 5 of the configuration menu '**Alert cyclic wakeup**' until the end of movement is detected (**Opcode 0x80**)



- During the **movement detection**, an alert frame of zone exit (**Opcode 0xA0**) will be sent, as well as a zone entry frame (**Opcode 0xC0**) if the geofencing is activated on the configuration.



- The entry and exit of zone are the priority for the movement detection. The opcode of end of movement does not appear if it is present with an entry or exit of zone.



6.1.2.2 Payload for Sigfox network or LoRa network

The payloads sent by the product have only one format for the tracking. Only the Opcode allows the identification of the kind of frame.

		Op Code	Latitude			Longitude			Reserved	Reserved	V _{BAT}	GNSS Fix	T° int.	Speed 10 km/h	HDOP	Reserved	Reserved
Bit	96	8	24			24			8	8	8	1	7	4	2	1	1
Octet	12	b7-b0	b23-b0			b23-b0			b7-b0	b7-b0	b7-b0	b7	b6-b0	b7-b4	b3-b2	b1	b0
Value		xx							7	8	9	10	11				
		00	Service init.									Invalid measure	0			00	0<2 Very good
		10	Cyclical frame									Valid measure	1			01	2<5 Good
		11	Life frame of EG-IoT									> 85 °C	0x7F			10	5<9 Moderate
		80	End of movement									85 °C	0x7E			11	9<20 Poor
		84	Movement detection									0 °C	0x28			Speed	
		A0	Exit zone									-40 °C	0x00			0000	10 Km/h par bit
		C0	Entry zone											FFFF			

Example of frame:

Opcode: Cyclic, Lat: 47.211467, Long: -0.060360, Vbat: 3.30V, GNSS Fix: Valid, T°int: 40°C, Speed: 35.2km/h, HDOP: 1.75

Frame : (all values in hexadecimal)

Opcode : Cyclic → **10**
 Lat : 47.211467 x 10000 = 472115 → **0x073433**
 Long : -0.060360 x 10000 = -604 → **0xFFFFDA4**
 Reserved 1 & 2... : → **00 00**
 V_{BAT} : 3.30V (3.30 x 100) – 200 = 130 → **0x82** (Note : measure range 2.00V à 4.55V)
 GNSS Fix : Valid measure → **1**
 T° int..... : 40°C = 0x28, 0x28 + 0x28 (0°) → **0x50** (Note : measure range -40°C à 85°C)
 Speed..... : 35.2 km/h → **0x0011**
 HDOP..... : 1.75 → very good → **00**
 Reserved..... : 0 0 → **0 0**

Frame in octets : **0x10 0x07 0x34 0x33 0xFF 0xFD 0xA4 0x00 0x00 0x82 0xD1 0x30**

Conversion in ASCII : **10073433FFFDA4000082D130** Payload Sigfox/LoRa

6.1.2.3 Frame sent by SMS

The transmission of information by SMS indicates the IMEI of the product, the OpCode, the date and time and additional useful information. The link at the end of the SMS allows the location of the product directly on Google Maps ©.

SMS	IMEI/ID	Opcode	DATE	TIME	LAT	LONG	Speed	GNSS Fix status	HDOP	res.*	res.*	Vbat	T° int	res.*	res.*	Remaining bat	Google Maps link to see the position
Characters	136	15	2	6	6	10	11	5	1	5	5	4	5	1	1	2	52
Separators (,)	16	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
Total chars	152	res.* : reserved															



Do not take into account the comma (,) as a separator in the Google Maps link
<https://www.google.fr/maps/place/47.211467,-0.060360>

SMS	Min	Max	Exemple
GSM IMEI / custom ID	0 chars	15 chars	123456789012345
Opcode (Hexa decimal)	00	C0	10
DATE (ddmmyy)	000000	311299	200717
TIME (hhmmss)	000000	235959	093653
LAT (Decimal degrees)	-89.999999	89.999999	47.211467
LONG (Decimal degrees)	-179.999999	179.999999	-0.060360
Speed (km/h)	0.0	999.9	35.2
GNSS Fix status : -1 : Unavailable 0 : Invalid 1 : GPS Fix (2D/3D) 2 : DGPS Fix	-1	2	1
HDOP Horizontal Dilution of Precision (<2 good value)	0.00	99.99	2.34
reserved	0	0	0
reserved	0	0	0
Vbat (mV)	0	9999	3300
Tint (°C)	-40.0	85.0	25.3
reserved	0	0	0
reserved	0	0	0
Remaining bat capacity (%)	0	99	53
Google Maps link to see the position	0	52	https://www.google.fr/maps/place/47.211467,-0.060360

00 = init
 10 = cyclic
 11 = Keep alive
 84 = Movement start
 80 = Movement stop
 A0 = Exit zone 0
 C0 = Entry zone 0

Example of frame:

ID : 1234564798012345

Opcode:01(Cyclic), Date: 250717, Time: 123456, Lat: 47.211467, Long: -0.060360, Speed: 35.2km/h, GNSS Fix: Valid, HDOP : 1.75, Vbat: 3.531V, T°int: 27°C, Remaining bat: 53%

The 2nd SMS below represents the same frame without valid GPS position.

SMS

1234564798012345,10,250717,123456,47.211467,-

0.060360,35.2,1,1,75,0,0,3531,27,0,0,53,"https://www.google.fr/maps/place/47.211467,-0.060360"

1234564798012345,10,,,,,0,99.99,0,0,3531,27,0,0,53,"https://www.google.com/maps/place/0.000000,0.000000"

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6.1.2.4 Frame sent via TCP or UDP

The transmission of information by SMS indicates the IMEI of the product, the OpCode, the date and time and additional useful information.

TCP/UDP	IMEI/ID	Opcode	DATE	TIME	LAT	LONG	Speed	GNSS Fix status	HDOP	res.*	res.*	Vbat	T° int	res.*	res.*	Altitude	Remaining bat	GSM RSSI	GSM QUAL	
Characters	96	15	2	6	6	10	11	5	1	5	5	5	4	5	1	1	6	2	3	3
Separators (,)	18	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
Total chars	114																			

res.* : reserved

TCP/UDP	Min	Max	Exemple
GSM IMEI/custom ID	0 chars	15 chars	123456789012345
Opcode (Hexa decimal)	00	C0	10
DATE (ddmmyy)	000000	311299	200717
TIME (hhmmss)	000000	235959	093653
LAT (Decimal degrees)	-89.999999	89.999999	47.211467
LONG (Decimal degrees)	-179.999999	179.999999	-0.06036
Speed (km/h)	0	999.9	35.2
GNSS Fix status : -1 : Unavailable 0 : Invalid 1 : GPS Fix (2D/3D) 2 : DGPS Fix	-1	2	1
HDOP Horizontal Dilution of Precision (<2 good value)	0	99.99	2.34
reserved	0	0	0
reserved	0	0	0
Vbat (mV)	0	9999	3300
Tint (°C)	-40	85	25.3
reserved	0	0	0
reserved	0	0	0
Altitude (m)	-12000	12000	40.3
Remaining bat capacity %	0	99	53
GSM RSSI level* or RSRQ (for LTE)*	0	31 ou 99 34 ou 255	10
GSM QUAL* or RSRP (for LTE)*	0	7 ou 99 97 ou 255	10

00 = init
10 = cyclic
11 = Keep alive
84 = Movement start
80 = Movement stop
A0 = Exit zone 0
C0 = Entry zone 0

* voir ANNEX 3 – GSM (RSSI/QUAL) LTE (RSRQ/RSRP)

Example of frame:

ID : 1234564798012345

Opcode:01(Cyclic), Date: 250717, Time: 123456, Lat: 47.211467, Long: -0.060360, Speed: 35.2km/h, GNSS Fix: Valid, HDOP : 1.75, Vbat: 3.30V, T°int: 40°C, Remaining bat: 53%, Altitude:60.4m, RSSI=10, QUAL=10

FRAME

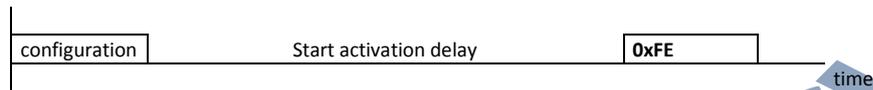
1234564798012345,10,250717,123456,47.211467,-0.060360,35.2, 1, 1.75 ,0,0,3300,40,0,0,60.4,53,10,10

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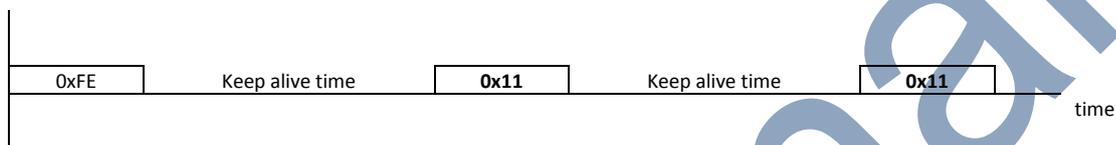
6.1.3 Application with mode telemetering / pulse counting / Hour meter:

6.1.3.1 Operating chronograms and kind of frames

- The first frame of activation:
 - **Opcode 0xFE** with mode telemetering/pulse counting/hour meter
 - It is sent to indicate that the activation is operational.
 - It is sent after the timeout set at line 3 of the configuration menu
- Example of chronogram



- The KeepAlive cyclical frame (**Opcode 0x11**)
 - It is cyclically sent according to parameters set at line 4 of the configuration menu



- An alert frame is sent if the threshold is reached (**Opcode 0x17**). For temperature threshold overrun, the frequency of frames transmission depends on the configuration at line '5' menu '**Alert cyclic wakeup**'.



6.1.3.2 Functioning of inputs

The inputs initialization is defined by 4 parameters IN (Type, Rest state, Value, Threshold)

Type :

- 0=Disable
- 1=Pulse Counter
- 2=Minutes Meter
- 3=Edge Detection

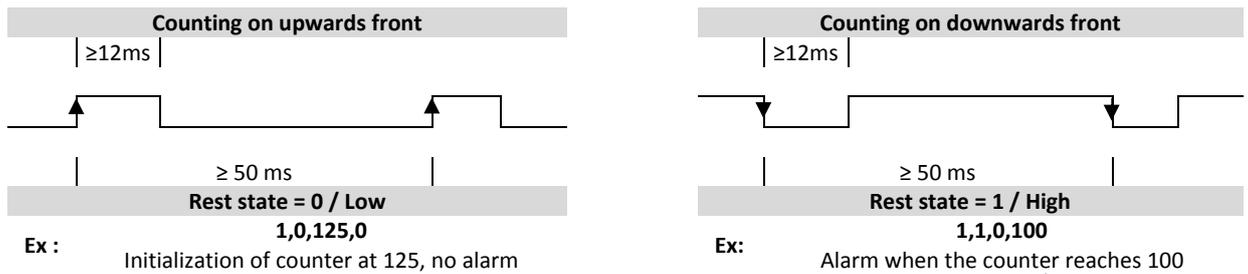
Rest state : 0=Low Status of input in idle mode

1=High

Value Initialization of counter if necessary.

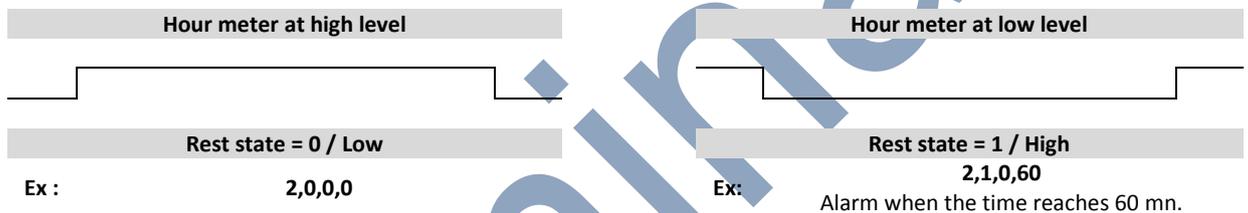
Threshold alarm threshold for hour meter or counting.

6.1.3.3 Counting



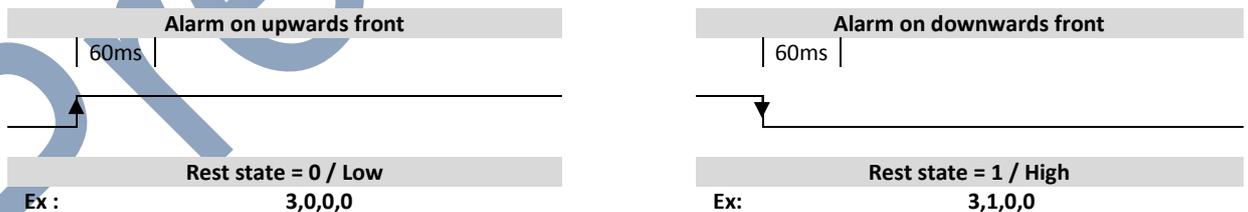
The alarm frame OpCode **17** is sent at the end of the **Keep Alive Time**.

6.1.3.4 Hour meter



The alarm frame OpCode **17** is sent at the end of the **Keep Alive Time**.

6.1.3.5 Front detection



The alarm frame OpCode **17** is sent 60 ms after the change of status is taken into account.

6.1.3.6 Payload for Sigfox or LoRa

PayLoad		Op Code	Compt. 1		Compt. 2		Res.	Res.	Res.	V _{BAT}	-	Temp. °C	Status of inputs / Alarms							
Bits	88	8	16		16		8	8	8	8		8	8							
		b7-b0	B15-b0		B15-b0		b7-b0	b7-b0	b7-b0	b7-b0	b7	B6-b0	b7	b6	b5	b4	b3	b2	b1	b0
Octet	11	0	1	2	3	4	5	6	7	8		9	10							
Value		0x--																		

11	Life frame of EG-IoT
17	Alarm frame
FE	Service Init.

reserved	-	Status input 1	b0
> +86 °C	0x7F	Status input 2	b1
+86 °C	0x7E	Counter 1 < Threshold	0
0 °C	0x28	Counter 1 ≥ Threshold	1
-40 °C	0x00	Counter 2 < Threshold	0
		Counter 2 ≥ Threshold	1
		Tmp. °C > Low threshold	0
		Tmp. °C ≤ Low threshold	1
		Tmp. °C ≥ High threshold	0
		Tmp. °C < High threshold	1
		Reserved	b7 b6

Compt. Counter
Res. Reserved

Example of frame:

Opcode: Keep alive, Digital input 1 counter : 100 , Digital input 2 counter : 32, Vbat: 3.30V, T°int: 40°C

Frame : (all values in hexadecimal)

Opcode : Keep alive → 11
 Digital input 1 counter .. : 100 → 0x0064
 Digital input 2 counter .. : 32 → 0x0020
 Reserved 1 & 2 : → 0x00 0x00
 Vbat..... : 3.30V (3.30 x 100) – 200 = 130 → 0x82 (Note : measure range 2.00V à 4.55V)
 T°int..... : 40°C = 0x28, 0x28 + 0x29 (0°) → 0x51 (Note : measure range -40°C à 85°C)
 Digital status : none → 0x00

Frame in octets : 0x11 0x00 0x64 0x00 0x20 0x00 0x00 0x82 0x51 0x00

Conversion in ASCII : 1100640020000000825100 Payload Sigfox/LoRa

6.1.3.7 Frame sent via SMS

SMS	Unit	Nb car min.	Nb car max.	Value min.	Value max.	Example
GSM IMEI/ Custom ID	-	0	15	-	-	123456789012345
Op code	-	2	2	11	FE	11
Date	ddmmyyyy	8	8			10012017
Hour	hhmm	4	4	0000	2359	1221
Counter 1	-	1	5	0	65535	47
Counter 2	-	1	5	0	65535	259
Alarm status	-	2	2	00	FF	00
Reserved	-	1	1	0	0	0
Reserved	-	1	1	0	0	0
V _{BAT}	mV	4	4	0	9999	3609
Temp.	°C	2	2	-40	+86	26
Reserved	-	1	1	0	0	0
Status input 1	-	1	1	0	1	0
Status input 2	-	1	1	0	1	1
Number of character per frame with separator		42	65			

11	Life frame
17	Alarm frame
FE	Service Init.

b0	Status input 1
b1	Status input 2
b2	Alarm counter 1
0	< Threshold
1	≥ Threshold
b3	Alarm counter 2
0	< Threshold
1	≥ Threshold
b4	Alarm low Temp.
0	< Threshold
1	≥ Threshold
b5	Alarm high Temp.
0	< Threshold
1	≥ Threshold
b6, b7	Reserved

Example of frame:

ID → 1234564798012345
 Opcode Life frame → 11
 Date → 10012017
 Time → 1221
 Value counter 1 → 47
 Value counter 2 → 259
 Alarms status → 00
 Reserved none → 0
 Reserved none → 0
 V_{BAT} 3.609V → 3609
 Temp. 26°C → 26
 Reserved none → 0
 Status input 1 none → 0
 Status input 2 none → 0

SMS

1234564798012345,11,10012017,1221,47,259,00,0,0,3609,26,0,0,0

6.1.3.8 Frame sent via TCP or UDP

TCP/UDP	IMEI/ID	Opcode	DATE	TIME	Counter value 1	Counter value 2	Counters status	res.*	res.*	Vbat	T° int	Analog status	Input state 1	Input state 2	GSM RSSI	GSM QUAL	
Characters	69	15	2	8	4	5	5	2	5	5	4	5	1	1	1	3	3
Separators (,)	15	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
Total chars	84																

res.* : reserved

SMS	Unit	Nb car min.	Nb car max.	Value min.	Value max.	Example
GSM IMEI/ Custom ID	-	0	15	-	-	123456789012345
Op code	-	2	2	11	FE	11
Date	ddmm yyyy	8	8			10012017
Hour	hhmm	4	4	0000	2359	1221
Counter 1	-	1	5	0	65535	47
Counter 2	-	1	5	0	65535	259
Alarm status	-	2	2	00	FF	02
Reserved	-	1	1	0	0	0
Reserved	-	1	1	0	0	0
V _{BAT}	mV	4	4	0	9999	3320
Temp.	°C	2	2	-40	+86	25
Reserved	-	1	1	0	0	0
Status input 1	-	1	1	0	1	0
Status input 2	-	1	1	0	1	1
GSM RSSI level* RSRQ (for LTE)*	-	1	3	0	31-99 34-255	12
GSM QUAL* RSRQ (for LTE)*	-	1	3	0	7-99 97-255	10

11	Life frame
17	Alarm frame
FE	Service Init.

b0	Status input 1
b1	Status input 2
b2	Alarm counter 1
0	< Threshold
1	≥ Threshold
b3	Alarm counter 2
0	< Threshold
1	≥ Threshold
b4	Alarm low Temp.
0	< Threshold
1	≥ Threshold
b5	Alarm high Temp.
0	< Threshold
1	≥ Threshold
b6, b7	Reserved

Number of character per frame with separator	46	73
--	----	----

* see ANNEX 3 – GSM (RSSI/QUAL) LTE (RSRQ/RSRP)

Example of frame:

ID : 1234564798012345

Opcode:11(Cyclic), Date: 25072017, Time: 1234, Counter value 1: 47, Counter value 2: 259, Counter status: 02, Reserved :0, Reserved : 0; Vbat: 3.32V, T°int: 25.3°C, Analog status = 00, Input state1 =0, Input state 2 = 1, RSSI=10, QUAL=10

FRAME

357520072362730,11,10012017,1221,47,249,02,0,0,3320,25,0,0,1,12,10

7 Interface on M8 connector

Table 4 : Input E1/E2



Broche	Designation	8-wire cable
1	Input 1	White
5	GND	Grey
8	Input 2	Red

7.1 Contact input

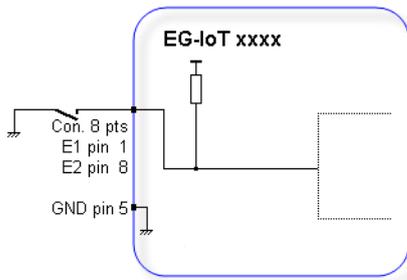


Table 5 : Characteristics of opto-coupled inputs

Characteristics	Symbols	Conditions	Min.	Typ.	Max.	Unit
Current max.	I_F	Contact closed			33	μA

7.2 Opto-coupled input

Figure 3 : Opto-coupled input E1/E2

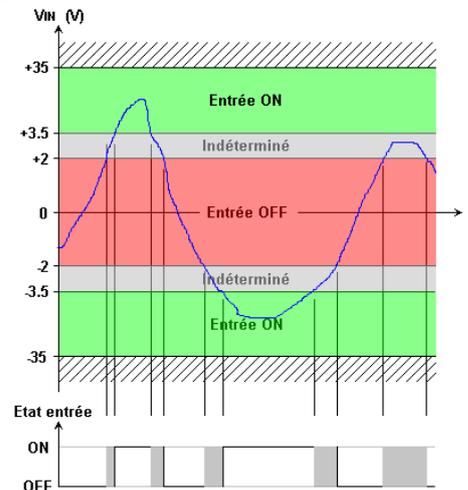
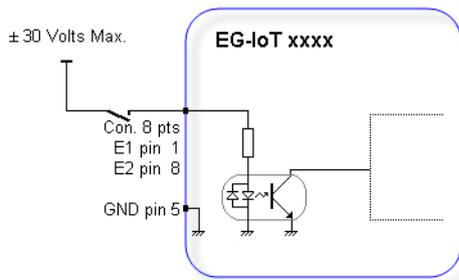


Table 6 : Characteristics of opto-coupled inputs

Characteristics	Symbols	Conditions	Min.	Typ.	Max.	Unit
Voltage max.	V_{IN}				± 30	V_{DC}
Current max.	I_F	à $V_{MAX.} \pm 30V_{DC}$			± 3.6	mA
Command voltage	V_{ON}		± 3.5		± 30	V_{DC}
Idle voltage	V_{OFF}				± 2	V_{DC}

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7.3 Power supply +V_{CC}



Only on the product **EG-IoT-4AA6**, and **EG-IoT-8AA6**

Table 7 : Power supply +V_{CC}



Pin	Designation	8-wire cable
7	+V _{CC}	Blue
5	GND	Grey

Table 8 : Characteristics of power supply

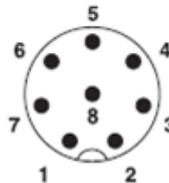
Characteristics	Symbols	Conditions	Min.	Typ.	Max.	Unit
Power supply	+V _{CC}	Without battery	10		30	V _{DC}
		With battery	8		30	V _{DC}

ANNEX 1 - 8-wire cable

(Ref. ERCOGENER : 4460508215)



Figure 4 : M8 connector male side view



Broche / Pin	Couleur / Color	Désignation / Designation
1	Blanc / White	Entrée 1 / Input 1
2	Marron / Brown	One wire
3	Vert / Green	Sortie / Output
4	Jaune / Yellow	RS485A or I2C or ANA
5	Gris / Grey	GND
6	Rose / Pink	RS485B or I2C or ANA
7	Bleu / Blue	+V_{cc}
8	Rouge / Red	Entrée 2 / Input 2



Cut or isolate the wires not used

Table 9 : Characteristics of 8-wire cable

Component	Characteristics
8-pin connector	
Cable	Lg ≥ 1.5m
Wire	AWG26 / 0.14 mm ²
Minimum bending radius, fixed installation	25.5 mm
Minimum bending radius, flexible installation	51 mm

ANNEX 2 –USB –TTL 4-pin cable

(Ref. ERCOGENER : 4440Z00025)



Figure 5 : 4 pins female connector

Broche / Pin		
	4	TXD
	3	RXD
	2	no used
	1	Gnd

Table 10 : Characteristics of 8-wire cable

Component	Characteristics
Connector 1	USB type A male
Cable	Lg ≈ 1.8m Ø 5 mm
Connector 2	4 pts serial SH

ANNEX 3 – GSM (RSSI/QUAL) LTE (RSRQ/RSRP)

GSM RSSI (Received Signal Strength Indication)	
0	Below -110.5 dBm
1..30	From -110.5 dBm to -51 dBm
31	Over -51 dBm
99	Unknown or not detectable

GSM QUALITY			
	2G – CSD data / GPRS Bit Error Rate	2G - EGPRS Bit Error Probability	3G - UMTS Energy per Chip/Noise
0	BER < 0.2%	28 <= BEP <= 31	ECNo >= 44
1	0.2% < BER < 0.4%	24 <= BEP <= 27	38 <= ECNo < 44
2	0.4% < BER < 0.8%	20 <= BEP <= 23	32 <= ECNo < 38
3	0.8% < BER < 1.6%	16 <= BEP <= 19	26 <= ECNo < 32
4	1.6% < BER < 3.2%	12 <= BEP <= 15	20 <= ECNo < 26
5	3.2% < BER < 6.4%	8 <= BEP <= 11	14 <= ECNo < 20
6	6.4% < BER < 12.8%	4 <= BEP <= 7	8 <= ECNo < 14
7	BER > 12.8%	0 <= BEP <= 3	ECNo < 8
99	Unknown or not detectable		

LTE - RSRQ (Reference Signal Received Quality)	
0	Below -19 dB
1..33	From -19.5 dB to -3.5 dB pitch of 0.5 dB
34	Over -3 dB
255	Unknown or not detectable

LTE - RSRP (Reference Signal Received Power)	
0	Below -141 dBm
1..96	From -140 dBm to -45 dBm pitch of 1 dBm
97	Over -44 dBm
255	Unknown or not detectable

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