

# USER GUIDE FOR SIGFOX-READY PRECISION FUEL LEVEL SENSOR WSSFC-CAP10

**THIS IS OBSOLETE MANUAL**

**Please access <https://www.iot.daviteq.com/wireless-sensors> for updated manual**

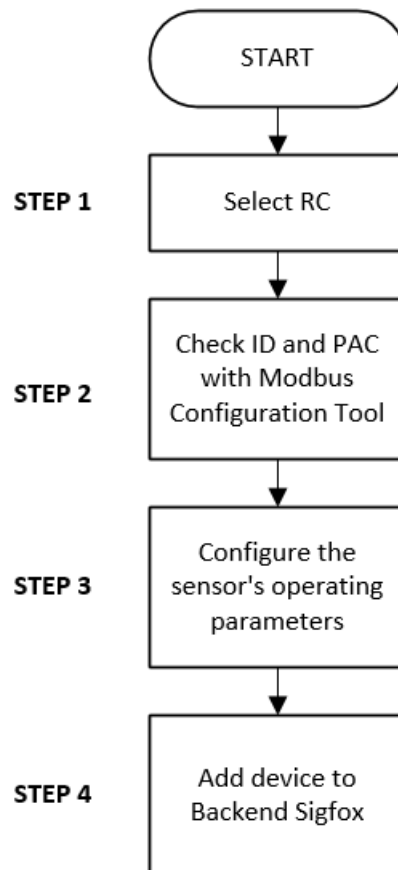
|                      |          |
|----------------------|----------|
| WSSFC-CAP10-MN-EN-01 | FEB-2022 |
|----------------------|----------|

*This document is applied for the following products*

| SKU       | WSSFC-G4F-NH3      | HW Ver.                                                                                                                                                                             | 1.1 | FW Ver. | 1.0 |
|-----------|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|---------|-----|
| Item Code | WSSFC-CAP10-8-1500 | SIGFOX HIGH PRECISION CAPACITANCE FUEL LEVEL SENSOR FOR DIESEL OIL, VEGETABLE OIL, LUBRICANT, 1500MM, FIELD CUTTABLE, INTERNAL ANTENNA, TYPE AA BATTERY 1.5VDC, IP67, RC1 ZONE      |     |         |     |
|           | WSSFC-CAP10-9-1500 | SIGFOX HIGH PRECISION CAPACITANCE FUEL LEVEL SENSOR FOR DIESEL OIL, VEGETABLE OIL, LUBRICANT, 1500MM, FIELD CUTTABLE, INTERNAL ANTENNA, TYPE AA BATTERY 1.5VDC, IP67, RC2-RC4 ZONES |     |         |     |
|           | CAP10PROEXT0700    | CAP10 PROBE EXTENSION LENGTH 700 MM                                                                                                                                                 |     |         |     |
|           | CAP10PROEXT1000    | CAP10 PROBE EXTENSION LENGTH 1000 MM                                                                                                                                                |     |         |     |
|           | CAP10PROEXT1500    | CAP10 PROBE EXTENSION LENGTH 1500 MM                                                                                                                                                |     |         |     |

## 0. Configuration Check List

### 0.1 Configuration Sigfox Sensor



|                                                              |                                                                                              |
|--------------------------------------------------------------|----------------------------------------------------------------------------------------------|
| <b>STEP 1: Select RC</b>                                     |                                                                                              |
| 1. Select RC zone                                            | RC zones selection 1, 2, 4,... is RCZ1, RCZ2, RCZ4,... (refer to <a href="#">section 6</a> ) |
| <b>STEP 2: Check ID and PAC</b>                              |                                                                                              |
| Use Modbus Configuration Cable to read the ID and PAC values | Refer to register address 8 and 10 (DEC)                                                     |
| <b>STEP 3: Configure the sensor's operating parameters</b>   |                                                                                              |
| Configure parameters like cycle send data, alarm, a, b,...   | Refer to the configuration <a href="#">section 6</a>                                         |
| <b>STEP 4: Add device to Backend Sigfox</b>                  |                                                                                              |
| <a href="#">refer to section 6.2 for details</a>             |                                                                                              |
| <b>STEP 5: Installation</b>                                  |                                                                                              |
| <a href="#">refer to section 9 for details</a>               |                                                                                              |

## 0.2 Setup Fuel Sensor

### **i Default communication of CAP10CNR RS485:**

Baudrate : **19200**  
 Data bit : **8**  
**i** Stop bit : **1**  
 Parity : **None**  
 Modbus Slave address : **30**

## SMART FUEL LEVEL SENSOR PulseCAP10



CAP10R-H1.PNG



[See more how to configure CAP10CNR here](#)

# 1. Functions Change Log

| HW Ver. | FW Ver. | Release Date | Functions Change |
|---------|---------|--------------|------------------|
| 1.1     | 1.0     | DEC-2020     |                  |

# 2. Introduction

WSSFC-CAP10 is a Sigfox fuel level sensor that utilizes the 10-year experience of Daviteq in digital capacitance measuring technique. It delivers high accuracy and stability with 0.1% of span. Ultra-low power design and smart firmware allow the complete Wireless and Sensor package to run on 2 x AA battery 1.5V for 2-5 years with 15 minutes updates. It can support the following regions RC1, RC2, & RC4.

**Typical Applications:** Monitoring fuel level and fuel consumption in fuel tanks of Genset, Boiler, Heavy equipment or machinery...



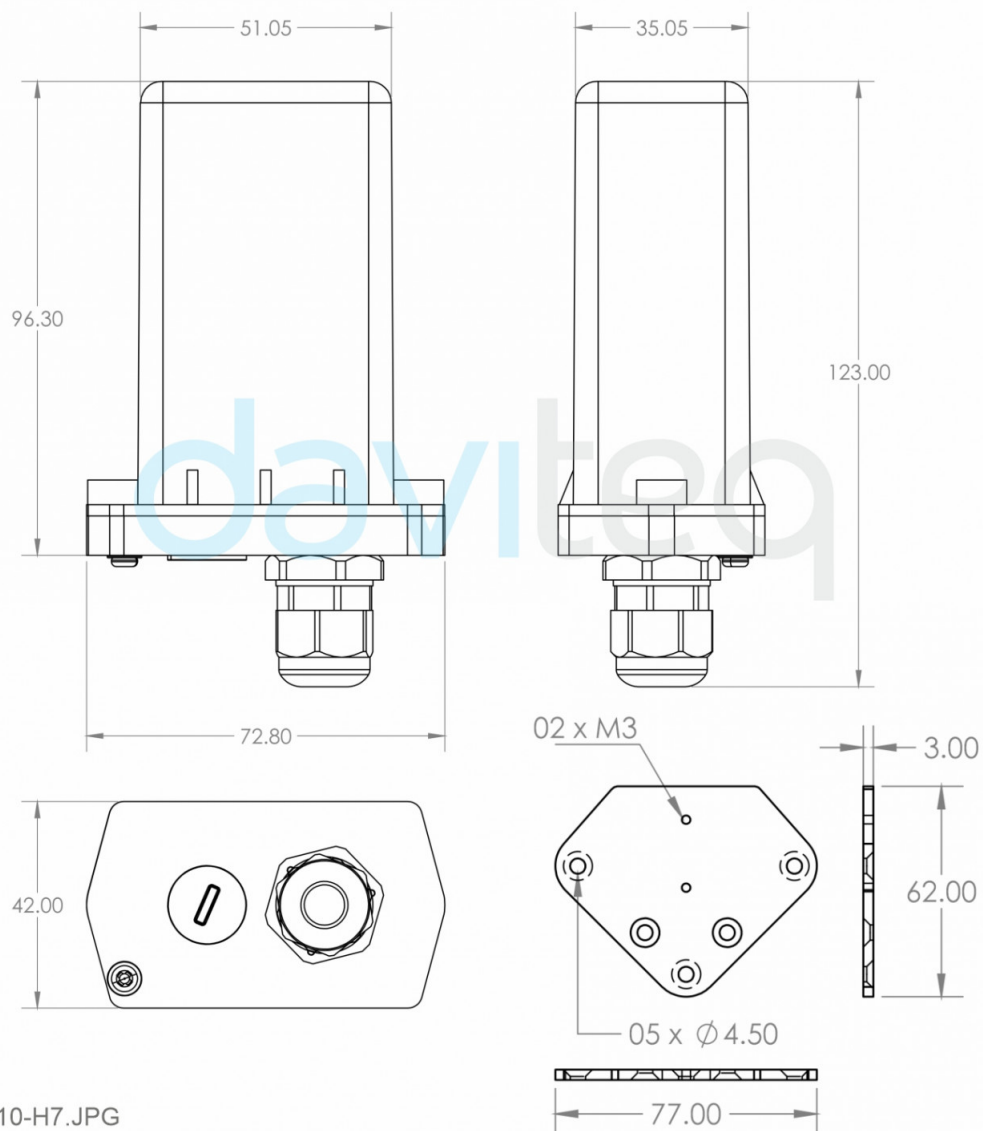
### 3. Specification

|                                       |                                                                     |
|---------------------------------------|---------------------------------------------------------------------|
| <b>SENSORS SPECIFICATION:</b>         |                                                                     |
| Measurement Range (mm)                | Standard Range: 700, 1000, 1500, can be extended up to 4000         |
| Accuracy / Resolution / Repeatability | ±0.1% of Span / 0.1% / ±0.1% of span                                |
| Thermal drift                         | < +0.03% of span per 10oC                                           |
| Connector                             | M12 male, 4-pin, Coding A                                           |
| Sensor MTBF                           | More than 10 years                                                  |
| Sensor wetted materials               | Aluminum and engineering plastic                                    |
| Operating Temperature Range           | -40 to 85 °C                                                        |
| Operating Humidity Range              | 0-100% RH                                                           |
| Sensor rating                         | IP67, outdoor                                                       |
| Certification                         | CE-Marking per EN61236-1 (with test report)                         |
| Standard accessories                  | Filter footer, flange, gasket, o-ring, self-tapping screws          |
| <b>Sigfox SPECIFICATION:</b>          |                                                                     |
| Sigfox zones                          | select RC1-RC2-RC4                                                  |
| Antenna                               | Internal Antenna 2 dbi                                              |
| Configuration                         | via Downlink or offline USB cable (PC software is supplied at free) |
| Battery                               | 02 x AA Type 1.5VDC                                                 |
| RF Module complies to                 | CE, FCC, ARIB                                                       |
| Working temperature                   | -40°C..+60°C (using Energizer Lithium Ultimate AA battery)          |
| Dimensions and Net-weight             | H140xW73xD42, 250 grams (Sigfox Device only)                        |
| Housing                               | Polycarbonate, IP67                                                 |
| Mounting                              | Wall mount bracket                                                  |
| Sensor cable                          | 2m sensor cable with M12-male connector                             |

### 4. Dimensions

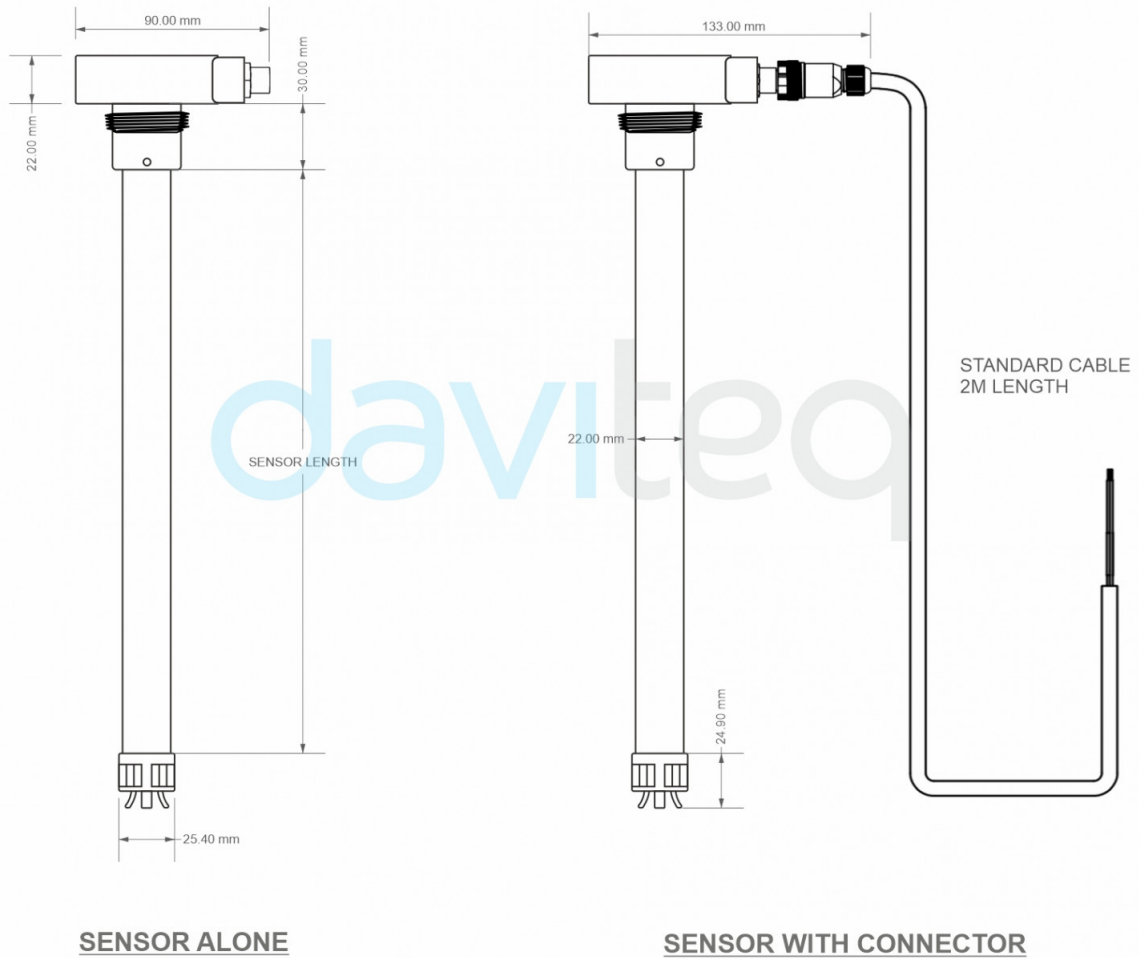
## 4.1 Dimensions of the Sigfox sensor

### DIMENSION DRAWING OF WIRELESS NODE (Unit: mm)



## 4.2 Dimensions of the Fuel Sensor

## DIMENSION DRAWING OF FUEL SENSOR (Unit: mm)



WSSFC-CAP10-H8.JPG

## 5. Scope of delivery

- Sigfox Sensor - Bracket
- Fuel Sensor
- Installation tool



## 6. Operation Principle

**i** Upon power on, the Sigfox node has **60 seconds** to wait for **off-line** configuration (via **cable** with **ModbusRTU** protocol).

After that, Sigfox node will send the first message to Base station.

Then during the operation, there are 03 cases of sending data to base station:

1. When the sensor sampling time interval is reached, the Sigfox node will read the data from Input or sensor and performing the calculation. After that it will check calculated value with alarm thresholds. If the calculated was out off the threshold values (Lo or Hi), called alarm, and the number of times of alarm did not pass the limit of number of alarms, then it will send data to Base station immediately;

### **NOTE:**



Once sending the data to base station by this alarm event, the timer of sending time interval will be reset;

2. When the sending time interval is reached, it will send data to Base station immediately, regardless of value;

3. By using the magnet key, the Sigfox node can be triggered to send data to base station immediately. There will be a beep sound from the buzzer meaning the data has been sent.



| EVENT             | PRE-CONDITION | ACTION                                                                                                          | LED STATUS            | BUZZER STATUS | ACTIVITIES   | POST-CONDITION         |
|-------------------|---------------|-----------------------------------------------------------------------------------------------------------------|-----------------------|---------------|--------------|------------------------|
| FORCE_DATA        | Any state     | Move Magnet Key to contact point of REED SWITCH. Buzzer beeps 1 time, move Magnet Key away.                     | Blink <b>SKY BLUE</b> | Beep 1 time   | See FW specs | Back to previous state |
| PARAMETERS_UPDATE | Any state     | Move Magnet Key to contact point of REED SWITCH. Buzzer beeps 1 time, hold Magnet Key 5s. Buzzer beeps 2 times. | Blink <b>PURPLE</b>   | Beep 2 times  | See FW specs | Back to previous state |

#### NOTE:



Once sending the data to base station by the magnet key, the timer of sending time interval will be reset;

The shortest time interval between the two manual triggers is 15s. If shorter than 15s, there will be no data sending and you will not hear the beep sound.

Contact point



Magnet key



**i** the push button can only be used for the first **60 seconds** after powering up.

## 6.1 RC technical details

The RF transmit power will be automatically set as the max value as allowed by the Zone.

Sigfox Radio Configuration (RC) defines the radio parameters in which the device shall operate: Sigfox operating frequencies, output power, spectrum access mechanism, throughput, coexistence with other radio technologies, etc.

Each radio configuration includes 4 uplink classes: 0u, 1u, 2u, and 3u.

The Sigfox network globally works within the ranges from 862 to 928 MHz. But not all RCs require such a wide range of operation.

|                                        | RC1     | RC2     | RC3     | RC4     | RC5     | RC6     | RC7     |
|----------------------------------------|---------|---------|---------|---------|---------|---------|---------|
| <b>Uplink center frequency (MHz)</b>   | 868.130 | 902.200 | 923.200 | 920.800 | 923.300 | 865.200 | 868.800 |
| <b>Downlink center frequency (MHz)</b> | 869.525 | 905.200 | 922.200 | 922.300 | 922.300 | 866.300 | 869.100 |
| <b>Uplink data rate (bit/s)</b>        | 100     | 600     | 100     | 600     | 100     | 100     | 100     |
| <b>Downlink data rate (bit/s)</b>      | 600     | 600     | 600     | 600     | 600     | 600     | 600     |



|                                      |                 |                      |                        |                      |                        |    |                 |
|--------------------------------------|-----------------|----------------------|------------------------|----------------------|------------------------|----|-----------------|
| <b>Sigfox recommended EIRP (dBm)</b> | 16              | 24                   | 16                     | 24                   | 14                     | 16 | 16              |
| <b>Specifics</b>                     | Duty cycle 1% * | Frequency hopping ** | Listen Before Talk *** | Frequency hopping ** | Listen Before Talk *** |    | Duty cycle 1% * |

\* **Duty cycle** is 1% of the time per hour (36 seconds). For an 8 to 12 bytes payload, this means 6 messages per hour, 140 per day.

\*\* **Frequency hopping**: The device broadcasts each message 3 times on 3 different frequencies. Maximum On time 400 ms per channel. No new emission before 20 s.

\*\*\* **Listen Before Talk**: Devices must verify that the Sigfox-operated 200 kHz channel is free of any signal stronger than -80 dBm before transmitting.

Sigfox's high limit EIRP recommendation is included in each column although regulations sometimes allow for more radiated power than the Sigfox recommendation.

Sigfox's recommendation is set to comply with the Sigfox technological approach of:

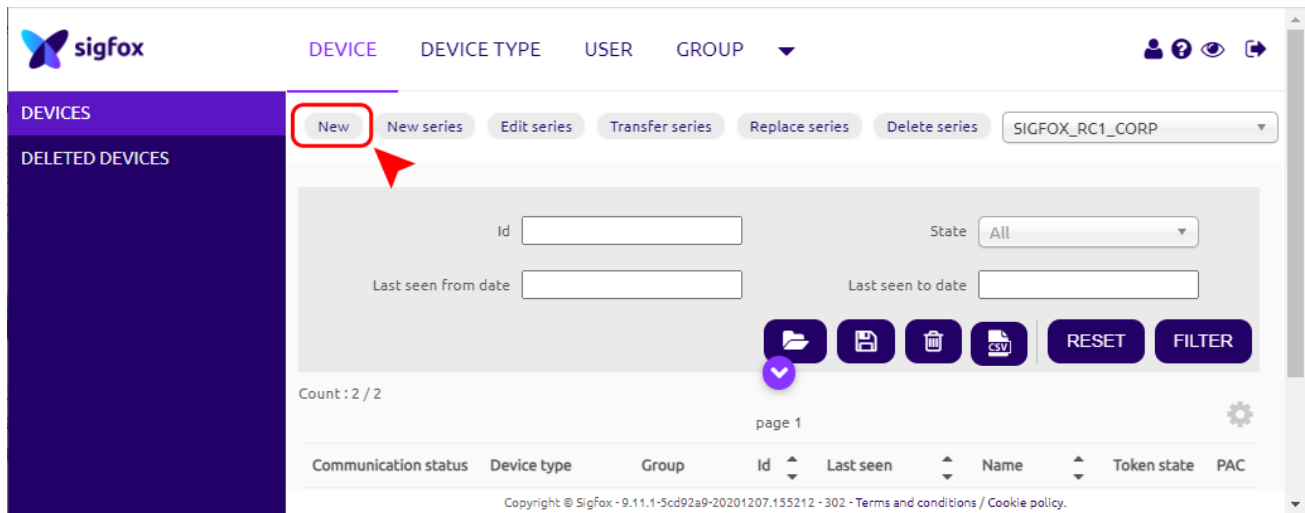
- Low current consumption
- Balanced link budget between uplink and downlink communication

## 6.2 Add a device to the Backend Sigfox

**Step 1:** Log in to the sigfox backend website

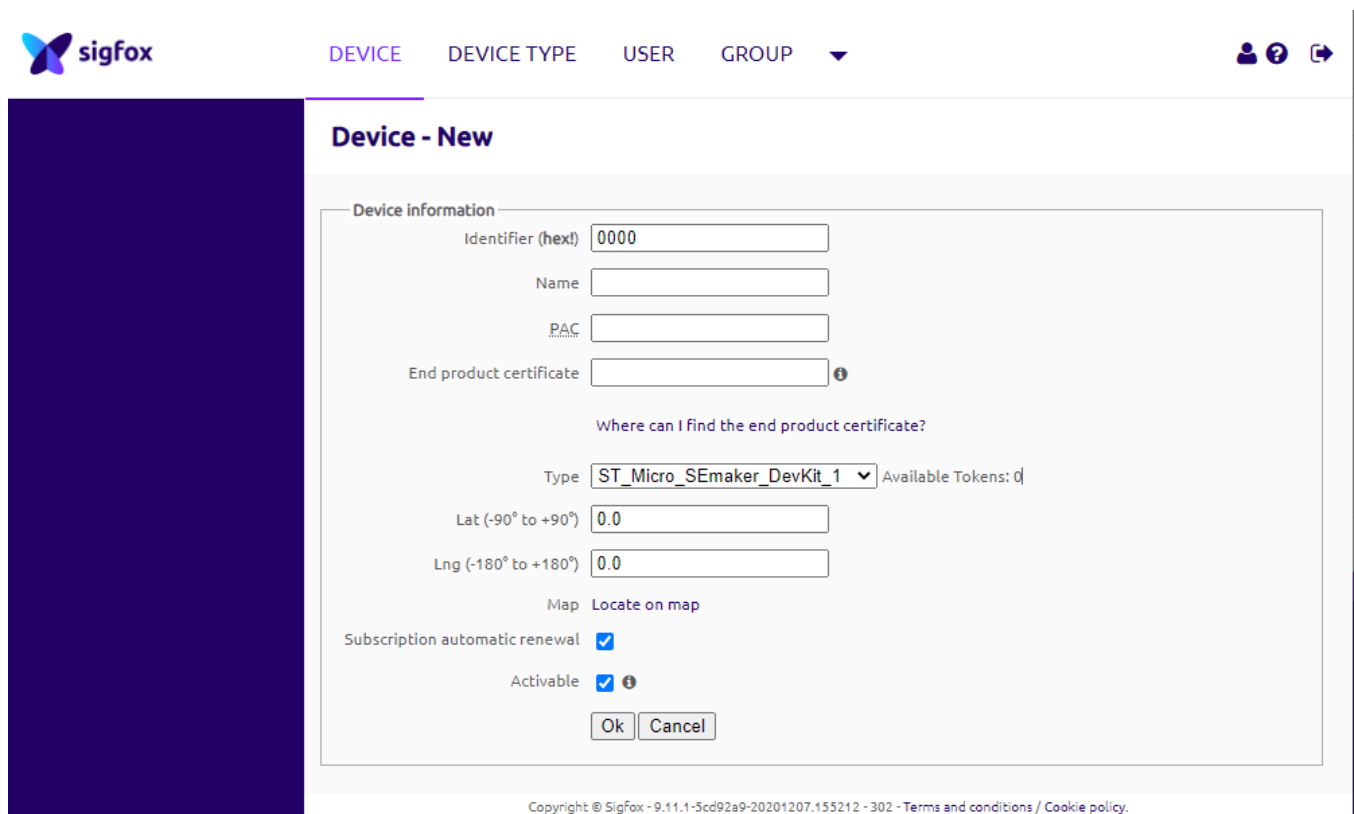
**Step 2:** Click on Device

**Step 3:** Click New → Select a group



The screenshot shows the Sigfox web interface. The top navigation bar includes the Sigfox logo and tabs for 'DEVICE', 'DEVICE TYPE', 'USER', and 'GROUP'. The left sidebar has 'DEVICES' and 'DELETED DEVICES'. The main content area has a 'New' button highlighted with a red box and a red arrow. Below the 'New' button are buttons for 'New series', 'Edit series', 'Transfer series', 'Replace series', and 'Delete series'. There is a dropdown menu for 'SIGFOX\_RC1\_CORP'. Below these are input fields for 'Id', 'State', 'Last seen from date', and 'Last seen to date'. There are also buttons for 'RESET' and 'FILTER'. At the bottom, there is a table with columns: 'Communication status', 'Device type', 'Group', 'Id', 'Last seen', 'Name', 'Token state', and 'PAC'. The table shows a count of 2 / 2 and is on page 1.

**Step 4:** Fill in the required information



The screenshot shows the 'Device - New' form in the Sigfox web interface. The form contains the following fields and options:

- Device information:**
  - Identifier (hex!): 0000
  - Name: [empty]
  - PAC: [empty]
  - End product certificate: [empty] ⓘ
- Where can I find the end product certificate?**
- Type:** ST\_Micro\_SEmaker\_DevKit\_1 (dropdown) Available Tokens: 0
- Lat (-90° to +90°):** 0.0
- Lng (-180° to +180°):** 0.0
- Map:** Locate on map
- Subscription automatic renewal:** ☒
- Activable:** ☒ ⓘ
- Buttons:** Ok, Cancel

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**Note:** Some of our products may not have end product certification in time, to add the product to Backend Sigfox please follow the steps below.

**Click on the text as shown below**

## Device - New

Device information

Identifier (hex!)

Name

PAC

End product certificate  ⓘ

Where can I find the end product certificate?

Type  Available Tokens: 0

Lat (-90° to +90°)

Lng (-180° to +180°)

Map [Locate on map](#)

Subscription automatic renewal ☒

Activable ☒ ⓘ

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Check the box as shown below to register as a prototype

## Device - New

Device information

Identifier (hex!)

Name

PAC

End product certificate  ⓘ

Where can I find the end product certificate?

The device vendor should provide the end product certificate number. If not, please use the search bar below:

Otherwise you can contact your Sigfox distributor service desk.  
If the device has not obtained an end product certificate yet, then you can register as a prototype.

☒ Register as a prototype (remaining prototypes which can be registered in your group: 1000)

Type  Available Tokens: 0

Lat (-90° to +90°)

Lng (-180° to +180°)

Map [Locate on map](#)

Subscription automatic renewal ☒

Activable ☒ ⓘ

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## 6.3 Measurement principle of Sigfox Sensor

When the sensor sampling time interval is reached, for example 2 minutes, the Sigfox node will wake up and switch ON

the power supply to supply the energy to external sensor to start the measurement. Depends on the type and characteristic of external sensor, the sensor will take a certain time to finish the measurement.

Once reading the value, it can be scaled to any engineering value by the following formula:

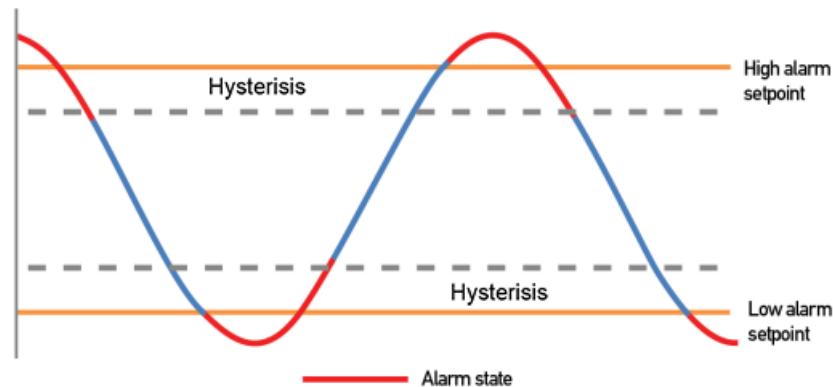
$$Y = aX + b$$

**Where:**

- X: the raw value from sensor
- Y: the calculated value will be sent to Sigfox base station in the payload data.
- a: constant (default value is 1)
- b: constant (default value is 0)

So, if there is no user setting for **a** and **b** ==> **Y = X**

The **Y** value will be compared with Lo and Hi threshold. Please refer below the graph of alarm processing.



[Here is the information about CAP10CNR](#)

## 6.4 Configuration Parameters

| Parameter                        | Description                                                                              | Possible values                                                                                                                                                                                                   | Default value                 |
|----------------------------------|------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|
| <b>HIGH_ALARM_SETPOINT</b>       | High alarm setpoint for calculated value                                                 | 32-bit float                                                                                                                                                                                                      | 1000000000                    |
| <b>LOW_ALARM_SETPOINT_FACTOR</b> | Low alarm setpoint for calculated value                                                  | 8-bit unsigned integer<br>LOW_ALARM_SETPOINT = HIGH_ALARM_SETPOINT * LOW_ALARM_SETPOINT_FACTOR / 200                                                                                                              | 0                             |
| <b>ALARM_ENABLE</b>              | Enable/Disable ALARM event                                                               | 0b0 = ALARM event is OFF<br>0b1 = ALARM event is ON                                                                                                                                                               | 0b0 = ALARM event is OFF      |
| <b>ALARM_PERIOD</b>              | Period of time to send ALARM event                                                       | 0b000 = every 10min<br>0b001 = every 30min<br>0b010 = every 1h<br>0b011 = every 2h<br>0b100 = every 3h<br>0b101 = every 6h<br>0b110 = every 12h<br>0b111 = every 24h                                              | 0b000 = every 10min           |
| <b>LED_BUZZER_ENABLE</b>         | Enable/Disable LEDs and Buzzers interactions for action not triggered by the reed switch | 0b0 = LEDs and Buzzers are OFF<br>0b1 = LEDs and Buzzers are ON                                                                                                                                                   | 0b1 = LEDs and Buzzers are ON |
| <b>HEARTBEAT_PERIOD</b>          | Period of time to send HEARTBEAT event                                                   | 0b000 = every 1h<br>0b001 = every 6h<br>0b010 = every 12h<br>0b011 = every 24h (1 day)<br>0b100 = every 48h (2 days)<br>0b101 = every 72h (3 days)<br>0b110 = every 120h (5 days)<br>0b111 = every 240h (10 days) | 0b011 = every 24h (1 day)     |

|                           |                                                                                               |                                                                                                                                                                                                                                                                                                                                                                |                      |
|---------------------------|-----------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| <b>MEASURE_PERIOD</b>     | Period of time to measure sensor                                                              | 0b0000 = every 1s<br>0b0001 = every 2s<br>0b0010 = every 5s<br>0b0011 = every 10s<br>0b0100 = every 20s<br>0b0101 = every 30s<br>0b0110 = every 1min<br>0b0111 = every 2min<br>0b1000 = every 5min<br>0b1001 = every 10min<br>0b1010 = every 20min<br>0b1011 = every 30min<br>0b1100 = every 1h<br>0b1101 = every 2h<br>0b1110 = every 3h<br>0b1111 = every 6h | 0b1100 = every 1h    |
| <b>TX_REPEAT</b>          | Sigfox TX repeat                                                                              | 0b0 = Send RF 1 time<br>0b1 = Send RF 3 time                                                                                                                                                                                                                                                                                                                   | 0b1 = Send RF 3 time |
| <b>CYCLIC_DATA_PERIOD</b> | Period of time to send CYCLIC_DATA event                                                      | 0b000 = every 10min<br>0b001 = every 30min<br>0b010 = every 1h<br>0b011 = every 2h<br>0b100 = every 3h<br>0b101 = every 6h<br>0b110 = every 12h<br>0b111 = every 24h                                                                                                                                                                                           | 0b010 = every 1h     |
| <b>DEVICE_RESET</b>       | Once this parameter is set, the device shall restart once after having received the Downlink. | 0b1010 = 0xA = force device reset<br>others = do nothing                                                                                                                                                                                                                                                                                                       | 0b0000 = do nothing  |
| <b>DOWNLINK_TYPE</b>      | Downlink type                                                                                 | 4-bit unsigned integer<br>See Sigfox Downlink tab                                                                                                                                                                                                                                                                                                              | 0b0000               |





## 6.5 Payload Fields

| Data name                     | Description                                                                | Encoding or Possible values                                                                                                                                        | Length (in bits) |
|-------------------------------|----------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| <b>EVENT_ID</b>               | Unique ID identifying the device event                                     | 4-bit unsigned integer<br>0 = START_UP<br>1 = HEARTBEAT<br>2 = PARAMETERS_UPDATE<br>3 = FORCE_DATA<br>4 = CYCLIC_DATA<br>5 = ALARM                                 | <b>4</b>         |
| <b>HW_VERSION</b>             | Indicate HW version                                                        | 4-bit unsigned integer<br>1..15                                                                                                                                    | <b>4</b>         |
| <b>FW_VERSION</b>             | Indicate FW version                                                        | 8-bit unsigned integer<br>1..255                                                                                                                                   | <b>8</b>         |
| <b>LATEST_SIGFOX_DOWNLINK</b> | Latest received and valid sigfox downlink frame<br>= Current configuration | 64-bit encoded field<br>See Sigfox Downlink tab                                                                                                                    | <b>64</b>        |
| <b>HW_ERROR</b>               | HW error                                                                   | 0b0 = no error<br>0b1 = error                                                                                                                                      | <b>1</b>         |
| <b>ALARM</b>                  | Alarm                                                                      | 0b00 = no alarm<br>0b01 = low alarm<br>0b10 = high alarm<br>0b11 = not used                                                                                        | <b>2</b>         |
| <b>BATTERY_LEVEL</b>          | Battery level                                                              | 2-bit unsigned integer<br>0..3                                                                                                                                     | <b>2</b>         |
| <b>RAW_VALUE</b>              | Raw value of CAP10-RS485                                                   | 16-bit unsigned integer                                                                                                                                            | <b>16</b>        |
| <b>SCALED_VALUE</b>           | Scaled value of CAP10-RS485                                                | 16-bit signed integer                                                                                                                                              | <b>16</b>        |
| <b>TENTATIVE</b>              | Tentative number                                                           | 8-bit unsigned integer<br>Formula: (8-bit Tentative + 1) = real_tentative #<br>Range: 1 to 256<br>Accuracy: 1<br>Example: 0b00000111 = 0x7=7=> 7+1 =>tentative # 8 | <b>8</b>         |

## 6.6 Sigfox Uplink Frame Format


| Size |                   |                            |            |            |                        |
|------|-------------------|----------------------------|------------|------------|------------------------|
|      | START_UP          | (led blink <i>WHITE</i> )  |            |            |                        |
|      | Payload           | EVENT_ID                   | HW_VERSION | FW_VERSION | LATEST_SIGFOX_DOWNLINK |
| 10.0 | bits              | 4                          | 4          | 8          | 64                     |
|      | Value             | 0b0000 = 0                 | yes        | yes        | yes                    |
|      |                   |                            |            |            |                        |
|      | HEARTBEAT         | (led blink <i>GREEN</i> )  |            |            |                        |
|      | Payload           | EVENT_ID                   | HW_VERSION | FW_VERSION | LATEST_SIGFOX_DOWNLINK |
| 10.0 | bits              | 4                          | 4          | 8          | 64                     |
|      | Value             | 0b0001 = 1                 | yes        | yes        | yes                    |
|      |                   |                            |            |            |                        |
|      | PARAMETERS_UPDATE | (led blink <i>PURPLE</i> ) |            |            |                        |
|      | Payload           | EVENT_ID                   | HW_VERSION | FW_VERSION | LATEST_SIGFOX_DOWNLINK |
| 10.0 | bits              | 4                          | 4          | 8          | 64                     |
|      | Value             | 0b0010 = 2                 | yes        | yes        | yes                    |

| Size |                        |                                           |                 |          |              |                          |          |                   |                      |                      |
|------|------------------------|-------------------------------------------|-----------------|----------|--------------|--------------------------|----------|-------------------|----------------------|----------------------|
|      | <b>FORCE_DATA</b><br>  | (led blink<br><b>SKY</b><br><b>BLUE</b> ) |                 |          |              |                          |          |                   |                      |                      |
|      | <b>Payload</b>         | <b>EVENT_ID</b>                           | <b>HW_ERROR</b> | reserved | <b>ALARM</b> | <b>BATTERY_LEVEL</b><br> | reserved | <b>RAW_VALUES</b> | <b>SCALED_VALUES</b> |                      |
| 6.0  | <b>bits</b>            | <b>4</b>                                  | <b>1</b>        | <b>3</b> | <b>2</b>     | <b>2</b>                 | <b>4</b> | <b>16</b>         | <b>16</b>            |                      |
|      | Value                  | 0b0011 = 3                                | yes             | zeros    | yes          | yes                      | zeros    | yes               | yes                  |                      |
|      |                        |                                           |                 |          |              |                          |          |                   |                      |                      |
|      | <b>CYCLIC_DATA</b><br> | (led blink<br><b>SKY</b><br><b>BLUE</b> ) |                 |          |              |                          |          |                   |                      |                      |
|      | <b>Payload</b>         | <b>EVENT_ID</b>                           | <b>HW_ERROR</b> | reserved | <b>ALARM</b> | <b>BATTERY_LEVEL</b><br> | reserved | <b>RAW_VALUES</b> | <b>SCALED_VALUES</b> | <b>TENTATIVE</b><br> |
| 7.0  | <b>bits</b>            | <b>4</b>                                  | <b>1</b>        | <b>3</b> | <b>2</b>     | <b>2</b>                 | <b>4</b> | <b>16</b>         | <b>16</b>            | <b>8</b>             |
|      | Value                  | 0b0100 = 4                                | yes             | zeros    | yes          | yes                      | zeros    | yes               | yes                  | yes                  |
|      |                        |                                           |                 |          |              |                          |          |                   |                      |                      |

|     |                |                            |                 |                 |              |                                                                                   |                 |                                                                                     |                                                                                     |                                                                                     |
|-----|----------------|----------------------------|-----------------|-----------------|--------------|-----------------------------------------------------------------------------------|-----------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|     | <b>ALARM</b>   | (led blink<br><b>RED</b> ) |                 |                 |              |                                                                                   |                 |                                                                                     |                                                                                     |                                                                                     |
|     | <b>Payload</b> | <b>EVENT_ID</b>            | <b>HW_ERROR</b> | <b>reserved</b> | <b>ALARM</b> | <b>BATTERY_L</b>                                                                  | <b>reserved</b> | <b>RAW_VALU</b>                                                                     | <b>SCALED_VA</b>                                                                    | <b>TENTATIVE</b>                                                                    |
|     |                |                            |                 |                 |              |  |                 |  |  |  |
| 7.0 | <b>bits</b>    | <b>4</b>                   | <b>1</b>        | <b>3</b>        | <b>2</b>     | <b>2</b>                                                                          | <b>4</b>        | <b>16</b>                                                                           | <b>16</b>                                                                           | <b>8</b>                                                                            |
|     | Value          | 0b0101 = 5                 | yes             | zeros           | yes          | yes                                                                               | zeros           | yes                                                                                 | yes                                                                                 | yes                                                                                 |


## 6.7 Sigfox Downlink Frame Format

### Sigfox Frame software for Sigfox Sensor








 The Sigfox node is only able to receive max 04 downlinks a day, each downlink will be waiting in every 06 hours.

User can set the down link data in Sigfox back-end system in advance, whenever the Sigfox node connected to base stations and with downlink waiting is enable at that time (one time in 6 hours), the downlink data will be loaded to Sigfox node.

The downlink data can be any configuration parameter.

 **Please pay attention when send downlink data.** If there was a mistake in sending wrong data, it would cause the Sigfox node not working properly and user need to configure it by **offline cable!!!**

### Downlink Frame Format:

|                          |                                                                                     |                                                                                     |                                                                                     |                                                                                      |                     |                                                                                       |
|--------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|---------------------|---------------------------------------------------------------------------------------|
| <b>Size</b>              |                                                                                     |                                                                                     |                                                                                     |                                                                                      |                     |                                                                                       |
| <b>DOWNLINK_TYPE = 0</b> |                                                                                     |                                                                                     |                                                                                     |                                                                                      |                     |                                                                                       |
|                          | <b>Payload</b>                                                                      | <b>HIGH_ALARM_SET</b>                                                               | <b>LOW_ALARM_SET</b>                                                                | <b>ALARM_ENABLE</b>                                                                  | <b>ALARM_PERIOD</b> | <b>LED_BUZZER_ENA</b>                                                                 |
|                          |                                                                                     |  |  |                                                                                      |                     |  |
| 8.0                      | <b>bits</b>                                                                         | <b>32</b>                                                                           | <b>8</b>                                                                            | <b>1</b>                                                                             | <b>3</b>            | <b>1</b>                                                                              |
|                          | Value                                                                               | yes                                                                                 | yes                                                                                 | yes                                                                                  | yes                 | yes                                                                                   |
|                          | <b>HEARTBEAT_PERIOD</b>                                                             | <b>MEASURE_PERIOD</b>                                                               | <b>TX_REPEAT</b>                                                                    | <b>CYCLIC_DATA_PERIOD</b>                                                            | <b>DEVICE_RESET</b> | <b>DOWNLINK_TYPE</b>                                                                  |
|                          |  |  |                                                                                     |  |                     |                                                                                       |
|                          | <b>3</b>                                                                            | <b>4</b>                                                                            | <b>1</b>                                                                            | <b>3</b>                                                                             | <b>4</b>            | <b>4</b>                                                                              |
|                          | yes                                                                                 | yes                                                                                 | yes                                                                                 | yes                                                                                  | yes                 | 0b0000 = 0                                                                            |
| <b>Size</b>              |                                                                                     |                                                                                     |                                                                                     |                                                                                      |                     |                                                                                       |
| <b>DOWNLINK_TYPE = 5</b> |                                                                                     |                                                                                     |                                                                                     |                                                                                      |                     |                                                                                       |
|                          | <b>Payload</b>                                                                      | <b>PRM_ADDRESS</b>                                                                  | <b>PRM_LENGTH</b>                                                                   | <b>PRM_VALUE</b>                                                                     | <b>reserved</b>     | <b>DOWNLINK_TYPE</b>                                                                  |
|                          |                                                                                     |                                                                                     |                                                                                     |                                                                                      |                     |  |
| 8.0                      | <b>bits</b>                                                                         | <b>8</b>                                                                            | <b>8</b>                                                                            | <b>16</b>                                                                            | <b>28</b>           | <b>4</b>                                                                              |
|                          | Value                                                                               | yes                                                                                 | 0x02 = 2                                                                            | yes                                                                                  | zeros               | 0b0101 = 5                                                                            |
|                          |                                                                                     |                                                                                     |                                                                                     |                                                                                      |                     |                                                                                       |

|     | Payload | PRM_ADDRESS | PRM_LENGTH | PRM_VALUE | reserved | DOWNLINK_TYPE |
|-----|---------|-------------|------------|-----------|----------|---------------|
| 8.0 | bits    | 8           | 8          | 32        | 12       | 4             |
|     | Value   | yes         | 0x04 = 4   | yes       | zeros    | 0b0101 = 5    |

## 7. Modbus Memmap

### 7.1 Data table

| Modbus Register (Decimal) | Modbus Register (Hex) | Function Code | # of Registers | Description | Range | Default | Format | Property | Comment              |
|---------------------------|-----------------------|---------------|----------------|-------------|-------|---------|--------|----------|----------------------|
| 2                         | 2                     | 3             | 4              | FW_VERSION  |       |         | string | Read     |                      |
| 6                         | 6                     | 3             | 2              | HW_VERSION  |       |         | string | Read     |                      |
| 8                         | 8                     | 3             | 2              | DEVICE_ID   |       |         | hex    | Read     | Product ID           |
| 10                        | A                     | 3             | 4              | DEVICE_PAC  |       |         | hex    | Read     | Product PAC          |
| 14                        | E                     | 3             | 1              | SENSOR_TYPE | 1-255 |         | uint16 | Read     | Sensor or Input Type |

### 7.2 Configuration table

| Modbus Register (Decimal) | Modbus Register (Hex) | Function Code (Read) | Function Code (Write) | # of Registers | Description | Range   | Default   | Format | Property   | Comment                                           |
|---------------------------|-----------------------|----------------------|-----------------------|----------------|-------------|---------|-----------|--------|------------|---------------------------------------------------|
| 270                       | 10E                   | 3                    | 16                    | 4              | CURRENT_C   |         |           | hex    | Read/Write |                                                   |
| 274                       | 112                   | 3                    | 16                    | 1              | SERVER_CO   |         |           | uint16 | Read/Write | 0: Send to Sigfox Network<br>1: Send to Dongle    |
| 276                       | 114                   | 3                    | 16                    | 1              | RADIO_CON   | 1, 2, 4 | 4         | uint16 | Read/Write | RC zones selection<br>1, 2, 4 is RCZ1, RCZ2, RCZ4 |
| 277                       | 115                   | 3                    | 16                    | 1              | TX_POWER    |         | 20        | int16  | Read/Write | RF Tx power                                       |
| 278                       | 116                   | 3                    | 16                    | 2              | CONSTANT_   |         | 0.06666   | float  | Read/Write | Constant a for scaling measured value             |
| 280                       | 118                   | 3                    | 16                    | 2              | CONSTANT_   |         | -1,113.33 | float  | Read/Write | Constant b for scaling measured value             |
| 282                       | 11A                   | 3                    | 16                    | 2              | HIGH_CUT    |         | 1E+09     | float  | Read/Write | High cut value for calculated value               |
| 284                       | 11C                   | 3                    | 16                    | 2              | LOW_CUT     |         | 0         | float  | Read/Write | Low cut value for calculated value                |



|     |     |   |    |   |           |      |     |        |            |                                                       |
|-----|-----|---|----|---|-----------|------|-----|--------|------------|-------------------------------------------------------|
| 286 | 11E | 3 | 16 | 2 | SENSOR_BO |      | 800 | uint32 | Read/Write | Boot time of sensor/input in ms                       |
| 306 | 132 | 3 | 16 | 1 | CAP10_BAU | 0-1  | 1   | uint16 | Read/Write | 0: 9600, 1:19200                                      |
| 307 | 133 | 3 | 16 | 1 | CAP10_NUM | 1-20 | 2   | uint16 | Read/Write | Number of cap10 sensor reading samples to get average |

## 8. Offline configuration

Using the configuration cable to connect to the sensor as below picture.



Serial port configuration on computer: **9600** baud, **None** parity, **1** stop bit.

**i** Reading data by **Function 3**.

Writing data by **Function 16**.

During connection with Modbus configuration tool, the Sigfox node will send all data in realtime: Battery, Battery level, Vref, Button status, reed switch status, PCB temperature, Measured value, alarm status.

**Step to configure & check data:**

### **NOTE:**



The Modbus configuration can be done in the first **60s** after power up the Sigfox node. After 60s, if user can not finish the configuration, user need to reset the power of Sigfox node again, by removing battery in at least 15s.

**Step 1:** Install the Modbus Configurator Software in the link below

<https://filerun.daviteq.com/wl/?id=yDOjE5d6kqFIGNVVIMdFg19Aad6aw0Hs>

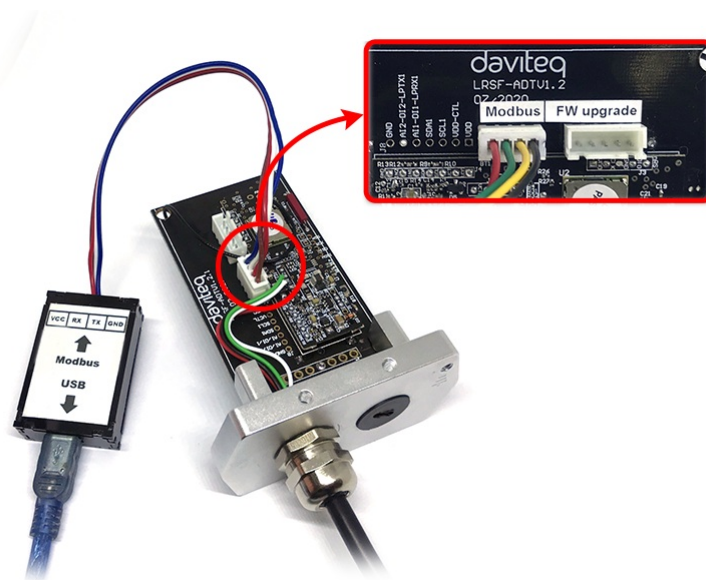
**i** **How to use the Modbus configuration software**

**Step 2:** Plug the configuration cable to Computer via **USB** port;



**Step 3:** Open the housing;

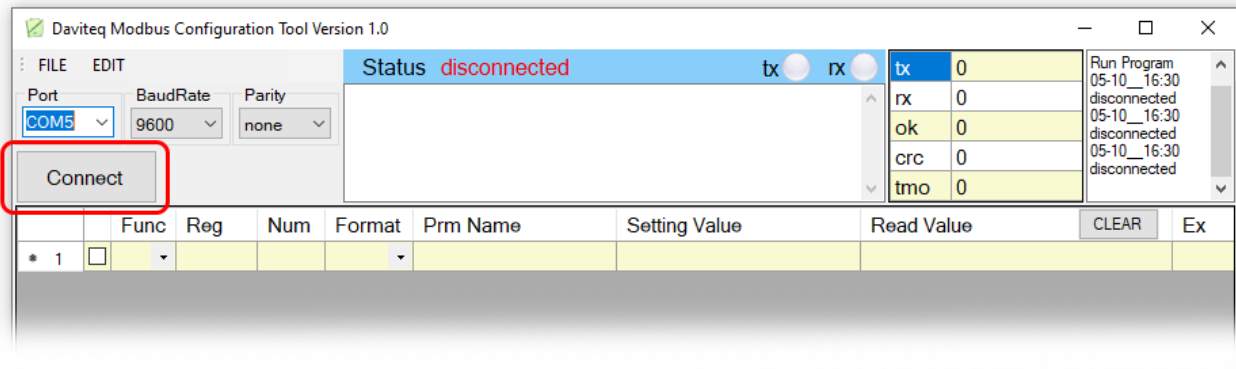
**Step 4:** Plug the connector to the configuration port;



**Step 5:** Import the configuration file by importing the csv file: Go to MENU:FILE / **Import New** / => select the file with name CONFIGURATION TEMPLATE FILE FOR SIGFOX CAP10 SENSOR FW1.0.csv (*in the link below*). Then click **Connect**;



**CONFIGURATION TEMPLATE FILE FOR WSSFC-CAP10**



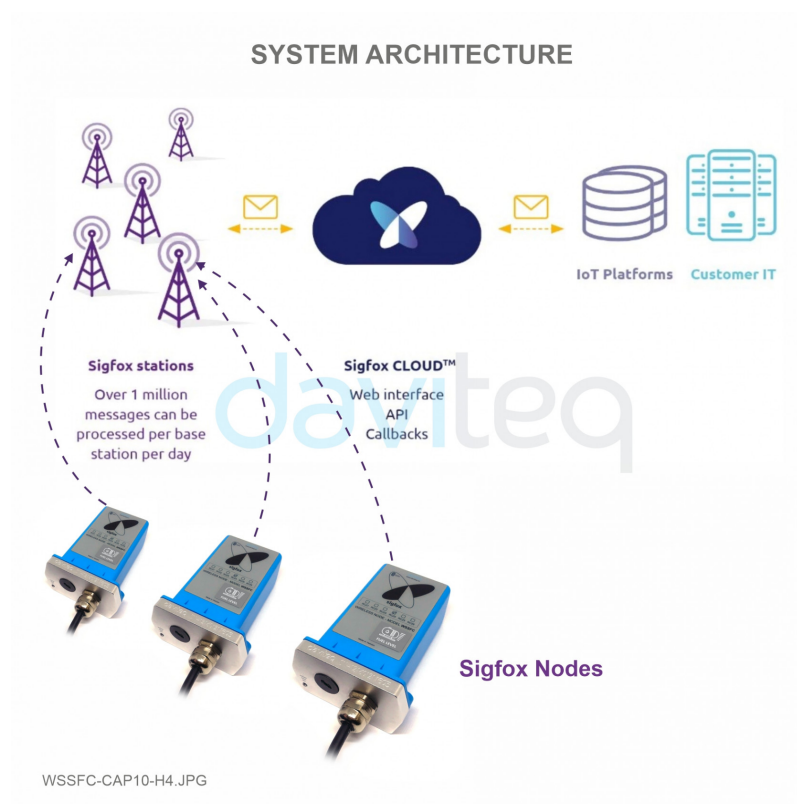
## 9. Installation

### 9.1 Locate the good place for Radio signal

To maximize the distance of transmission, the ideal condition is Line-of-sight (LOS) between the Sigfox sensor and Base station. In real life, there may be no LOS condition. However, the Sigfox sensor still communicate with Base station, but the distance will be reduced significantly.

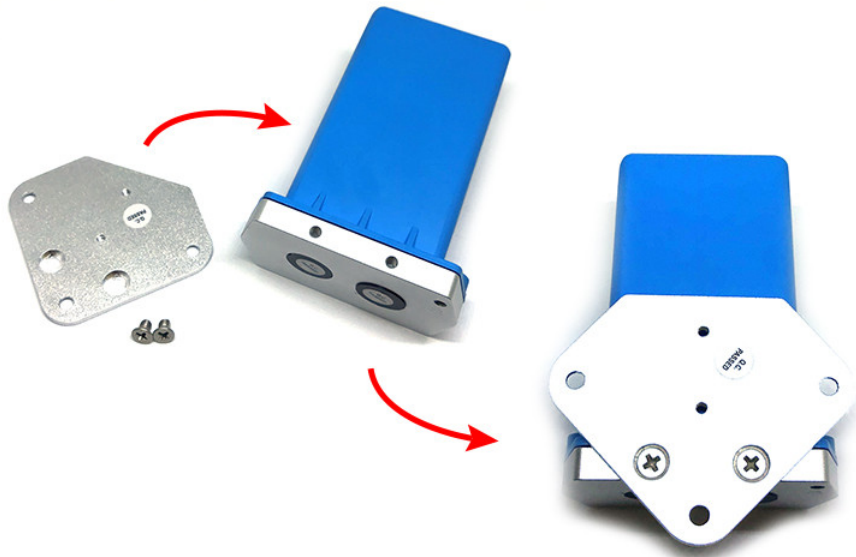
#### **ATTENTION:**

⚠ **DO NOT** install the Sigfox sensor or its antenna inside a completed **metallic** box or housing, because RF signal can not pass through metallic wall. The housing is made from Non-metallic materials like plastic, glass, wood, leather, concrete, cement...is acceptable.



### 9.2 Mounting

#### 9.2.1 Bracket installation



## 9.2.2 Site installation

**⚠ WARNING:** The sensor must be securely fixed near the measuring area.

Sigfox sensor connected to fuel sensor via M12 . connection cable

### **i** Default communication of CAP10CNR RS485:

Baudrate : **19200**  
Data bit : **8**  
**i** Stop bit : **1**  
Parity : **None**  
Modbus Slave address : **30**



**i** [Refer here for installation instructions for cap10](#)



## 9.3 Battery installation

### RECOMMENDED BATTERIES

#### E91 AA Alkaline battery



-18 .. + 60 oC working temperature  
10-year shelf life  
3000 mAH Capacity  
Price: 1X

#### L91 AA Lithium battery



-40 .. + 60 oC working temperature  
20-year shelf life  
3500 mAH Capacity  
Price: 3.5X

WSSFC-LPC-H5.PNG

*Steps for battery installation:*

**Step 1:** Open the cover by using flat head screwdriver

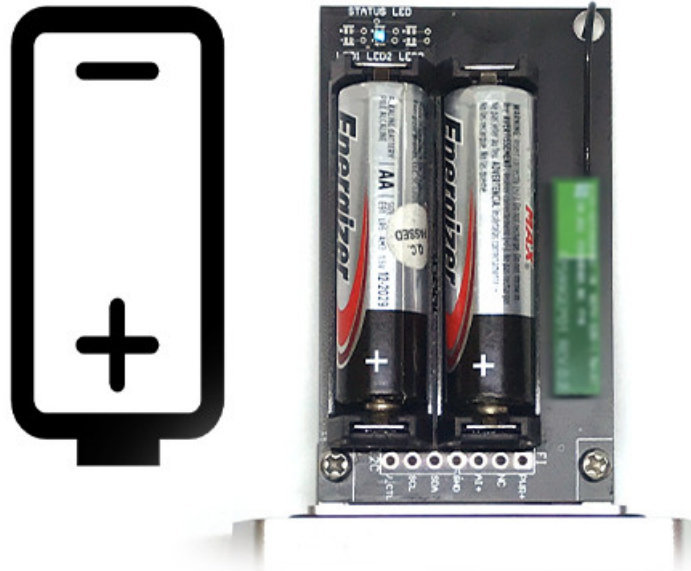


**Step 2:** Insert 02 x AA 1.5VDC battery, please take note the poles of the battery

**ATTENTION:**



**REVERSED POLARITY OF BATTERIES IN 10 SECONDS CAN DAMAGE THE SENSOR CIRCUIT!!!**



**Step 3:** Insert the top plastic housing and locking by L hex key



**ATTENTION:** When reinstalling the cover, pay attention to put the PCB edge into the middle slot of the box inside as shown below)





## 10. Troubleshooting

| No. | Phenomena                                                                                       | Reason                                                                                                                                              | Solutions                                                                                                                                                                                                                                  |
|-----|-------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1   | Node does not send RF to base station periodically, LED does not blink                          | <ul style="list-style-type: none"> <li>No power supply or battery ran out</li> <li>Configuration sending cycle is incorrect</li> </ul>              | <ul style="list-style-type: none"> <li>Check that the battery is empty or not installed correctly</li> <li>Check the power supply</li> <li>Check the send cycle configuration</li> </ul>                                                   |
| 2   | Node does not send RF to base station according to the alarm, LED does not blink                | <ul style="list-style-type: none"> <li>The alarm configuration is incorrect</li> <li>Running out of the number of alarms set for the day</li> </ul> | <ul style="list-style-type: none"> <li>Check alarm configuration</li> <li>Check the configuration for the maximum number of alarms per day</li> </ul>                                                                                      |
| 3   | Node does not send RF to base station when activated by the magnetic switch, LED does not blink | <ul style="list-style-type: none"> <li>Magnetic switch has malfunctioned</li> <li>Or place the Magnet key not right position</li> </ul>             | <ul style="list-style-type: none"> <li>Locate the correct position for magnet key</li> <li>Read the status of the magnetic switch via modbus (when powering or attaching the battery) to see if the magnetic switch is working.</li> </ul> |
| 4   | Node has blinked LED when sending RF but the base station cannot received                       | <ul style="list-style-type: none"> <li>Out of the number of RF packages of uplink per day (140 packages / day)</li> </ul>                           | <ul style="list-style-type: none"> <li>Check on the base station whether the event message exceeds the number of RF packets</li> </ul>                                                                                                     |
| 5   | Node has sent RF but the LED does not blink                                                     | <ul style="list-style-type: none"> <li>LED malfunction</li> </ul>                                                                                   | <ul style="list-style-type: none"> <li>Contact manufacturer</li> </ul>                                                                                                                                                                     |
| 6   | The measurement values from sensor do not change, keep constant values for long time            | <ul style="list-style-type: none"> <li>Sensor got failure</li> <li>Sensor cable broken</li> <li>Sensor connector is not connected firmly</li> </ul> | <ul style="list-style-type: none"> <li>Check sensor cable and connector</li> <li>If the issue is still exist, please contact manufacturer for warranty or replace new sensor</li> </ul>                                                    |

|   |                                                    |                                                                                                                                                                           |                                                                                                                                                                  |
|---|----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7 | The node does not send RF and the RF module is hot | <ul style="list-style-type: none"> <li>• Insert the battery in the wrong direction</li> <li>• Electronics got problem</li> </ul>                                          | <ul style="list-style-type: none"> <li>• Check battery polarity</li> </ul>                                                                                       |
| 8 | RSSI is weak and often loses data                  | <ul style="list-style-type: none"> <li>• Distance between Node and Base station is far or there are many obstructions</li> <li>• Connection to Antenna problem</li> </ul> | <ul style="list-style-type: none"> <li>• Check location of Sigfox node and distance to base station</li> <li>• Check the antenna connector in the PCB</li> </ul> |

## 11. Support contacts



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