

# USER GUIDE FOR EX D APPROVED SIGFOX READER FOR ELECTRONIC VOLUME CORRECTOR WSSFCEX-EVC

**THIS IS OBSOLETE MANUAL**

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

WSSFCEX-EVC -MN-EN-01	MAY-2021
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*This document is applied for the following products*

SKU	WSSFCEX-EVC	HW Ver.	1.2	FW Ver.	1.2
Item Code	WSSFCEX-EVC-9-MINI-MAX-Z1	SIGFOX MERCURY EVC MINI-MAX READER, ATEX EXD APPROVAL ZONE 1/2, M20 CABLE GLAND WITH 10M SHIELDED CABLE AND AMP CONNECTOR, IP67 CAST ALUMINUM HOUSING, TYPE AA BATTERY 1.5VDC, RC2-RC3-RC4-RC5 ZONES			
	WSSFCEX-EVC-8-MINI-MAX-Z1	SIGFOX MERCURY EVC MINI-MAX READER, ATEX EXD APPROVAL ZONE 1/2, M20 CABLE GLAND WITH 10M SHIELDED CABLE AND AMP CONNECTOR, IP67 CAST ALUMINUM HOUSING, TYPE AA BATTERY 1.5VDC, RC1-RC6-RC7 ZONES			

## 1. Functions Change Log

HW Ver.	FW Ver.	Release Date	Functions Change
1.2	1.2	SEP-2020	

## 2. Introduction

WSSFCEX-EVC is the Sigfox reader to read process data from Electronics Volume Corrector (EVC) with Exd approval for installation in Zone 1, Zone 2 or Safe Zone, and it can connect to any EVC with Modbus RTU communication or Mercury proprietary protocol. It will automatically read those parameters from EVC: corrected volume, un-corrected volume, gas pressure, gas temperature...With Ultra-low-power design and smart firmware allow the Sigfox device can last up to 10 years with single 2 x AA batteries (depends on configuration). It can supports all regions of Sigfox network in over the World, RC1, RC2, RC3, RC4, RC5, RC6, RC7. Typical applications are monitoring of Gas metering skids, Gas metering system for Natural Gas, LNG, CNG...

Ex d Approved **SIGFOX** Reader for Electronic Volume Corrector  
WSSFCEX-EVC



WSSFCEX-EVC-H1.PNG

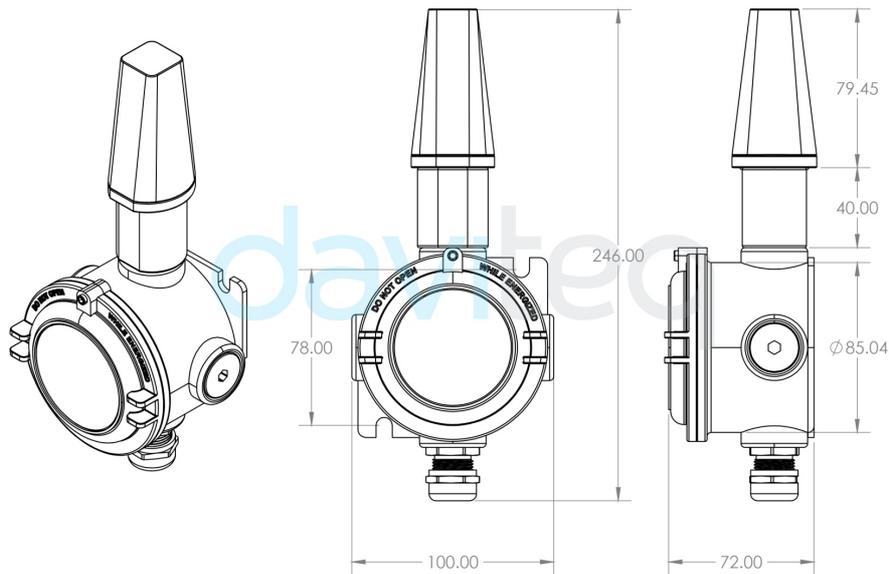


### 3. Specification

Type of EVC to connect	Connect to any Electronic Volume Corrector with Modbus RTU or Mercury protocol
Connector	Standard is AMP connector to work with Mercury Mini-Max EVC, for other EVC pls specify when ordering
Cable length	10m shielded cable
Sigfox zones	select RC2-RC3-RC4-RC5 or RC1-RC6-RC7
Antenna	N-male type external Antenna
Battery	02 x AA Type 1.5VDC, working time up to 10 years (depends on configuration)
ATEX Certificates	IMQ 14 ATEX 005 X and TÜV CY 18 ATEX 0206158 X
Marking	ATEX II 2G Ex db IIC T5/T6 Gb and ATEX II 2D Ex tb IIIC T100/T85°C Db
Directive	ATEX 2014/34/EU
Standards	IEC-EN60079-0 IEC-EN60079-1 IEC-EN60079-31
Applicable zones	Zone 1 - 21 (gas) and Zone 2 - 22 (dust)
Ambient working temperature	-40°C..+85°C
Housing	Cast aluminium, powder coated, IP66
Mounting	wall mounting holes
Product dimensions	H210xW100XD72
Net weight	1.5 kgs
Packaging dimension	W160 x D150 x H250 mm
Gross weight	< 1.6 kgs

### 4. Dimensions

## DIMENSION DRAWING OF SIGFOX DEVICE (Unit: mm)



WSSFCEX-EVC-H4.PNG

## 5. Operation Principle

- 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:

- 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;

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

### **NOTE:**



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

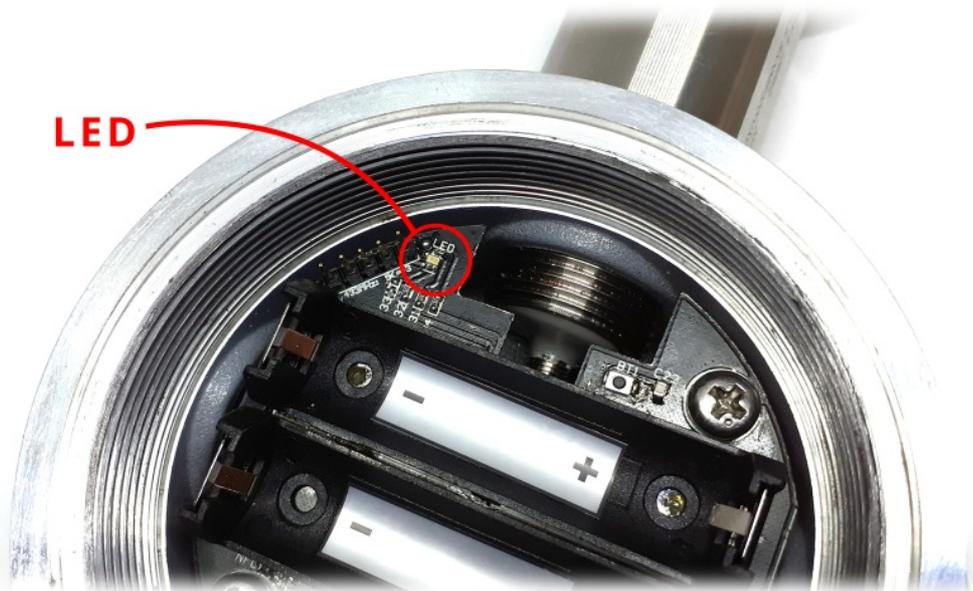
The shortest time interval between the two manual triggers is 15s. if shorter than 15s, there will be no data sending and you will not hear the beep sound.



## 5.1 LED meaning

Whenever the data is sent to base station, the LED will lit with color codes as below:

- RC1: RED colour
- RC2: GREEN colour
- RC4: BLUE colour



## 5.2 Button Function

### 5.2.1 Menu configuration

There are 3 configuration menus: **tx\_repeat**, **downlink\_flag**, **radio configuration**.

We use the button to enter the menus as follows:

### 5.2.1.1 tx\_repeat

Press and hold the button **2s** -> When the **Red LED** is on, it means entering the **tx\_repeat** configuration menu. Then release to configure it.

Press to configure. After pressing if the **Red LED** flashes **once**, **tx\_repeat = 0** (send 1 time). After pressing if the **Red LED** blinks **twice**, it is **tx\_repeat = 1** (send 3 times).

### 5.2.1.1 downlink\_flag

Press and hold the button **5s** -> When the **Green LED** is on, it means entering the **downlink\_flag** configuration menu. Then release to configure it.

Press to configure. After pressing if the **Green LED** flashes **once**, it is **downlink\_flag = 0** (downlink is not allowed). After pressing if the **Red LED** blinks **twice**, it is **downlink\_flag = 1** (downlink is allowed).

### 5.2.1.1 radio configuration

Press and hold the button **10s** -> **Blue LED** is on, it means entering the **Radio Configuration** menu. Then release to configure it.

Press to configure. After pressing if the **Blue LED** blinks **once**, it is **Radio Configuration = 1**. After pressing if the **Blue LED** flashes **twice**, it is **Radio Configuration = 2**. After pressing if the **Blue LED** flashes **4 times**, it is **Radio Configuration = 4**.

## 5.2.2 Exit the menu:

There are 3 ways to exit the menu:

- Press and hold for 3s, the LED turns off to exit the menu;
- Wait 30 seconds, then exit the menu;
- Take out the battery, it all starts over (outside the menu)).

## 5.3 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

## 5.4 Payload Data

The following is the format of payload data will be sent to Sigfox server.

### 5.4.1 Payload data 12 bytes sent hourly

Sensor type (1 byte)	Status + Interval Avg Pressure + Interval Avg Temperature (3 bytes)	Corrected Volume (4 bytes)	Uncorrected Volume (4 bytes)
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#### Meaning of Data in the Payload

Data	Size	Bit	Format	Meaning
Sensor type	1 byte	all	UInt8	Sensor type = 0x16 means Sigfox Node with EVC sensor type = 0xFF means no sensor.
Status: battery level	2 bits	Bit 23 and 22		Battery capacity in 04 levels <ul style="list-style-type: none"> <li>• 11: battery level 4 (99%)</li> <li>• 10: battery level 3 (60%)</li> <li>• 01: battery level 2 (30%)</li> <li>• 00: battery level 1 (10%)</li> </ul>
Status: error	2 bits	Bit 21 and 20		Node status <ul style="list-style-type: none"> <li>• 01: error</li> <li>• 00: no error</li> </ul>
Interval Avg Pressure (bar)	10 bits	Bit 19 to 10	UInt16	X Real Interval Avg Pressure value = X Interval Avg Pressure value / 10 (0.0 to 102.3bar)
Interval Avg Temperature (°C)	10 bits	Bit 9 to 0	UInt16	Y Real Interval Avg Temperature value = Y Interval Avg Temperature value / 10 (0.0 to 102.3°C)
Corrected Volume(m3)	4 bytes	all	UInt32	Corrected Volume
Uncorrected Volume(m3)	4 bytes	all	UInt32	Uncorrected Volume

#### FOR EXAMPLE

Raw data: 0x16819FF60156C78600238415

#### Explain:

- Sesor type : 0x16

- Status + Interval Avg Pressure + Interval Avg Temperature : **0x819FF6** = **0b100000011001111111110110**
  - Status battery level : **0b10** battery level 3 (60%)
  - Status error : **0b00** Node status no error
  - Interval Avg Pressure : **0b0001100111** = **103** => Interval Avg Pressure = 10.3 (bar)
  - Interval Avg Temperature : **0b1111110110** = **1014** => Interval Avg Temperature = 101.4 (°C)
- Corrected Volume : **0x0156C786** = **22464390**
- Uncorrected Volume : **0x00238415** = **02327573**

## 5.4.2 Payload battery packet sent daily 4 bytes

Sensor type (1 byte)	Status (1 byte)	Battery Voltage (2 bytes)
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### Meaning of Data in the Payload

Data	Size	Bit	Format	Meaning
Sensor type	1 byte	all	Uint8	Sensor type = 0x16 means Sigfox Node with EVC sensor type = 0xFF means no sensor.
Status: battery level	2 bits	Bit 7 and 6		Battery capacity in 04 levels 11: battery level 4 (99%) 10: battery level 3 (60%) 01: battery level 2 (30%) 00: battery level 1 (10%)
Status: error	2 bits	Bit 5 and 4		Node status 01: error 00: no error
Status : reserved	4 bits	Bit 3 to 0		0000
Battery Voltage (V)	2 bytes	all	Uint16	X Real Battery Voltage of EVC = X Real Battery Voltage of EVC / 100

### FOR EXAMPLE

Raw data: **0x16800252**

### Explain:

- Sesor type : **0x16**
- Status : **0x80** = **0b10000000**
  - Status battery level : **0b10** battery level 3 (60%)
  - Status error : **0b00** Node status no error
  - Status reserved : **0000**
- Battery Voltage : **0x0252** = 594 => Battery Voltage = 5.94 (V)

## 5.4.3 Payload for downlink

### Length is 8 bytes

Prm_adr (1 byte)	Prm_len (1 byte)	Prm_value (6 bytes)
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Prm_name	Prm_adr	Prm_len	Comment
cycle_send_data	18	4	

# 6. Configuration

### **DANGER:**

**DO NOT OPEN THE COVER AT HAZARDOUS LOCATION!**

**ONLY OPEN COVER FOR TROUBLE SHOOTING AND CONFIGURATION IN SAFE AREA!**

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=qK0PGNbY1g1fuxTqbFW9SXtEvCw7bpc6>

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

**Step 2:** Plug the configuration cable to computer via **USB** port and install the driver;



**Step 3:** Open the housing;



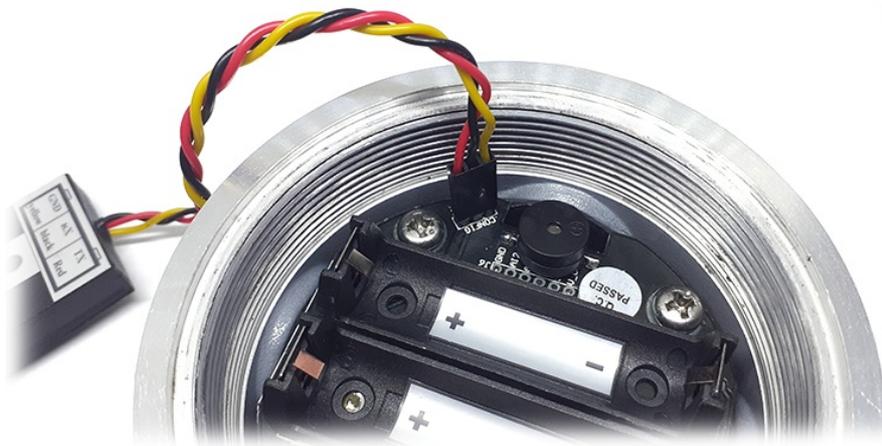
**Step 4:** Plug the connector to the configuration port;

<b>Red</b>	<b>Tx</b>
<b>Black</b>	<b>Rx</b>
<b>Yellow</b>	<b>GND</b>

**i** **Tx** on cable will go with **Rx** on sensor and vice versa.



**Configuration port**

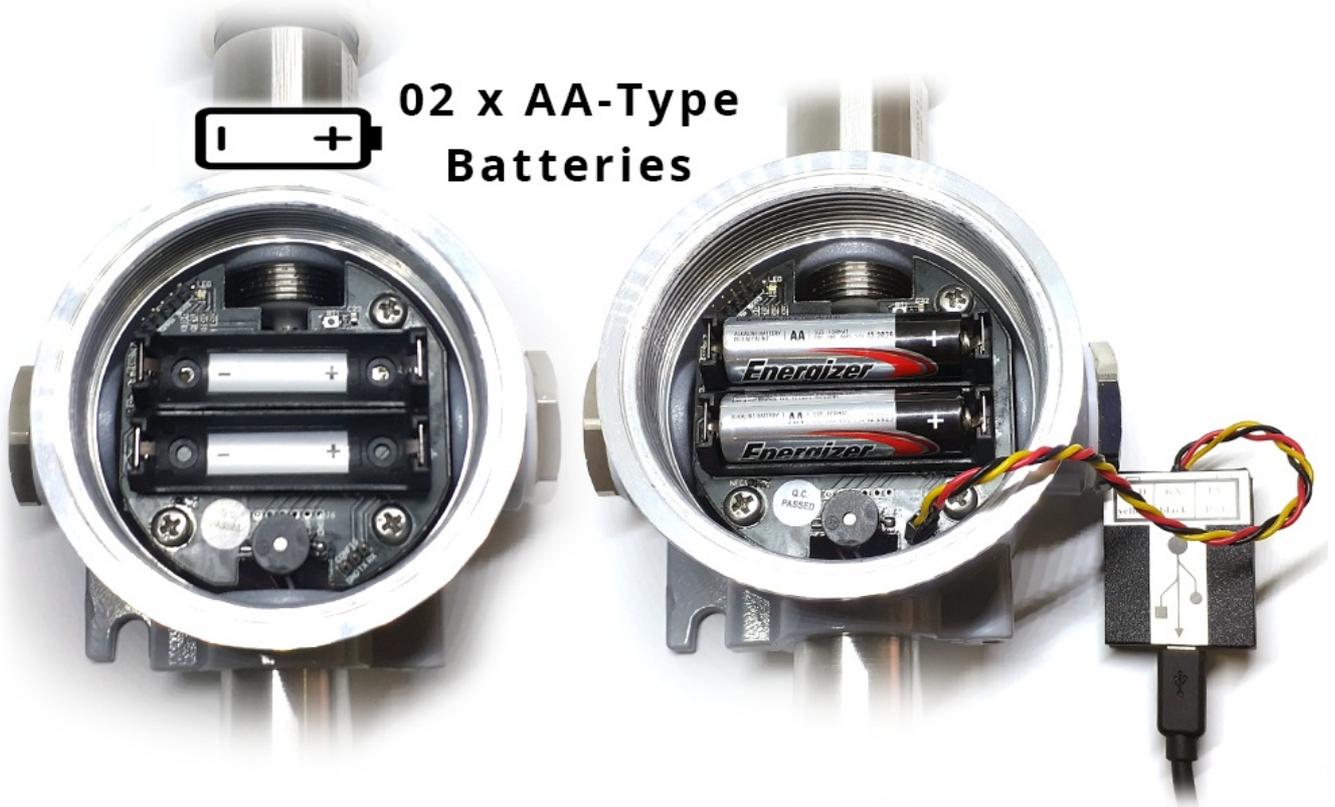


**Step 5:** Insert the battery;

**ATTENTION:**

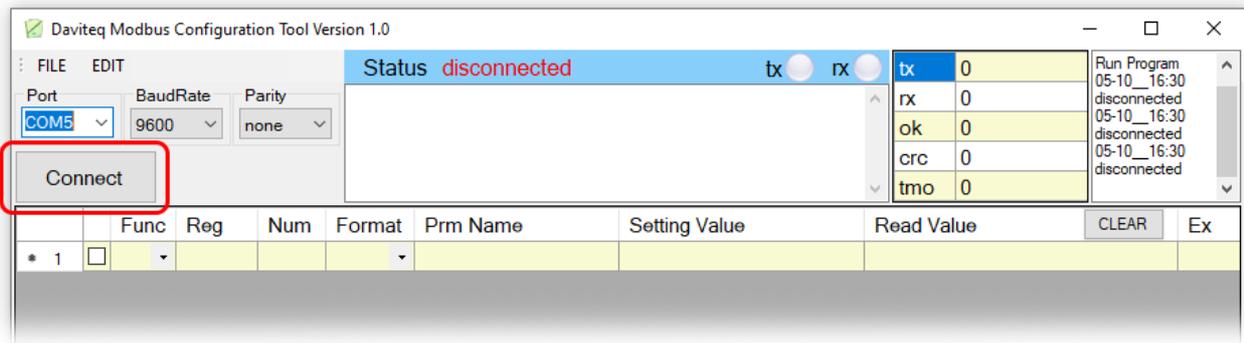


**REVERSED POLARITY OF BATTERIES IN 10 SECONDS CAN DAMAGE THE SENSOR CIRCUIT!!!**



**Step 6:** 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 FW1.9.3.csv (in the link below). Then click **Connect**;

**CONFIGURATION TEMPLATE FILE FOR SIGFOX WSSFCEX-EVC.csv**



**Here is the table of Data will be read by Modbus tool**

Modbus Register (Decimal)	Modbus Register (Hex)	Function Code	# of Registers	Description	Range	Default	Format	Property	Comment
0	0	3	2	device info			string	Read	Product name
2	2	3	4	firmware version		1.0	string	Read	
6	6	3	2	hardware version		1.0	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	sen_type	1-255		uint16	Read	Sensor or Input Type
15	F	3	1	batt level	0-3		uint16	Read	Battery level
16	10	3	1	err_status	0-1		uint16	Read	Sensor error code
17	11	3	1	prm1 alm_status	0-2		uint16	Read	Alarm status of 1st parameter
18	12	3	1	prm2 alm_status	0-2		uint16	Read	Alarm status of 1st parameter
19	13	3	2	prm1 value			float	Read	1st calculated value
21	15	3	2	prm2 value			float	Read	2nd calculated value
23	17	3	1	batt %	10%, 30%, 60%, 99%		uint16	Read	Battery %
24	18	3	2	batt volt	0-3.67 vdc		float	Read	Battery Voltage
26	1A	3	2	temp	oC		float	Read	RF module temperature
28	1C	3	1	vref	0-3.67 vdc		uint16	Read	Vref of RF Module
29	1D	3	1	btn1 status	0-1		uint16	Read	Button status, 0: released, 1: pressed
30	1E	3	1	btn2 status	0-1		uint16	Read	Reedswitch status, 0: opened, 1: closed

**Here is the table for Configuration:**

Modbus Register (Decimal)	Modbus Register (Hex)	Function Code (Read)	Function Code (Write)	# of Registers	Description	Range	Default	Format	Property	Comment
256	100	3	16	1	modbus address	1-247	1	uint16	Read/Write	Modbus address of device
257	101	3	16	1	modbus baudrate	0-1	0	uint16	Read/Write	Baudrate: 0: 9600, 1: 19200
258	102	3	16	1	modbus parity	0-2	0	uint16	Read/Write	Parity: 0: none, 1: odd, 2: even
259	103	3	16	9	serial number			string	Read/Write (PW)	Product S/N
268	10C	3	16	2	password for setting			uint32	Read/Write	Password for setting

270	10E	3	16	1	Radio Configuratio	1-6	4	uint16	Read/Write	RC zones selection 1..6 is RCZ1 .. RCZ6
271	10F	3	16	1	tx_power		20	int16	Read/Write	RF Tx power
272	110	3	16	1	tx_repeat	0-1	1	uint16	Read/Write	Number of repeat, 0: 1 time, 1: 3 repeats
273	111	3	16	1	downlink_flg	0-1	0	uint16	Read/Write	1: enable Downlink, 0: disable Downlink (Fw v1.0 hasn't got Downlink function)
274	112	3	16	2	cycle_send_		3600	uint32	Read/Write	Data sending cycle, in seconds

Modbus Master 1.1 by quoctuan.dinh79@gmail.com

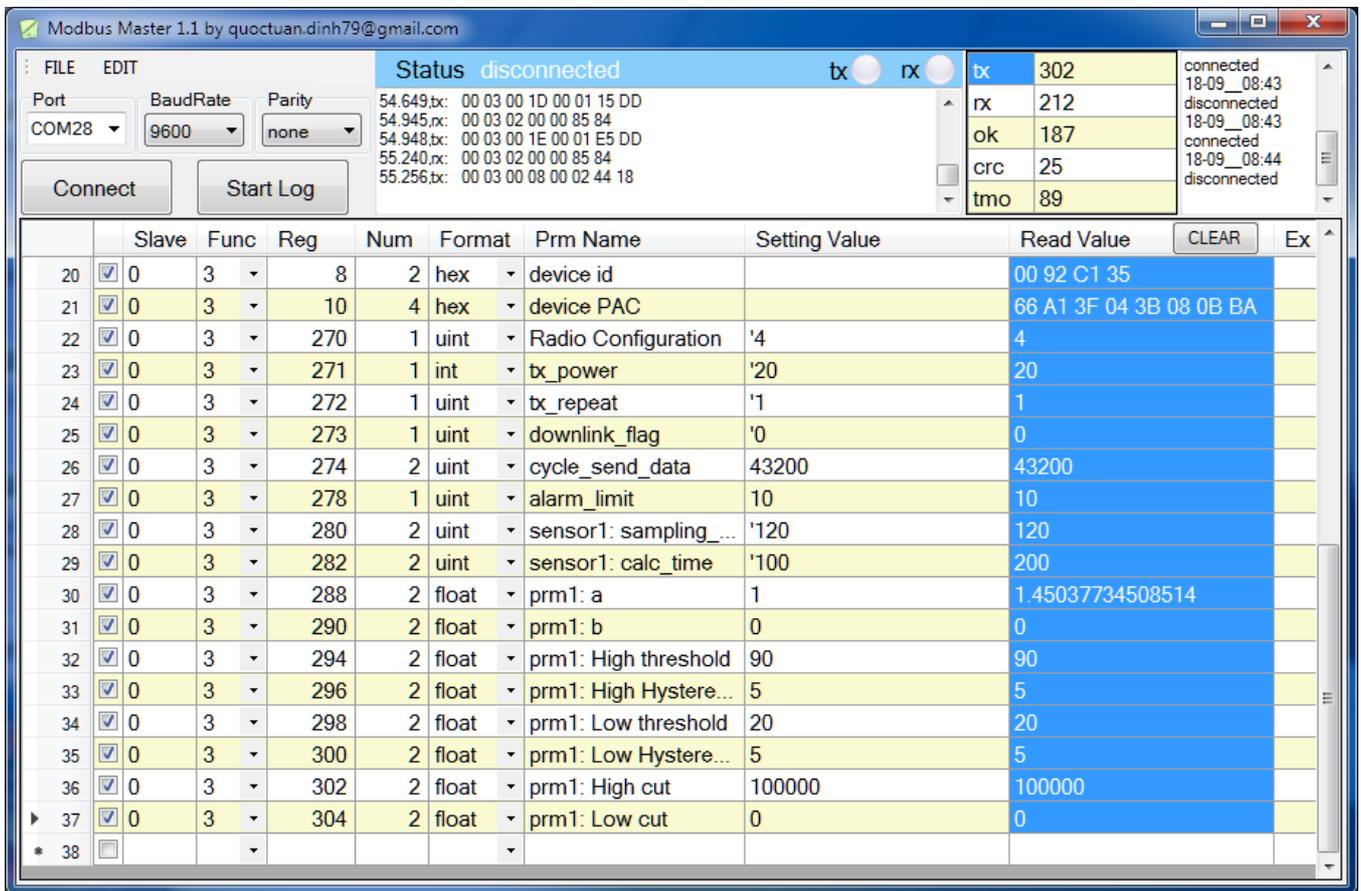
Port: COM28, BaudRate: 9600, Parity: none

Status: disconnected

54.649,tx: 00 03 00 1D 00 01 15 DD  
54.945,rx: 00 03 02 00 00 85 84  
54.948,tx: 00 03 00 1E 00 01 E5 DD  
55.240,rx: 00 03 02 00 00 85 84  
55.256,tx: 00 03 00 08 00 02 44 18

tx	302
rx	212
ok	187
crc	25
tmo	89

	Slave	Func	Reg	Num	Format	Prm Name	Setting Value	Read Value	CLEAR	Ex
1	0	3	0	2	string	device info	'SF01	SF02		
2	0	3	2	4	string	firmware version	'1.0	1.2.0917		
3	0	3	6	2	string	hardware version	'1.0	1.2		
4	0	3	8	2	hex	device id		00 92 C1 35		
5	0	3	10	4	hex	device PAC		66 A1 3F 04 3B 08 0B BA		
6	0	3	14	1	uint	sen_type	'1	4		
7	0	3	15	1	uint	batt level	'0..3	3		
8	0	3	16	1	uint	err_status	'0	0		
9	0	3	17	1	uint	prm1 alm_status	'0..2	1		
10	0	3	18	1	uint	prm2 alm_status	'0..2	0		
11	0	3	19	2	float	prm1 value		0		
12	0	3	21	2	float	prm2 value	'0..4095	26.2060012817383		
13	0	3	23	1	uint	batt %	10;30;60;99	99		
14	0	3	24	2	float	batt volt	'1..3.6v	3.06773567199707		
15	0	3	26	2	float	temp	'20..45	27.7000007629395		
16	0	3	28	1	uint	vref	'3..3.3v	3292		
17	0	3	29	1	uint	btn1 status	'0..1	0		
18	0	3	30	1	uint	btn2 status	'0..1	0		
19	0					**** CONFIG ****				



## 7. Installation

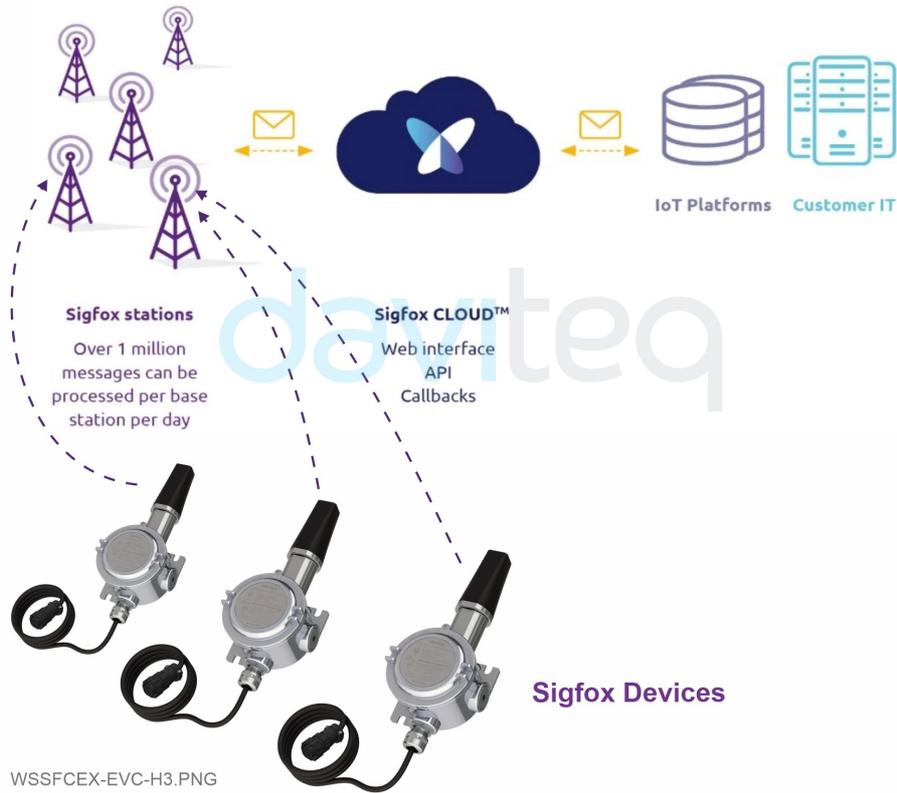
### 7.1 Locate the good place for Radio signal

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.

## SYSTEM ARCHITECTURE



### **WARNINGS:**



Prepare the professional tools for installation. The inappropriate tools may cause damage to the sensor.

### **DANGER:**

1. The installer need to be equipped with full Safety gears during installation, such as safety glasses, safety shoes, safety cloths, safety mask...Please follow the safety instructions of the installation site;
2. The installer must be qualified for this installation job;
3. The installer must be permitted by Site's owner for performing the installation;
4. The working conditions in hazardous areas (toxic gases, explosive atmosphere, high pressure, high temperature...) must be highly attention and follow the site's owner instruction strictly.

**DO NOT OPEN THE COVER OR REPLACE/INSERT BATTERIES IN THE HAZADOUS AREAS**

## 7.2 Battery installation

*Steps for battery installation:*

### **DANGER:**

**DO NOT REPLACE BATTERY AT HAZARDOUS LOCATION!**

**DO NOT OPEN THE COVER AT HAZARDOUS LOCATION!**

**ONLY OPEN COVER AND REPLACE BATTERY IN SAFE AREA!**

**Step 1:** Turn the front cover of the sensor counter-clockwise;



**Step 2:** Carefully take out the front cover of the sensor



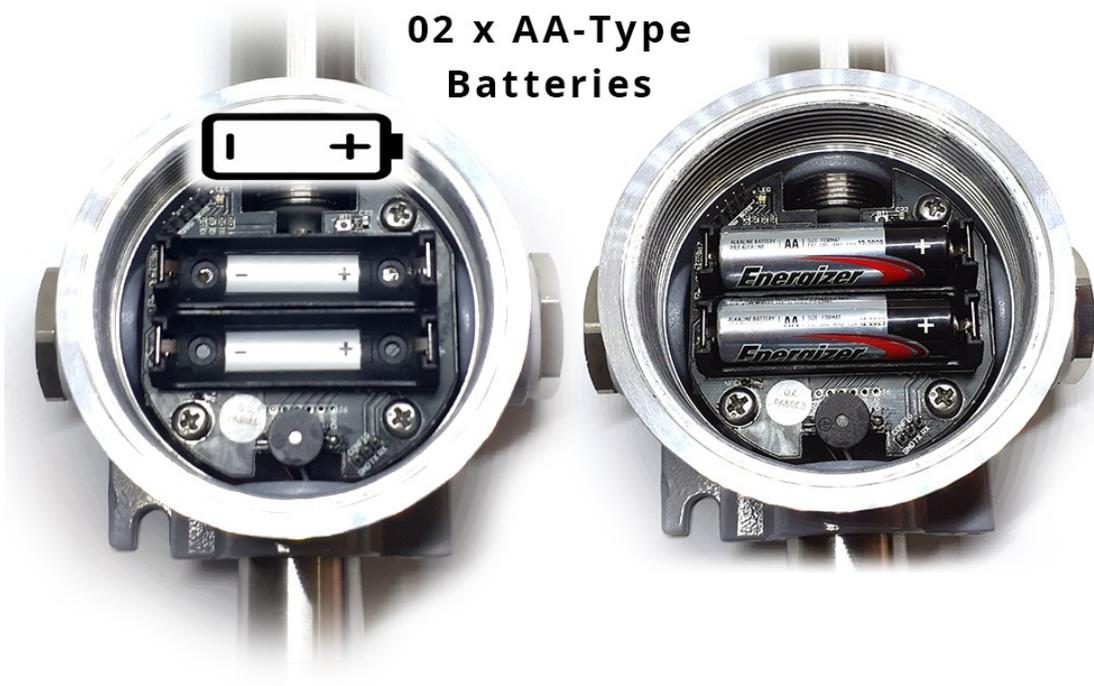
**Step 3:** Insert the type AA battery, please take note the polarity of battery

**ATTENTION:**



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

## 02 x AA-Type Batteries



**Step 4:** Turn the front cover of the sensor clockwise to close fully.

### **NOTES:**



Using 2mm hex key to lock the cover to prevent the unattended opening.

## 7.3 Sigfox node connection

**i** WSSFCEX-EVC can connect to any electronic volume corrector via **Mercury protocol**.

## CONNECT TO ANY ELECTRONIC VOLUME CORRECTOR



Modbus RTU / Mercury protocol

WSSFC-EX-EVC-H2.PNG

### **i** Configuration information for EVC

**RS232 Connection:** auto-baurate or 9600

**Instrument access code:** 33333

**Temperature Unit:** °C

**Model requirements:** Honeywell / Mercury Mini - Max

## 8. 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</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> </ul>	<ul style="list-style-type: none"> <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 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> <li>LED welding is not good</li> </ul>	<ul style="list-style-type: none"> <li>Check LED condition and LED weld</li> </ul>
6	The value of the sensor is 0	<ul style="list-style-type: none"> <li>No pressure</li> <li>Lost connection with the sensor</li> </ul>	<ul style="list-style-type: none"> <li>Check pipe pressure</li> <li>Check sensor connection</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 opposite direction</li> <li>Short circuit</li> </ul>	Warranty or replacement
8	RSSI is weak and often loses data	<ul style="list-style-type: none"> <li>Distance between Node and Gateway is far or there are many obstructions</li> <li>Connection to Antenna problem</li> </ul>	<ul style="list-style-type: none"> <li>Check Antenna position</li> <li>Install Node in a well ventilated location</li> </ul>

## 9. Support contacts

Manufacturer



**Daviteq Technologies Inc**

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Email: info@daviteq.com | www.daviteq.com

Distributor in **Australia** and **New Zealand**



**Templogger Pty Ltd**

Tel: 1800 LOGGER

Email: contact@templogger.net

🔄 Revision #13

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