



# Vape Detector

## GS601

### User Guide

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# Chapter 1. Introduction

## Copyright Statement

This guide may not be reproduced in any form or by any means to create any derivative such as translation, transformation, or adaptation without the prior written permission of Xiamen Milesight IoT Co., Ltd (Hereinafter referred to as Milesight).

**Milesight** reserves the right to change this guide and the specifications without prior notice. The latest specifications and user documentation for all Milesight products are available on our official website <http://www.milesight.com>

## Safety Instruction

These instructions are intended to ensure that user can use the product correctly to avoid danger or property loss. Milesight will not shoulder responsibility for any loss or damage resulting from not following the instructions of this operating guide.



### **CAUTION:**

Injury or equipment damage may be caused if any of these cautions are neglected.

- The device must not be disassembled or remodeled in any way.
- To ensure the security of your device, please change the device password during the initial configuration. The default password is 123456.
- The device is not intended to be used as a reference sensor, and Milesight will not hold responsibility for any damage which may result from inaccurate readings.
- Do not place the device in places where the temperature is below/above the operating range.
- Do not place the device near naked flames, heat source (such as oven), or expose it to direct sunlight, cold source, liquid, and with extreme temperature changes.
- The device must never be subjected to shocks or impacts.

## Services

Milesight provides customers with timely and comprehensive technical support services. End-users can contact your local dealer to obtain technical support. Distributors and resellers can contact directly with Milesight for technical support.

Technical Support Mailbox: [iot.support@milesight.com](mailto:iot.support@milesight.com)

Online Support Portal: <https://support.milesight-iot.com>

Resource Download Center: <https://www.milesight.com/iot/resources/download-center/>

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Add: Building C09, Software Park Phase III, Xiamen 361024, Fujian, China

## Revision History

| Release Date  | Version | Description     |
|---------------|---------|-----------------|
| Sept.30, 2024 | V 1.0   | Initial version |

## Chapter 2. Product Introduction

### Overview

GS601 is a LoRaWAN<sup>®</sup> vape detector designed to identify vaping and smoking events and send alerts. Equipped with a suite of powerful embedded sensors, GS601 simultaneously measures temperature, humidity, TVOC, and PM parameters.

When environmental changes reach the preset thresholds, the detector activates both the LED light alarm and buzzer sound alarm.

In addition to local alerts, GS601 can also remotely report the air quality status and alarm messages via LoRaWAN<sup>®</sup> technology. By integrating with Milesight LoRaWAN<sup>®</sup> gateway and Milesight Development Platform, users can visually monitor all sensor data and manage the device remotely.

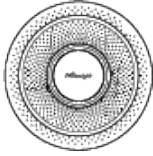
GS601 seamlessly blends into various installation environments, making it ideal in restrooms, changing rooms, classrooms, stairwells, apartments and other locations.

### Features

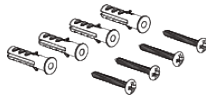
- Integrated with multiple sensors to detect vape, smoke, TVOC, temperature, humidity, and PM parameters
- Supports anti-water vapor disturbance and other gas interference, with interference information reported
- Equipped with a buzzer and indicator to signal when the device is powered, faulty, alarmed, or in an invalid status
- Supports setting the buzzer hibernate time to avoid false alarms during deployment
- Equipped with a vibration sensor to detect acts of vandalism or tampering
- Built-in NFC for easy configuration
- Compatible with standard LoRaWAN<sup>®</sup> gateways and network servers
- Compliant with Milesight Development Platform
- Support Firmware Update Over the Air (FUOTA) feature

## Chapter 3. Hardware Introduction

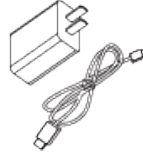
### Packing List



1 × GS601 Sensor



4 × Ceiling  
Mounting Kits



1 × Type-C Cable  
& Power Adapter



1 × PoE Split-  
ter (Optional)



1 × Quick Guide



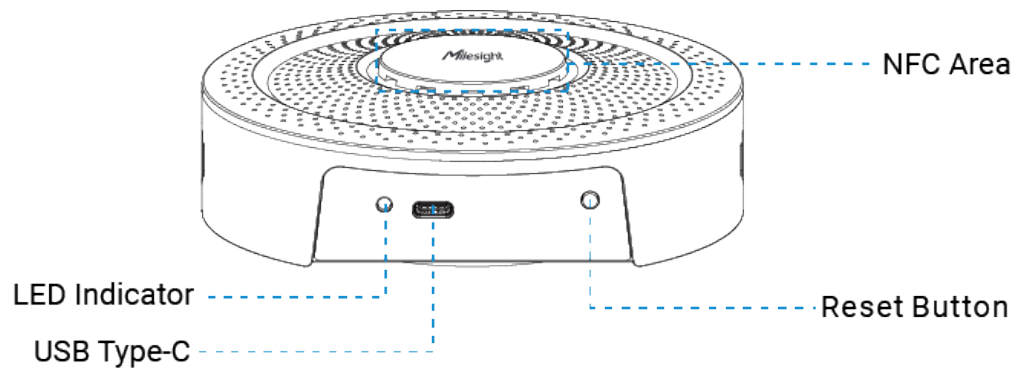
1 × Warranty Card



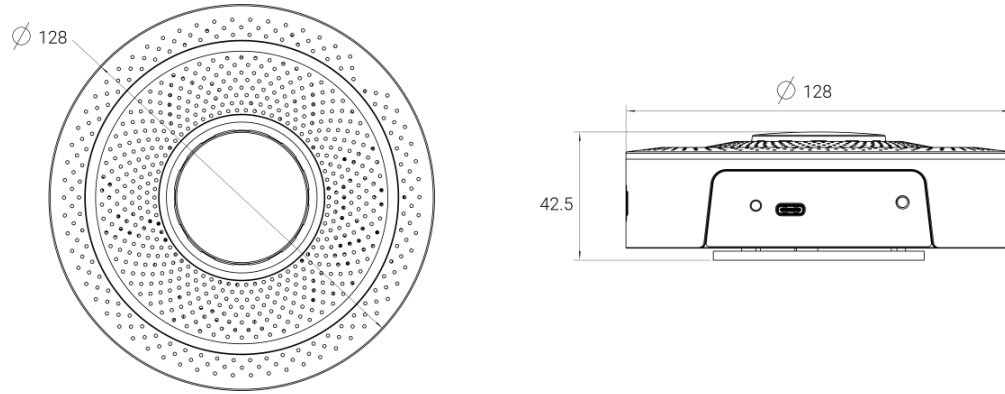
#### Note:

If any of the above items is missing or damaged, please contact your sales representative.

### Hardware Overview



### Dimensions(mm)



### Button and LED Indicator

| Function                 | Action                                                    | LED Indicator         |
|--------------------------|-----------------------------------------------------------|-----------------------|
| Power ON/OFF             | Connect to the power supply                               | Green Light Static On |
|                          | Disconnect power                                          | Light Off             |
| Reboot                   | Press and hold reset button for more than 3s              | Blinks Slowly         |
| Reset to Factory Default | Press and hold the power button for more than 10 seconds. | Blinks Quickly        |
| Alarm                    | When one of the measured values exceeds the threshold     | Red Light Static On   |
|                          | When someone tampers the device                           |                       |

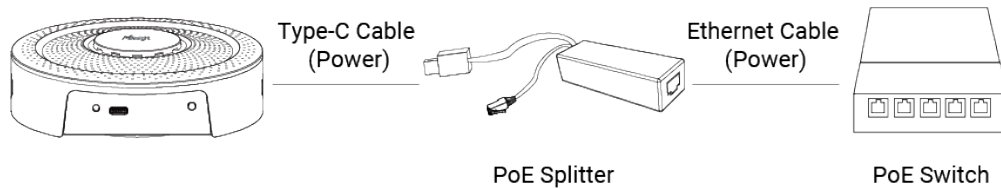
## Chapter 4. Power Supply

The device can be powered by USB (5V/1A). Choose one of the following methods to power up the device.

### Powered by a Power Adapter



### Powered by a PoE Splitter



## Chapter 5. Quick Start

This chapter describe the steps to quickly configure this device. If you requires more advanced settings, please refer to operation guide chapter.

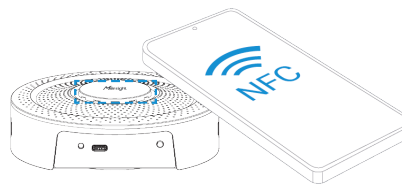
### Access the Sensor via NFC

1. Download and install "Milesight ToolBox" App from Google Play or Apple Store on an NFC-supported smartphone.
2. Enable NFC function on the smartphone.
3. Launch Milesight ToolBox, and select the default mode as NFC.
4. Attach the smart phone with NFC area to the device and click  to read device information. Basic information, data, and settings of the device will be shown on the Milesight ToolBox App if it's recognized successfully.
5. Adjust the settings on the App, then attach the smartphone with NFC area to the device and click **Write** to write the settings. After writing, reread the device to check if the configuration is written well.



#### Note:

- Ensure the location of smartphone NFC area and it's recommended to take off phone case.
- If the smart phone fails to read/write configurations via NFC, keep the phone away and back to try again.
- The default device password is 123456. Please change a new password for security.



### Configure the Network Setting

1. Go to **Network** settings page, select the join type as OTAA or ABP as required.

**Note:**

OTAA mode is required if you connect device to Milesight IoT Cloud or Milesight Development Platform.

2. Select supported frequency the same as LoRaWAN<sup>®</sup> gateway.

**Note:**

Set the channel index as 8-15 for US915 or AU915 if using default settings of Milesight gateways.

Device

Network

LoRaWAN

\* Support Frequency

US915

Enable Channel Index ⓘ

8-15

| Index   | Frequency/MHz ⓘ |
|---------|-----------------|
| 0 - 15  | 902.3 - 905.3   |
| 16 - 31 | 905.5 - 908.5   |
| 32 - 47 | 908.7 - 911.7   |
| 48 - 63 | 911.9 - 914.9   |
| 64 - 71 | 903 - 914.2     |

3. Keep other settings by default and click **Write** to save the settings.

## Chapter 6. Operation Guide

### LoRaWAN<sup>®</sup> Settings

This chapter describes the LoRaWAN<sup>®</sup> network settings of device.

| Parameter                    | Description                                                                                                                                                                                                                                                                                                  |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Device EUI                   | <p>Unique ID of the device which can be found on the device.</p> <div>  <b>Note:</b><br/>           please contact sales for device EUI list if you have many units.         </div>                                         |
| App EUI                      | The default App EUI (join EUI) is 24E124C0002A0001.                                                                                                                                                                                                                                                          |
| Application Port             | The port used for sending and receiving data, the default port is 85.                                                                                                                                                                                                                                        |
| LoRaWAN <sup>®</sup> Version | V1.0.2 and V1.0.3 are available.                                                                                                                                                                                                                                                                             |
| Work Mode                    | It is fixed as Class C.                                                                                                                                                                                                                                                                                      |
| Confirmed Mode               | If the device does not receive ACK packet from network server, it will re-send data once.                                                                                                                                                                                                                    |
| Join Type                    | <p>OTAA and ABP mode are available.</p> <div>  <b>Note:</b><br/>           it's necessary to select OTAA mode if connecting device to Mile-sight IoT Cloud or Milesight Development Platform.         </div>              |
| Application Key              | <p>Appkey for OTAA mode, the default is 5572404C696E6B4C6F52613230313823.</p> <div>  <b>Note:</b><br/>           please contact sales if you require random App Keys for bulks of devices before purchase.         </div> |
| Network Session Key          | Nwkskey for ABP mode, the default is 5572404C696E6B4C6F52613230313823.                                                                                                                                                                                                                                       |
| Application Session Key      | Appskey for ABP mode, the default is 5572404C696E6B4C6F52613230313823.                                                                                                                                                                                                                                       |

| Parameter           | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Device Address      | DevAddr for ABP mode, default is the 5 <sup>th</sup> to 12 <sup>th</sup> digits of SN.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Rejoin Mode         | <p>Reporting interval ≤ 35 mins: the device will send a specific number of Link-CheckReq MAC packets to the network server every reporting interval or every double reporting interval to validate connectivity; If there is no response, the device will re-join the network.</p> <p>Reporting interval &gt; 35 mins: the device will send a specific number of LinkCheckReq MAC packets to the network server every reporting interval to validate connectivity; If there is no response, the device will re-join the network.</p> <div>  <b>Note:</b> <ol style="list-style-type: none"> <li>1. Only OTAA mode supports rejoin mode.</li> <li>2. The actual sending number is <b>Set the number of packets sent + 1</b>.</li> </ol> </div> |
| Supported Frequency | <p>Enable or disable the frequency to send uplinks. If frequency is one of CN470/AU915/US915, enter the index of the channel to enable in the input box, making them separated by commas.</p> <p><b>Examples:</b></p> <p>1, 40: Enabling Channel 1 and Channel 40</p> <p>1-40: Enabling Channel 1 to Channel 40</p> <p>1-40, 60: Enabling Channel 1 to Channel 40 and Channel 60</p> <p>All: Enabling all channels</p> <p>Null: Indicate that all channels are disabled</p>                                                                                                                                                                                                                                                                                                                                                    |
| ADR Mode            | Enable or disable network server to adjust Spreading Factor, Bandwidth and Tx Power to optimize data rates, airtime and energy consumption in the network.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Spreading Factor    | If ADR mode is disabled, the device will send uplink data following this SF parameter. The higher the spreading factor, the longer the transmission distance, the slower the transmission speed and the more the consumption.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

| Parameter     | Description                                                                                                                          |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------|
| Tx Power      | Tx power (transmit power) refers to the strength of the outgoing signal transmitted by the device. This is defined by LoRa alliance. |
| RX2 Data Rate | RX2 data rate to receive downlinks.                                                                                                  |
| RX2 Frequency | RX2 frequency to receive downlinks. Unit: Hz                                                                                         |

## Multicast Setting

The device supports setting up several multicast groups to receive multicast commands from the network server, then users can use this feature to control devices in bulk.

**Step 1:** Enable **Multicast Group**, and set unique multicast address and keys to distinguish other groups. You can also keep these settings by default.

Multicast Group1
☒

Multicast Address ⓘ

11111111

McNetSKey

\*\*\*\*\*

McAppSKey

\*\*\*\*\*

Multicast Group2
☐

Multicast Group3
☐

Multicast Group4
☐

| Parameter           | Description                                                       |
|---------------------|-------------------------------------------------------------------|
| Multicast Address   | Unique 8-digit address to distinguish different multicast groups. |
| Multicast McNetSkey | 32-digit key. Default values:                                     |
| Multicast McAppSkey | Multicast Group 1: 5572404C696E6B4C6F52613230313823               |

| Parameter | Description                                         |
|-----------|-----------------------------------------------------|
|           | Multicast Group 2: 5572404C696E6B4C6F52613230313824 |
|           | Multicast Group 3: 5572404C696E6B4C6F52613230313825 |
|           | Multicast Group 4: 5572404C696E6B4C6F52613230313826 |

**Step 2:** Add a multicast group on the LoRaWAN<sup>®</sup> network server. Take Milesight gateway as example, go to **Network Server > Multicast Groups** to add a multicast group and configure the group according to the device settings.

|                                   |                          |
|-----------------------------------|--------------------------|
| Group Name                        | Device Control           |
| Multicast Address                 | 11111111                 |
| Multicast Network Session Key     | 5572404C696E6B4C6F526132 |
| Multicast Application Session Key | 5572404C696E6B4C6F526132 |
| Class Type                        | Class C                  |
| Datarate                          | DR0 (SF12, 125kHz)       |
| Frequency                         | 869525000 Hz             |
| Frame-counter                     | 0                        |
| Selected Devices                  | device1 , device2 x      |

**Step 3:** Go to **Network Server > Packets**, select the multicast group and fill in the downlink command, click **Send**. The network server will broadcast the command to devices that belong to this multicast group.



**Note:**

Ensure all devices' application ports are the same.

|                      |  |  |  |  |  |         |
|----------------------|--|--|--|--|--|---------|
| Status               |  |  |  |  |  | Packets |
| Packet Forwarder     |  |  |  |  |  |         |
| Network Server       |  |  |  |  |  |         |
| Protocol Integration |  |  |  |  |  |         |
| Network              |  |  |  |  |  |         |
| System               |  |  |  |  |  |         |

|                     |       |         |      |                          |      |
|---------------------|-------|---------|------|--------------------------|------|
| Send Data To Device |       |         |      |                          |      |
| Device EUI          | Type  | Payload | Port | Confirmed                |      |
| 0000000000000000    | ASCII |         | 85   | <input type="checkbox"/> | Send |

|                              |      |         |      |  |      |
|------------------------------|------|---------|------|--|------|
| Send Data To Multicast Group |      |         |      |  |      |
| Multicast Group              | Type | Payload | Port |  |      |
| Device Control               | hex  |         | 85   |  | Send |

## General Settings

General settings include the basic parameters of the device.

Device

Network

General

Calibration

Th

...

Reporting Interval(min)

3

Temperature Unit

°C

LED Indicator

Buzzer

Tampering Alarms ⓘ

Time Zone

UTC+8 (CT/CST: China St...

| Parameter          | Description                                                                                                                                                                                                                                                                                                                                                                   |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Reporting Interval | Reporting interval of transmitting current sensor values to network server. Default: 10 mins, Range: 1-1440 mins.                                                                                                                                                                                                                                                             |
| Temperature Unit   | Change the temperature unit displayed on the ToolBox and screen. <div>  <b>Note:</b> <ol style="list-style-type: none"> <li>The temperature unit in the reporting package is fixed as Celsius(°C).</li> <li>Please modify the threshold settings if the unit is changed.</li> </ol> </div> |
| LED Indicator      | Enable or disable the LED Indicator to display alarm status.                                                                                                                                                                                                                                                                                                                  |

| Parameter            | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Buzzer               | <p>Enable or disable the buzzer to sound for three reasons: the vaping index exceeds the threshold, triggering the tamper alarm and triggering the burning alarm.</p> <p><b>Hibernate Period:</b> When enabled, the buzzer will not respond when the vaping index exceeds the threshold within the set time period.</p> <p><b>Stop Buzzer:</b> When enabled, press the reset button to turn off the current buzzer alarm.</p>                                    |
| Tampering Alarms     | <p>After enabled, if the device is tampered with or forcibly moved, it will trigger an alarm accompanied by a red light and a buzzer.</p> <p><b>Mute Buzzer Time:</b> Within 15 minutes after the device is powered on, if the tampering alarm is triggered, the buzzer will remain silent. However, an alarm packet will still be reported, and the red indicator light will remain steadily on. This parameter can be configured using a downlink command.</p> |
| Time Zone            | Set the time zone of the current location. When you click <b>Sync</b> button of ToolBox App to sync time, the device will also sync the time zone from smartphone automatically.                                                                                                                                                                                                                                                                                 |
| Daylight Saving Time | <p>Enable or disable Daylight Saving Time (DST).</p> <p><b>Start Time:</b> the start time of DST time range.</p> <p><b>End Time:</b> the end time of DST time range.</p> <p><b>DST Bias:</b>the DST time will be faster according to this bias setting.</p>                                                                                                                                                                                                      |
| Change Password      | Change the password for ToolBox App to write this device.                                                                                                                                                                                                                                                                                                                                                                                                        |

## Calibration Settings

The device supports to add the calibration value to the raw collected value, and report the results.

General
Calibration
Th
...

Temperature
☒

Current Value(°C)  
**29.2**

Final Value(°C)  
**28.7**

Calibration Value(°C)

Humidity
☐

Vaping Index
☐

PM1.0
☐

PM2.5
☐

PM10
☐

TVOC
☐

## Threshold Settings

When current value is over the threshold value, the device will report a threshold alarm packet once instantly.

al

Calibration

Threshold

...

Temperature

Vaping Index ⓘ

Above

10

PM1.0

PM2.5

PM10

TVOC

Alarm Reporting Times

1

Alarm Dismiss Report ⓘ

| Parameters            | Description                                                                                                                                                                                                                                       |
|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Alarm Reporting Times | Set the number of alarm reports to be sent after the threshold is triggered, the default value is 1.                                                                                                                                              |
| Alarm Dismiss Report  | Once enabled, the device will send an alarm dismiss report when it detects a value below the threshold for 1 minute (vape index) or if the collected value is below the threshold for 3 continuous times (for other items except the vape index). |

## Maintenance

### Upgrade

This chapter describe the steps to upgrade the device via ToolBox App.

#### Upgrade via NFC

**Step 1:** Download firmware from Milesight official website to your smartphone.

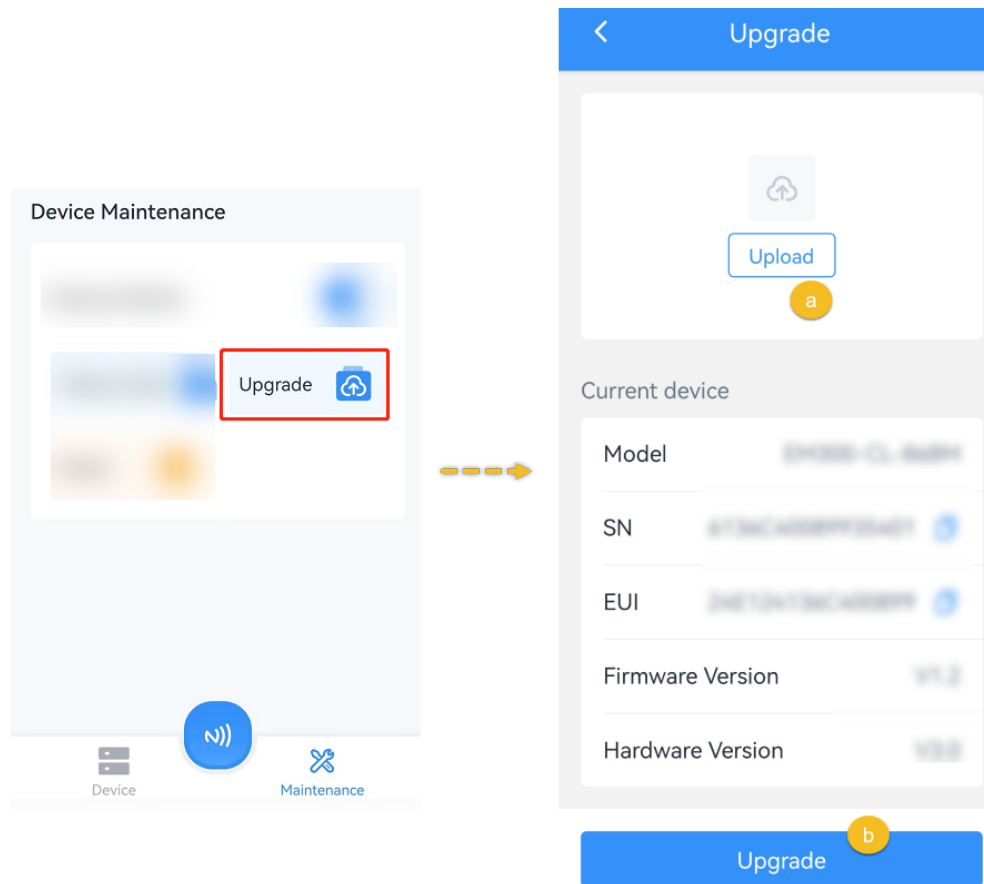
**Step 2:** Launch ToolBox App, click **Upgrade** to upload the firmware file.

**Step 3:** Click **Upgrade** to upgrade the device.



**Note:**

- Operation on ToolBox is not supported during an upgrade.
- Only Android version ToolBox supports the upgrade feature.



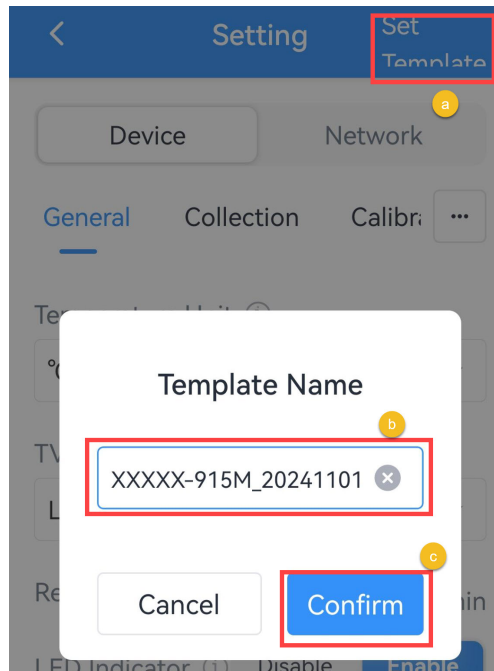
## Backup and Restore

This device supports configuration backup for easy and quick device configuration in bulks. Backup and restore is allowed only for devices with the same model and frequency band.

## Backup and Restore

**Step 1:** Launch ToolBox App, attach the NFC area of smartphone to the device to read the configuration.

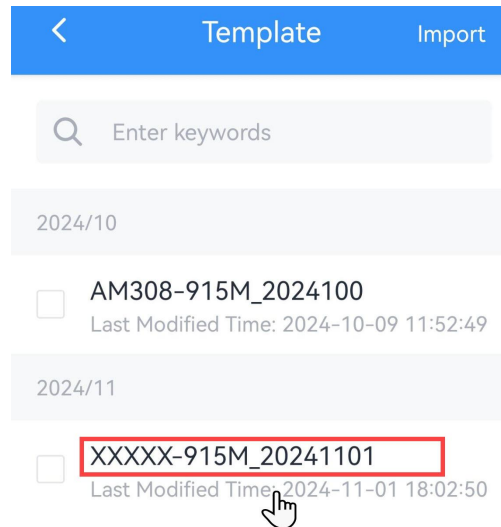
**Step 2:** Edit the configuration as required, click **Set Template** to save current configuration as a template to the ToolBox App.



**Step 3:** Go to **Device > Template** page.



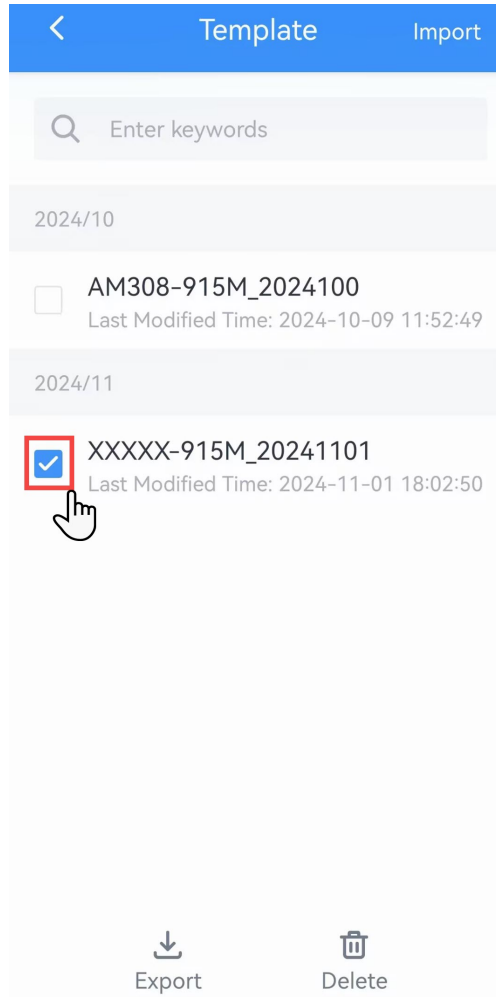
**Step 4:** Select and click the target template, click **Write** to import the configuration to target devices.



### Export and Delete Template

**Step 1:** Check the box of the target template.

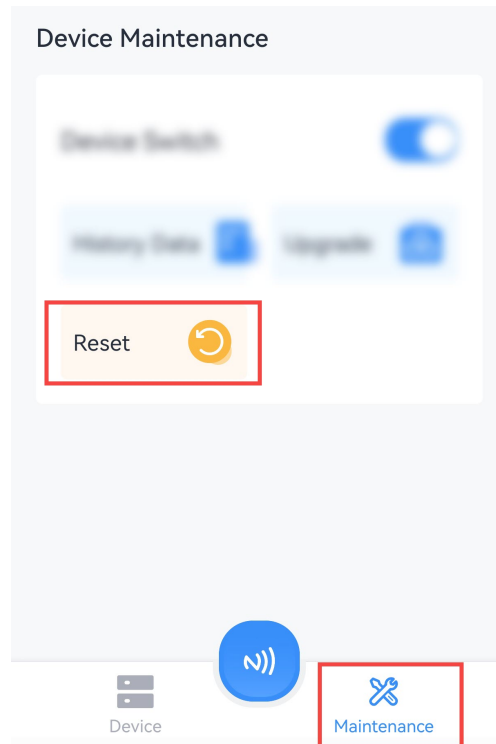
**Step 2:** Click **Export** to export this template as JSON format file and save it to the smartphone, click **Delete** to delete this template from your ToolBox App.



## Reset to Factory Default

**Via Hardware:** Hold on the reset button for more than 10s until the LED indicator quickly blinks.

**Via Toolbox App:** Click **Reset** and attach the smartphone to device to reset the device.



## Chapter 7. Device Maintenance

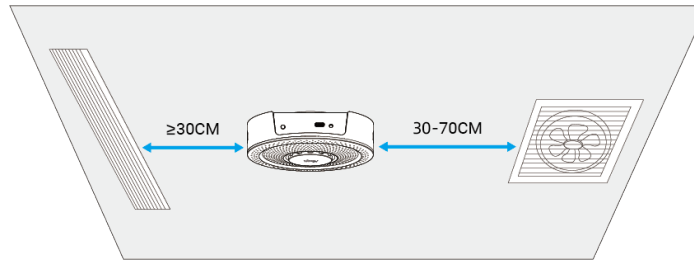
- Avoid exposing the device to gases with high concentrations over a long period time, or it may damage the device and decrease the performance.
- Do not expose the device to corrosive gas, silicon vapor or high levels of volatile organic compounds.
- Do not clean the device with detergents or solvents such as benzene or alcohol. To clean the device, wipe with a soft moistened cloth. Use another soft, dry cloth to wipe dry.
- Do not paint or cover the device, which may block the air inlets.
- It is suggested to place device under well-ventilated environment, otherwise the accuracy of TVOC will drop.
- There may be an accuracy drift in TVOC detection if the device is stored without power for a long time, and different devices may experience varying degrees of TVOC drift. If you prefer a more consistent reading with better precision, you can keep the device powered on in clear air for some time according to the below list.

| Storage Time (Power Off) | Operating Time  |
|--------------------------|-----------------|
| Less than 1 month        | At least 2 days |
| 1~6 months               | At least 3 days |
| More than 6 months       | At least 7 days |

# Chapter 8. Installation

## Installation Location

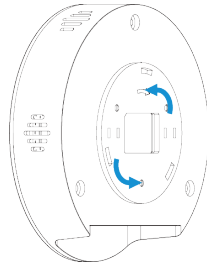
- Recommended installation height and environment: On the ceiling at a height of 2.4m to 3m in areas where smoking may occur.
- Avoid installing the device near large metal objects and in areas where it may be exposed to liquid sprays.
- The device's response speed is affected by the ambient airflow. It is recommended to install it in places where the airflow is stable, such as 30-70cm away from exhaust fans. Avoid installing it in places with unstable airflow, such as near doors/windows/air conditioning vents/places directly blown by fans. Ensure a distance of more than 30cm, and the greater the wind force, the farther the distance should be.



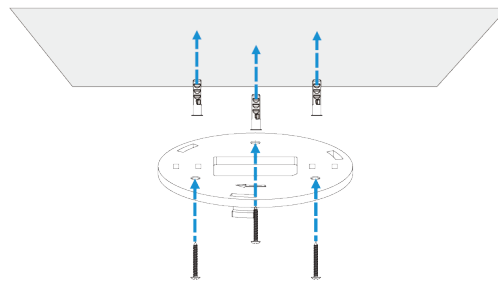
- If there are no exhaust fans or other ventilation equipment in the installation environment, it is recommended to deploy devices within a detection range of a 1.5m radius.
- In an installation environment with partitions or dividers (like toilet): If the partitions or dividers extend to the ceiling, it is recommended to install one device in each partition or divider; If not, it is recommended to deploy devices according to the detection range of a 1.5m radius.

## Device Installation

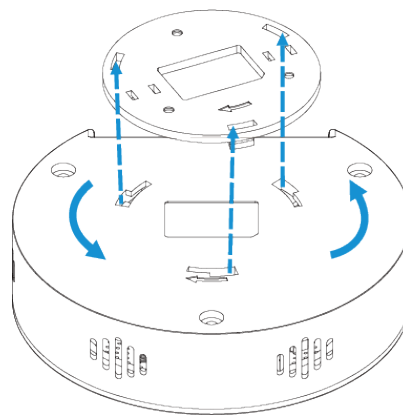
**Step 1:** Hold the back mounting plate, rotate counterclockwise to remove the mounting plate from the back of the device.



**Step 2:** Drill 3 holes in the ceiling according to the mounting plate. Insert the wall plugs into the holes, then secure the mounting plate with screws.



**Step 3:** Align the three holes on the device with the three protrusions on the mounting bracket, then rotate the device clockwise to secure it.



# Chapter 9. Communication Protocol

## Overview

All messages are based on the following format (HEX), the Data field should follow little-endian:

| Channel1 | Type1  | Data1   | Channel2 | Type2  | Data2   | Channel3 | ... |
|----------|--------|---------|----------|--------|---------|----------|-----|
| 1 Byte   | 1 Byte | N Bytes | 1 Byte   | 1 Byte | N Bytes | 1 Byte   | ... |

For decoder examples, please find files on <https://github.com/Milesight-IoT/SensorDecoders>.

## Uplink Data

This chapter describes the reported data of the device.

### Basic Information

The device will report a basic information packet whenever joining the network.

| Item             | Channel | Byte | Description                                                        |
|------------------|---------|------|--------------------------------------------------------------------|
| Protocol Version | df      | 2    | Example: 01 02 = V1.2                                              |
| Reset Report     | ee      | 0    | Reset                                                              |
| Serial Number    | db      | 8    | 16 digits                                                          |
| Device Version   | da      | 8    | Hardware Version (2B) +<br>Software Version: 010101(2B) + 00000000 |
| OEM ID           | d9      | 2    | 4 digits                                                           |
| Power On         | c8      | 1    | 01: Device is on                                                   |
| Device Type      | cf00    | 1    | 02: Class C                                                        |

**Example:**

| df0100 ee db6850e23348820008 da0100010100000000 d91234 c801 cf0002 |         |            |
|--------------------------------------------------------------------|---------|------------|
| Item                                                               | Channel | Value      |
| Protocol version                                                   | df      | 0102: V1.2 |
| Reset Report                                                       | ee      | Reset      |

| df0100 ee db6850e23348820008 da0100010100000000 d91234 c801 cf0002 |         |                                                              |
|--------------------------------------------------------------------|---------|--------------------------------------------------------------|
| Item                                                               | Channel | Value                                                        |
| Device SN                                                          | db      | 6850e23348820008                                             |
| Device Version                                                     | da      | Hardware Version: 0100(V1.0)<br>Software Version: 0101(V1.1) |
| OEM ID                                                             | d9      | 1234                                                         |
| Power On                                                           | c8      | 01: Device is on                                             |
| Device Type                                                        | cf00    | 02: Class C                                                  |

### Sensor Data

The device supports to report the sensor data according to reporting interval.

| Item             | Channel | Byte | Description                                            |
|------------------|---------|------|--------------------------------------------------------|
| Vaping Index     | 01      | 1    | UINT8, Range: 0~100                                    |
| PM1.0            | 03      | 2    | UINT16, Unit: $\mu\text{g}/\text{m}^3$ , Range: 0~1000 |
| PM2.5            | 05      | 2    | UINT16, Unit: $\mu\text{g}/\text{m}^3$ , Range: 0~1000 |
| PM10             | 07      | 2    | UINT16, Unit: $\mu\text{g}/\text{m}^3$ , Range: 0~1000 |
| Temperature      | 09      | 2    | INT16*0.1, Unit: $^{\circ}\text{C}$ , Range: -20~60    |
| Humidity         | 0b      | 2    | UINT16*0.1, Unit: %, Range: 0~100                      |
| TVOC             | 0d      | 2    | UINT16, Unit: $\mu\text{g}/\text{m}^3$ , Range: 0~2000 |
| Tampering Status | 0f      | 1    | 01-Triggered; 00-Normal                                |
| Buzzer           | 11      | 1    | 00-buzzer is not beeping<br>01-buzzer is beeping       |

### Example:

| 0104 030f00 051000 071100 091c01 0b0702 0d0000 0f00 1100 |         |                                              |
|----------------------------------------------------------|---------|----------------------------------------------|
| Item                                                     | Channel | Value                                        |
| Vaping Index                                             | 01      | 04 => 4                                      |
| PM1.0                                                    | 03      | 0f 00 => 000f => 15 $\mu\text{g}/\text{m}^3$ |

| 0104 030f00 051000 071100 091c01 0b0702 0d0000 0f00 1100 |         |                                        |
|----------------------------------------------------------|---------|----------------------------------------|
| Item                                                     | Channel | Value                                  |
| PM2.5                                                    | 05      | 1000 => 0010=16 $\mu$ g/m <sup>3</sup> |
| PM10                                                     | 07      | 1100 => 0011=17 $\mu$ g/m <sup>3</sup> |
| Temperature                                              | 09      | 1c01 => 011c=284*0.1=28.4°C            |
| Humidity                                                 | 0b      | 0702 => 0207 => 519*0.1 =51.9%         |
| TVOC                                                     | 0d      | 0000 => 0 $\mu$ g/m <sup>3</sup>       |
| Tampering Status                                         | 0f      | 00 => Normal                           |
| Buzzer                                                   | 11      | 00 => No beep                          |

## Alarm Report

| Item               | Channel | Byte | Description                                                                                                                                                                                                                                            |
|--------------------|---------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Vaping Index Alarm | 02      | 1/2  | <b>Byte1:</b><br>00-Collecting failed;<br>01-Under-range;<br>02-Over-range;<br>10-Threshold Alarm Dismiss; 11-Threshold Alarm;<br>20-Water Vapor Interference Alarm Dismiss;<br>21-Water Vapor Interference Alarm<br><b>Byte2:</b> UINT8, Range: 0~100 |
| PM1.0 Alarm        | 04      | 1/3  | <b>Byte1:</b><br>00-Collecting failed;<br>01-Under-range;<br>02-Over-range;<br>10-Threshold Alarm Dismiss; 11-Threshold Alarm;<br><b>Byte2-3:</b> UINT16, Unit: $\mu$ g/m <sup>3</sup> , Range: 0~1000                                                 |
| PM2.5 Alarm        | 06      | 1/3  | <b>Byte1:</b>                                                                                                                                                                                                                                          |

| Item              | Channel | Byte | Description                                                                                                                                                                                                                                                                                            |
|-------------------|---------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                   |         |      | 00-Collecting failed;<br>01-Under-range;<br>02-Over-range;<br>10-Threshold Alarm Dismiss; 11-Threshold Alarm;<br><b>Byte2-3:</b> UINT16, Unit: $\mu\text{g}/\text{m}^3$ , Range: 0~1000                                                                                                                |
| PM10 Alarm        | 08      | 1/3  | <b>Byte1:</b><br>00-Collecting failed;<br>01-Under-range;<br>02-Over-range;<br>10-Threshold Alarm Dismiss; 11-Threshold Alarm;<br><b>Byte2-3:</b> UINT16, Unit: $\mu\text{g}/\text{m}^3$ , Range: 0~1000                                                                                               |
| Temperature Alarm | 0a      | 1/3  | <b>Byte1:</b><br>00-Collecting failed;<br>01-Under-range;<br>02-Over-range;<br>10-Threshold Alarm Dismiss; 11-Threshold Alarm;<br>20-Burning Alarm Dismiss;<br>21-Burning Alarm (Temperature > 70°C or change of temperature > 15 °C within 15s)<br><b>Byte2-3:</b> INT16*0.1, Unit: °C, Range: -20~60 |
| Humidity Alarm    | 0c      | 1    | 00-Collecting failed;<br>01-Under-range;<br>02-Over-range                                                                                                                                                                                                                                              |
| TVOC Alarm        | 0e      | 1/3  | <b>Byte1:</b><br>00-Collecting failed;<br>01-Under-range;<br>02-Over-range;<br>10-Threshold Alarm Dismiss; 11-Threshold Alarm;                                                                                                                                                                         |

| Item            | Channel | Byte | Description                                                            |
|-----------------|---------|------|------------------------------------------------------------------------|
|                 |         |      | <b>Byte2-3:</b> UINT16, Unit: $\mu\text{g}/\text{m}^3$ , Range: 0~2000 |
| Tampering Alarm | 10      | 1    | 21-Alarm; 20-Alarm Dismiss                                             |
| Buzzer          | 11      | 1    | 00-buzzer is not beeping<br>01-buzzer is beeping                       |

#### Example:

1. Temperature Alarm: the environment detection item exceeds threshold.

| 0a112001 1100 |                                                                    |
|---------------|--------------------------------------------------------------------|
| Channel       | Value                                                              |
| 0a            | 11=>Threshold Alarm<br>2001 => $0120=288*0.1=28.8^{\circ}\text{C}$ |
| 11            | 00 => No beep                                                      |

2. Tampering Alarm.

| 1021 1101 |           |
|-----------|-----------|
| Channel   | Value     |
| 10        | 21=>Alarm |
| 11        | 01 =>Beep |

## Downlink Command

This device supports downlink commands for configuration and control. The downlink application port is 85 by default.

#### General Setting

| Item               | Channel | Byte | Description                                |
|--------------------|---------|------|--------------------------------------------|
| Reporting Interval | 60      | 3    | <b>Byte1:</b> Unit<br>00-Second; 01-Minute |

| Item                     | Channel | Byte | Description                                                                                                                                                                                                                                                                                  |
|--------------------------|---------|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                          |         |      | <b>Byte2-3:</b> Interval, UINT16, Range: 10~64800s or 1~1440min                                                                                                                                                                                                                              |
| Temperature Unit         | 61      | 1    | 00-°C; 01-°F                                                                                                                                                                                                                                                                                 |
| LED Indicator            | 62      | 1    | 01-Enable; 00-Disable                                                                                                                                                                                                                                                                        |
| Buzzer                   | 63      | 1    | 01-Enable; 00-Disable                                                                                                                                                                                                                                                                        |
| Buzzer Hiber-nate Period | 64      | 6    | <b>Byte1:</b><br>01-Period 1; 02-Period 2<br><b>Byte2:</b><br>01-Enable; 00-Disable<br><b>Byte3-4:</b> Start Time, UINT16, Unit: min, Range: 0~1440<br><b>Byte5-6:</b> End Time, UINT16, Unit: min, Range: 0~1440                                                                            |
| Stop Buzzer              | 67      | 1    | 01-Enable; 00-Disable                                                                                                                                                                                                                                                                        |
| Mute Buzzer Time         | 66      | 2    | UINT16, Unit: min, Range: 1~1440<br>This downlink is only set for the tamper alarm.                                                                                                                                                                                                          |
| Tampering Alarm          | 67      | 1    | 01-Enable; 00-Disable                                                                                                                                                                                                                                                                        |
| UTC Time Zone            | c7      | 2    | INT16 / 60                                                                                                                                                                                                                                                                                   |
| Daylight Sav-ing Time    | c6      | 10   | <b>Byte1:</b><br>01-Enable; 00-Disable<br><b>Byte2:</b> DST Bias, INT8, Unit:min<br><b>Byte3:</b> Start Month<br><b>Byte4:</b><br>Bit 7-4: Start Week<br>Bit 3-0: Start Day<br><b>Byte5-6:</b> Start Time, UINT 16, Unit:min<br><b>Byte7:</b> End Month<br><b>Byte8:</b><br>Bit 7-4:End Week |

| Item | Channel | Byte | Description                                  |
|------|---------|------|----------------------------------------------|
|      |         |      | Bit 3-0: End Day                             |
|      |         |      | <b>Byte9-10:</b> End Time, UINT 16, Unit:min |

### Example:

1. Set reporting interval as 20 minutes.

| 60 01 1400 |                                          |
|------------|------------------------------------------|
| Channel    | Value                                    |
| 60         | 01=Minute<br>14 00 => 00 14 = 20 minutes |

2. Set time zone to UTC-4.

| c7 10ff |                              |
|---------|------------------------------|
| Channel | Value                        |
| c7      | 10 ff => ff10 = -240/60 = -4 |

3. Set Daylight Saving Time from Mar. /2nd /Sun. 14:00 to Nov. /1st /Mon 14:00 and Bias as 60min.

| c6 01 3c 03 27 4803 0b 11 4803 |                                                                                                                                                                                                                                                                   |
|--------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Channel                        | Value                                                                                                                                                                                                                                                             |
| c6                             | 01=enable<br>Bias: 3c=60min<br>Start Month: 03=March<br>27=>0010 0111<br>Start Week: 0010=2= 2 <sup>nd</sup><br>Start Day: 0111=7=Sunday<br>Start Time: 48 03=> 03 48=>840min=14:00<br>End Month: 0b=11=Nov.<br>11=>0001 0001<br>End Week: 0001=1=1 <sup>st</sup> |

| c6 01 3c 03 27 4803 0b 11 4803 |                                                                 |
|--------------------------------|-----------------------------------------------------------------|
| Channel                        | Value                                                           |
|                                | End Day: 0001=1=Monday<br>End Time: 48 03=> 03 48=>840min=14:00 |

4. Mute the Buzzer for 10 minute.

| 66 0a00 |                         |
|---------|-------------------------|
| Channel | Value                   |
| 66      | 0a 00 => 00 0a = 10 min |

## Calibration Setting

| Item                     | Channel | Byte | Description                                                                                                         |
|--------------------------|---------|------|---------------------------------------------------------------------------------------------------------------------|
| Temperature Calibration  | 71      | 3    | <b>Byte1:</b><br>01-Enable; 00-Disable<br><b>Byte2-3:</b> INT16*0.1, Unit: °C, Range: -80~80                        |
| Humidity Calibration     | 72      | 3    | <b>Byte1:</b><br>01-Enable; 00-Disable<br><b>Byte2-3:</b> INT16*0.1, Unit: %, Range: -100~100                       |
| Vaping Index Calibration | 77      | 2    | <b>Byte1:</b><br>01-Enable; 00-Disable<br><b>Byte2:</b> INT8, Range: -100~100                                       |
| PM1.0 Calibration        | 73      | 3    | <b>Byte1:</b><br>01-Enable; 00-Disable<br><b>Byte2-3:</b> INT16, Unit: $\mu\text{g}/\text{m}^3$ , Range: -1000~1000 |
| PM2.5 Calibration        | 74      | 3    | <b>Byte1:</b><br>01-Enable; 00-Disable<br><b>Byte2-3:</b> INT16, Unit: $\mu\text{g}/\text{m}^3$ , Range: -1000~1000 |
| PM10 Calibration         | 75      | 3    | <b>Byte1:</b><br>01-Enable; 00-Disable                                                                              |

| Item             | Channel | Byte | Description                                                                                                             |
|------------------|---------|------|-------------------------------------------------------------------------------------------------------------------------|
|                  |         |      | <b>Byte2-3:</b> INT16, Unit: $\mu\text{g}/\text{m}^3$ , Range: -1000~1000                                               |
| TVOC Calibration | 76      | 3    | <b>Byte1:</b><br>01-Enable; 00-Disable<br><br><b>Byte2-3:</b> INT16, Unit: $\mu\text{g}/\text{m}^3$ , Range: -2000~2000 |

## Threshold Setting

| Item                   | Channel | Byte | Description                                                                                                                                                                                                                                          |
|------------------------|---------|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Temperature Threshold  | 69      | 6    | Byte1:<br>01-Enable; 00-Disable<br><br>Byte2: 00-disable; 01-below; 02-over; 03-within; 04-below or over<br><br>Byte3-4: Min. Value, INT16*0.1, Unit: °C<br><br>Byte5-6: Max. Value, INT16*0.1, Unit: °C                                             |
| Vaping Index Threshold | 6e      | 4    | Byte1:<br>01-Enable; 00-Disable<br><br>Byte2: 00-disable; 01-below; 02-over; 03-within; 04-below or over<br><br>Byte3: Min. Value, UINT8<br><br>Byte4: Max. Value, UINT8                                                                             |
| PM1.0 Threshold        | 6a      | 6    | Byte1:<br>01-Enable; 00-Disable<br><br>Byte2: 00-disable; 01-below; 02-over; 03-within; 04-below or over<br><br>Byte3-4: Min. Value, INT16*0.1, Unit: $\mu\text{g}/\text{m}^3$<br><br>Byte5-6: Max. Value, INT16*0.1, Unit: $\mu\text{g}/\text{m}^3$ |
| PM2.5 Threshold        | 6b      | 6    | Byte1:<br>01-Enable; 00-Disable<br><br>Byte2: 00-disable; 01-below; 02-over; 03-within; 04-below or over                                                                                                                                             |

| Item           | Channel | Byte | Description                                                                                                                                                                                                                              |
|----------------|---------|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                |         |      | Byte3-4: Min. Value, INT16*0.1, Unit: $\mu\text{g}/\text{m}^3$<br>Byte5-6: Max. Value, INT16*0.1, Unit: $\mu\text{g}/\text{m}^3$                                                                                                         |
| PM10 Threshold | 6c      | 6    | Byte1:<br>01-Enable; 00-Disable<br>Byte2: 00-disable; 01-below; 02-over; 03-within; 04-below or over<br>Byte3-4: Min. Value, INT16*0.1, Unit: $\mu\text{g}/\text{m}^3$<br>Byte5-6: Max. Value, INT16*0.1, Unit: $\mu\text{g}/\text{m}^3$ |
| TVOC Threshold | 6d      | 6    | Byte1:<br>01-Enable; 00-Disable<br>Byte2: 00-disable; 01-below; 02-over; 03-within; 04-below or over<br>Byte3-4: Min. Value, INT16, Unit: $\mu\text{g}/\text{m}^3$<br>Byte5-6: Max. Value, INT16, Unit: $\mu\text{g}/\text{m}^3$         |

#### Example:

Set Vaping Index threshold as above 2.

| 6e 01 020002 |                                                            |
|--------------|------------------------------------------------------------|
| Channel      | Value                                                      |
| 6e           | 01=>Enable<br>02=>over<br>00=>Min. Value<br>02=>Max. Value |

#### Alarm Setting

| Item                  | Channel | Byte | Description           |
|-----------------------|---------|------|-----------------------|
| Alarm Reporting Times | 6f      | 2    | UINT16, Range: 1~1000 |
| Alarm Dismiss Report  | 70      | 1    | 01-Enable; 00-Disable |

**Control Command**

| Item                  | Channel |
|-----------------------|---------|
| Reboot                | be      |
| Query Periodic Report | b9      |
| Stop Buzzer Alarm     | 5f      |
| Rejoin the Network    | 0b      |

# Chapter 10. Appendix

## TVOC Levels and Guidelines

| IAQ Rating   | TVOC ( $\mu\text{g}/\text{m}^3$ ) | Air Quality                                       |
|--------------|-----------------------------------|---------------------------------------------------|
| $\leq 1.99$  | <300                              | Very Good                                         |
| 2.00 to 2.99 | 300 to 1000                       | Good                                              |
| 3.00 to 3.99 | 1000 to 3000                      | Medium (not recommended for exposure > 12 months) |
| 4.00 to 4.99 | 3000 to 10000                     | Poor (not recommended for exposure > 1 month)     |
| $\geq 5.00$  | >10000                            | Bad (not recommended)                             |