Bathroom Odor Detector Sensor

Featuring LoRaWAN®

GS301

User Guide

Safety Precautions

Milesight will not shoulder responsibility for any loss or damage resulting from not following the instructions of this operating guide.

- The device must not be disassembled or remodeled in any way.
- In order to protect the security of the device, please change device password when first configuration. Default password is 123456.
- Do not place the device outdoors where the temperature is below/above operating range. Do not place the device close to objects with naked flames, heat source (oven or sunlight), cold source, liquid and extreme temperature changes.
- The device is not intended to be used as a reference sensor, and Milesight will not should responsibility for any damage which may result from inaccurate readings.
- The device must never be subjected to shocks or impacts.
- Keep the device away from the water to prevent damage to the detector and electric shock.
- Keep the device out of children's reach.

Declaration of Conformity

GS301 is in conformity with the essential requirements and other relevant provisions of the CE, FCC, and RoHS.

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Revision History

Date	Doc Version	Description
Jun.5, 2023	V 1.0	Initial version

Contents

1. Product Introduction

1.1 Overview

GS301 is a 4-in-1 LoRaWAN® bathroom odor detector to detect ammonia (NH_3) and hydrogen sulfide (H_2S) gas according to electrochemical principle. GS301 is also able to detect temperature and humidity to fully aware of the environment of bathrooms. When the NH_3 or H_2S gas concentration reaches the preset threshold, the detector will trigger both LED light alarm and buzzer to notify people timely to ventilate, which is an important part in smart bathroom solution.

Apart from local alarms, GS301 can also report the sensor data and alarm messages remotely using LoRaWAN® technology. Integrating with Milesight LoRaWAN® gateway and Milesight IoT Cloud solution, users can monitor all the sensor data and control the deice remotely and flexibly. Moreover, GS301 supports Milesight D2D to enable ultra-low latency control without gateways.

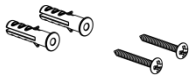
1.2 Features

- Built-in high accuracy electrochemical gas detection sensor with more than 3-year-long life expectancy
- Built-in multiple sensors including NH_3, H_2S, temperature and humidity
- Built-in batteries to achieve wireless power supply and decrease in installation cost
- Equipped with buzzer and LED indicator to indicate threshold alarms
- Damp proof coating inside the device to ensure device working well on various conditions of bathrooms
- Support Milesight D2D protocol to enable ultra-low latency and direct ventilation control without gateways
- Built-in NFC for easy configuration
- Compatible with standard LoRaWAN® gateways and network servers
- Quick and easy management with Milesight IoT Cloud solution

2. Hardware Introduction

2.1 Packing List

1 × Bathroom Odor Detector



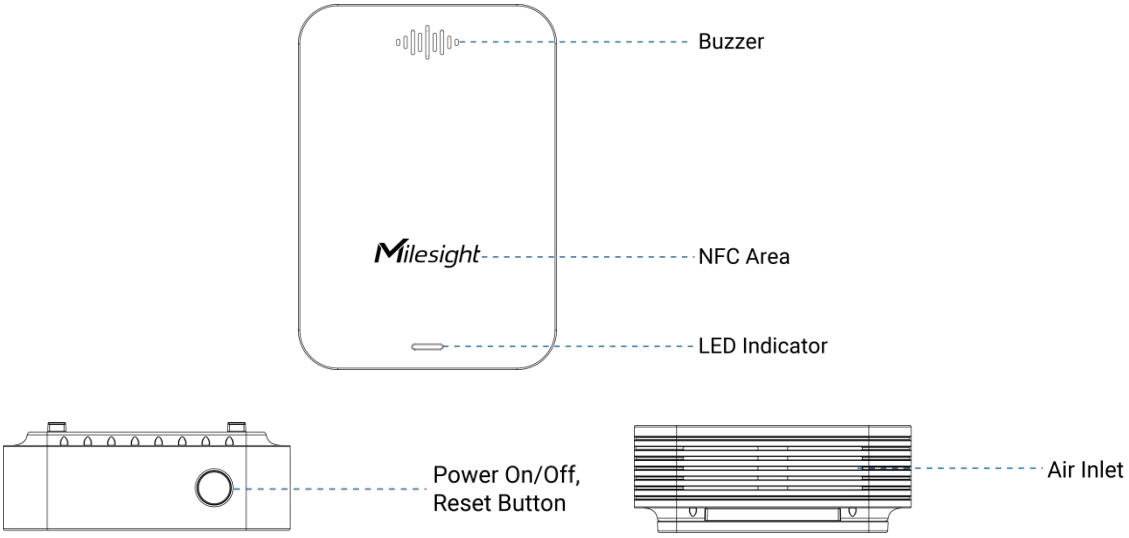
2 × Wall Mounting Kits

1 × Quick Start Guide

1 × Warranty Card

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

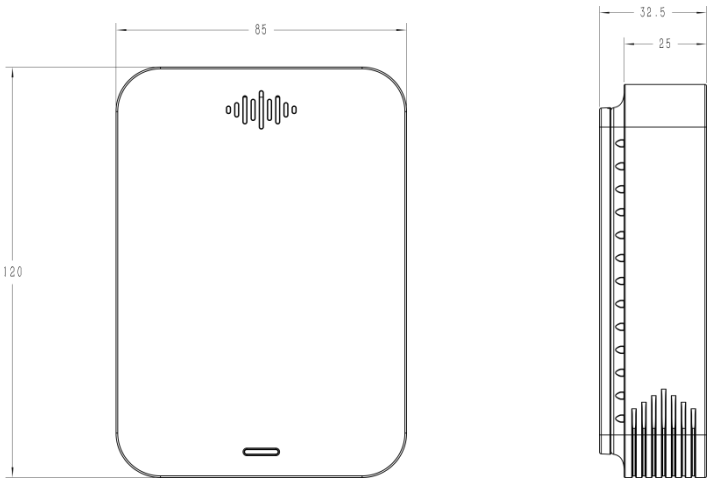
2.2 Hardware Overview



2.3 LED and Button Patterns

Function	Action	LED (Enable)
Power ON/OFF	Press and hold the button for more than 3 seconds.	Power On: Off → On
		Power Off: On → Off
Check On/Off Status	Quick press the power button once.	Device On: Blink Once
		Device Off: Off
Reset to Factory Default	Press and hold the reset button for more than 10 seconds	Quickly Blinks
Threshold Alarm	When any concentration of NH_3 or H_2S exceeds the threshold	Quickly Blinks

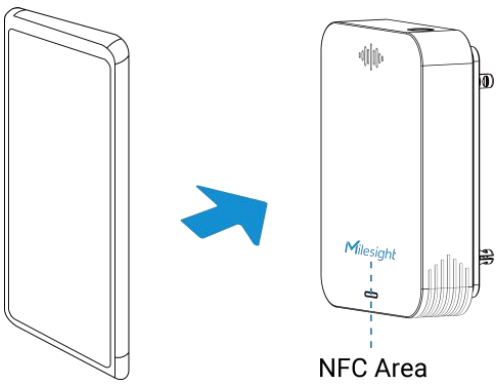
2.4 Dimensions(mm)



3. Operation Guide

3.1 Basic Configuration

1. Long press and hold the power button for more than 3 seconds to power on the device. After powering on or rebooting, wait for about 30 minutes for sensor polarization process. Only when the polarization completes, the device can collect NH_3 and H_2S data.
2. Download and install “Milesight ToolBox” App from Google Play or Apple App Store.
3. Enable NFC on the smartphone and launch Milesight ToolBox.
4. Attach the smartphone with the NFC area to the device to read device information. Basic information and settings of the device will be shown on ToolBox App if it’s recognized successfully. You can read and configure the device by tapping the Read/Write device on the App. To order to protect the security of the device, please change the password when first configuration. The default password is **123456**.



Note:

1) During polarization process, temperature and humidity data will be collected as usual, NH_3

and H_2S values will be shown 655.34 ppm on ToolBox page.

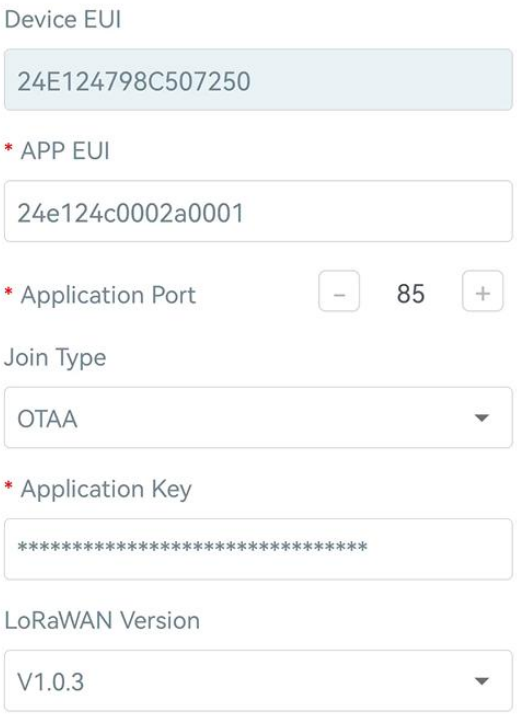
2) Ensure the location of smartphone NFC area and it's recommended to take off phone case.

3) If the smartphone fails to read/write configurations via NFC, keep the phone away and back to try again.

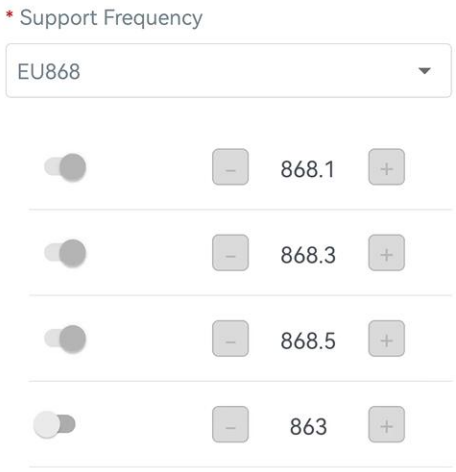
4) GS301 can also be configured by a dedicated NFC reader, which can be purchased from Milesight IoT.

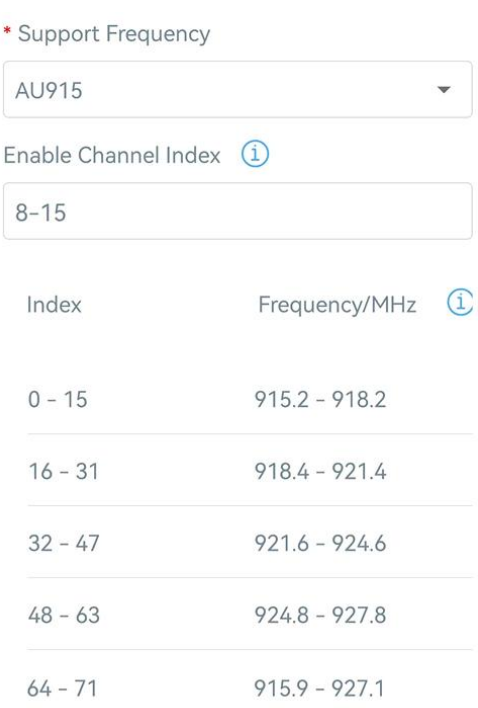
3.2 LoRaWAN Settings

Go to **Device > Settings > LoRaWAN Settings** to configure join type, App EUI, App Key and other information. You can also keep all settings by default.



Parameters	Description
Device EUI	Unique ID of the device which can also be found on the label.
App EUI	Default App EUI is 24E124C0002A0001.
Application Port	The port is used for sending and receiving data, the default port is 85.
Join Type	OTAA and ABP mode are available.
LoRaWAN Version	V1.0.2, V1.0.3 are available.
Work Mode	It's fixed as Class A.
Application Key	Appkey for OTAA mode, default is 5572404C696E6B4C6F52613230313823.
Device Address	DevAddr for ABP mode, default is the 5th to 12th digits of SN.
Network Session	Nwkskey for ABP mode, default is 5572404C696E6B4C6F52613230313823.

Key	
Application Session Key	Appskey for ABP mode, default is 5572404C696E6B4C6F52613230313823.
RX2 Data Rate	RX2 data rate to receive downlinks or send D2D commands.
RX2 Frequency	RX2 frequency to receive downlinks or send D2D commands. Unit: Hz
Channel Mode	Select Standard-Channel mode or Single-Channel mode. When Single-Channel mode is enabled, only one channel can be selected to send uplinks. Please enable Single-Channel mode if you connect device to DS7610.
Channel	Enable or disable the frequency to send uplinks.  If frequency is one of CN470/AU915/US915, enter the index of the channel that you want to enable and make them separated by commas. **Examples:** 1, 40: Enabling Channel 1 and Channel 40 1-40: Enabling Channel 1 to Channel 40 1-40, 60: Enabling Channel 1 to Channel 40 and Channel 60 All: Enabling all channels Null: Indicates that all channels are disabled

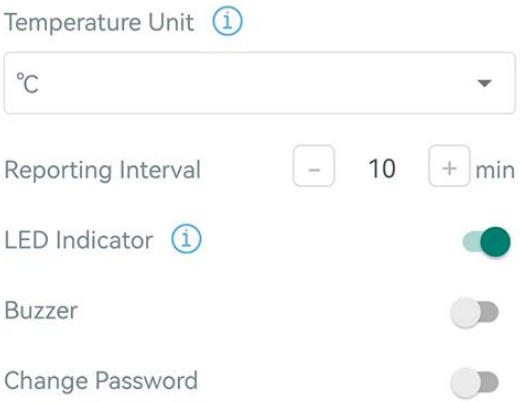
	
Spread Factor	If ADR is disabled, the device will send data via this spread factor.
Confirmed Mode	If the device does not receive ACK packet from the network server, it will resend data once.
Rejoin Mode	Reporting interval ≤ 30 mins: the device will send a specific number of LinkCheckReq MAC packets to the network server every 30 mins to validate connectivity; If there is no response, the device will re-join the network. Reporting interval > 30 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.
Set the number of packets sent	When rejoin mode is enabled, set the number of LinkCheckReq packets sent.
ADR Mode	Allow the network server to adjust datarate of the device. This only works with Standard Channel Mode.
Tx Power	Transmit power of the device.

Note:

1) Please contact sales for device EUI list if there are many units.
2) Please contact sales if you need random App keys before purchase.
3) Select OTAA mode if you use Milesight IoT cloud to manage devices.
4) Only OTAA mode supports rejoin mode.

3.3 Basic Settings

Go to **Device > Settings > General Settings** of ToolBox App to change the reporting interval, etc.



Parameters	Description
Reporting Interval	Reporting interval of transmitting current sensor values to the network server. Default: 10 mins, Range: 1-1080 mins
Temperature Unit	Change the temperature unit displayed on the ToolBox. **Note:** 1) The temperature unit in the reporting package is fixed as °C. 2) Please modify the threshold settings if the unit is changed.
LED Indicator	Disable or enable LED Indicator for alarming when the value of NH_3 or H_2S exceeds the threshold.
Buzzer	Disable or enable buzzer for alarming when the value of NH_3 or H_2S exceeds the threshold. The buzzer will automatically stop if both values are lower than the threshold. If you want to stop the buzzing, please disable the buzzer.
Change Password	Change the password for ToolBox App or software to read/write this device.

Note: When temperature is higher than 35°C, LED indicator and buzzer alarm will stop working until the temperature goes back to 35°C or below.

3.4 Advanced Settings

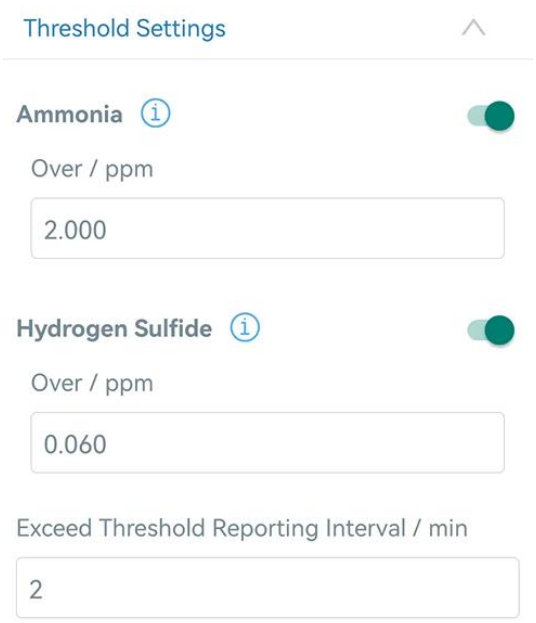
3.4.1 Calibration Settings

ToolBox supports numerical calibration for temperature and humidity. Go to **Device > Settings > Calibration Settings** of ToolBox App to type the calibration value and save, the deice will add the calibration value to raw value.

3.4.2 Threshold Settings

Go to **Device > Settings > Threshold Settings** of ToolBox App to enable the threshold settings and input the threshold. When one of NH_3 and H_2S exceeds threshold, GS301 will report the threshold value according to the **Exceed Threshold Reporting Interval.** When both values are below the threshold, it will also report the current data once.

Note: When temperature is higher than 35°C, the threshold alarm will stop working until the temperature is back to 35°C or below.

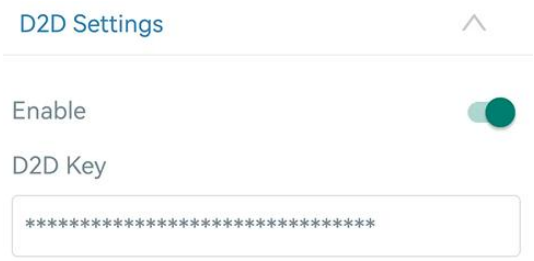


3.4.3 Milesight D2D Settings

Milesight D2D protocol is developed by Milesight and used for setting up transmission among Milesight devices without gateway. When D2D setting is enabled, GS301 can work as the Milesight D2D Controller device to send commands to trigger Milesight D2D agent devices.

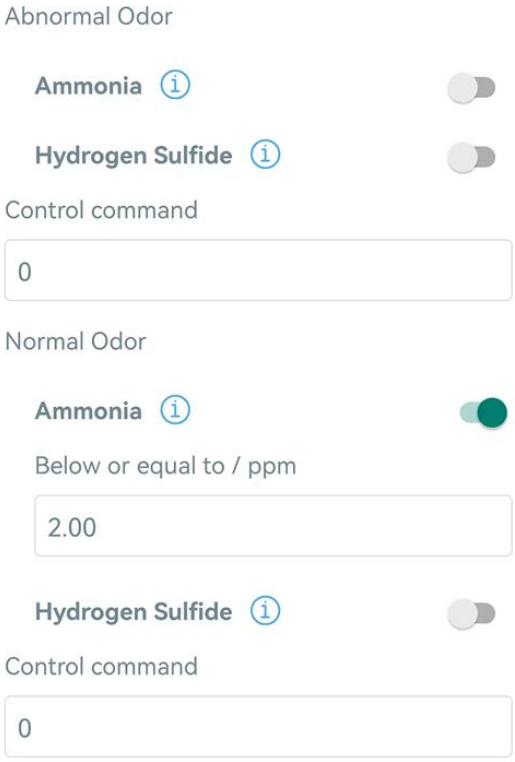
1. Configure RX2 datarate and RX2 frequency in LoRaWAN® settings, it is suggested to change the default value if there are many LoRaWAN® devices around.

2. Go to **Device > Settings > D2D Settings** to enable D2D function, and define an unique Milesight D2D key to be the same as Milesight D2D agent device. (Default Milesight D2D Key: 5572404C696E6B4C6F52613230313823).



3. Define a 2-byte hexadecimal control command (0x0000 to 0xffff). GS301 will send the control command to correspond Milesight D2D agent devices according to the conditions. For abnormal odor, it will send D2D command when one of NH_3 or H_2S exceeds the value; for normal odor, it will send D2D command when both NH_3 and H_2S equals or are below the values.

Note: When temperature is higher than 35°C, Milesight D2D will stop working until the temperature is back to 35°C or below.



3.5 Maintenance

3.5.1 Upgrade

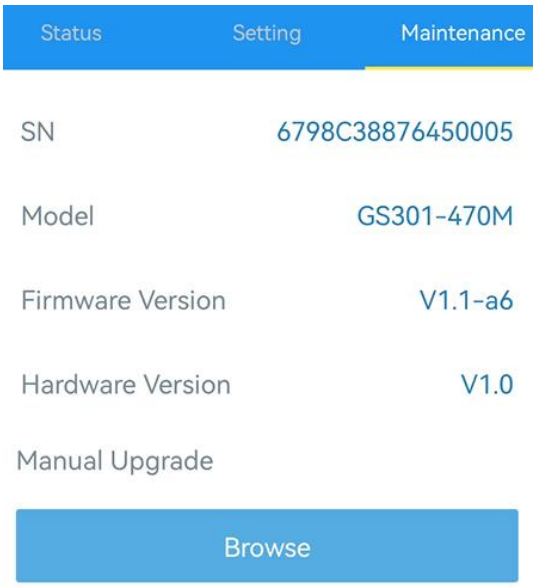
1. Download firmware from www.milesight-iot.com to your smartphone.

2. Open ToolBox App and click **Browse** to import firmware and upgrade the device.

Note:

1) Operation on ToolBox is not supported during the upgrade.

2) Only Android version ToolBox supports the upgrade feature.

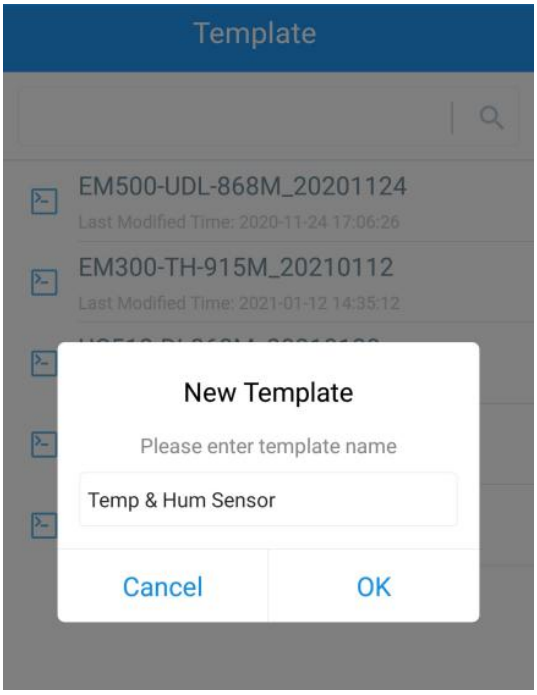


3.5.2 Backup

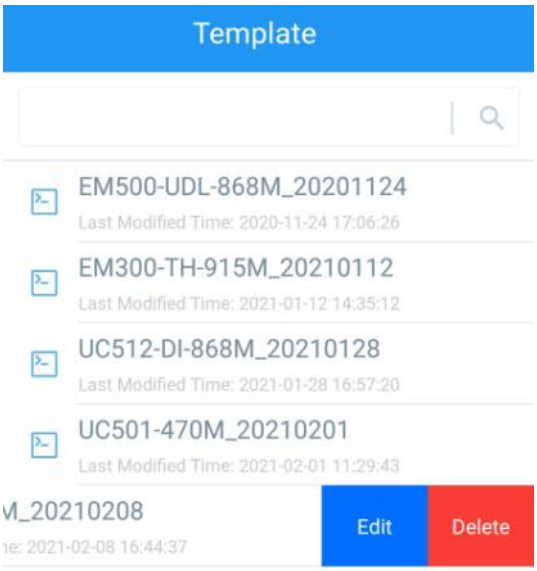
GS301 supports configuration backup for easy and quick device configuration in bulk. Backup is allowed only for devices with the same model and LoRaWAN® frequency band.

1. Go to **Template** page on the App and save current settings as a template. You can also edit the template file.

2. Select one template file that is saved in the smartphone and click **Write**, then attach it to another device to write the configuration.



Note: Slide the template item to the left to edit or delete it. Click the template to edit the configurations.

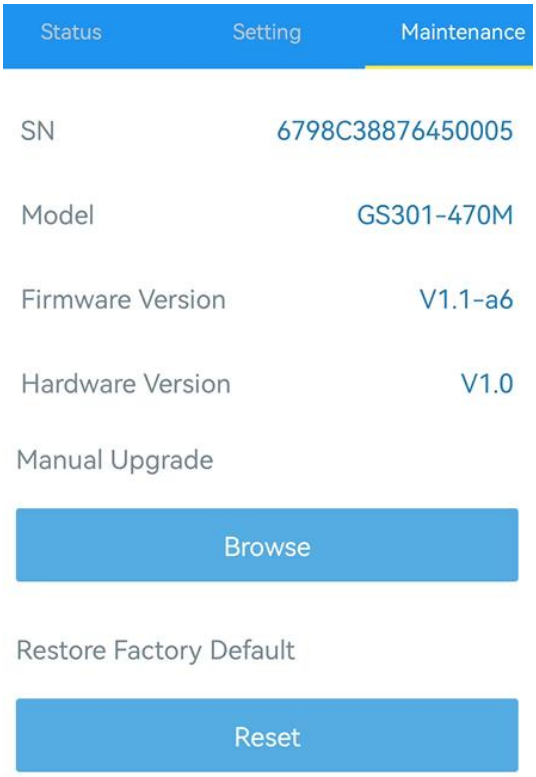


3.5.3 Reset to Factory Default

Please select one of the following methods to reset the device:

Via Hardware: Hold on reset button more than 10 seconds to reset.

Via ToolBox App: Go to **Device > Maintenance** to click **Reset**, then attach smartphone with the NFC area to the device.



4. Installation

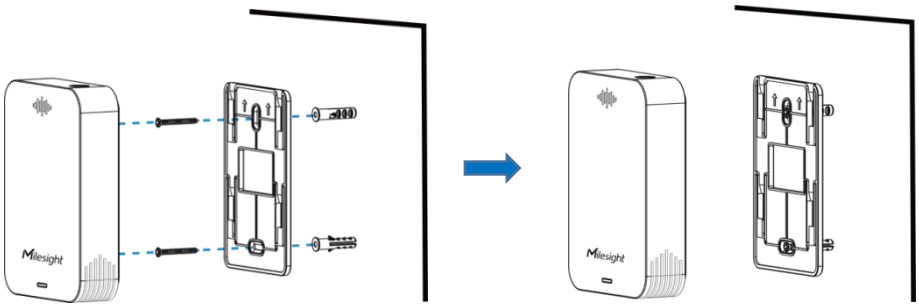
Locations to avoid

- In a area expect for the operating temperature or larger temperature difference;
- Damp or very humid location expect for operating humidity (0 to 95%);
- The place close to heat source and even sunlight;
- In any outdoor places;
- Dusty or dirty environments may block the air inlets;
- Behind metal objects and obstacles which affect the LoRaWAN® transmission;
- The place with lots of electromagnetic interfaces;
- The place where strong vibration may happen or easy to be subjected to physical shock;
- Next to a door or window or any air ventilation openings like ventilation fans, bents, etc;
- The places spraying alcohol, perfume, fresheners, hair spray, gasoline, paint and other aerosols.

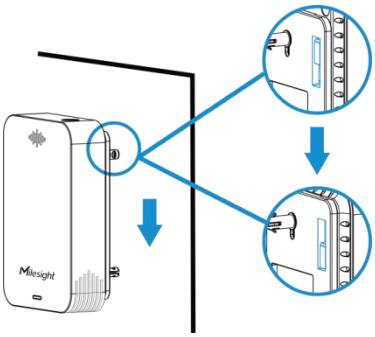
Installation Steps

1. Take off the mounting bracket on the back of the device, drill 2 holes on the wall according to the wall mounting bracket, and then fix the wall plugs into the wall. It's suggested to install the device in the height of human breath which is a way from ground about 6.5 to 8.2 feet.

2. Fix the mounting bracket to the wall plugs with screws, and note the bracket should not be installed upside down.



3. Hang the device to the bracket.



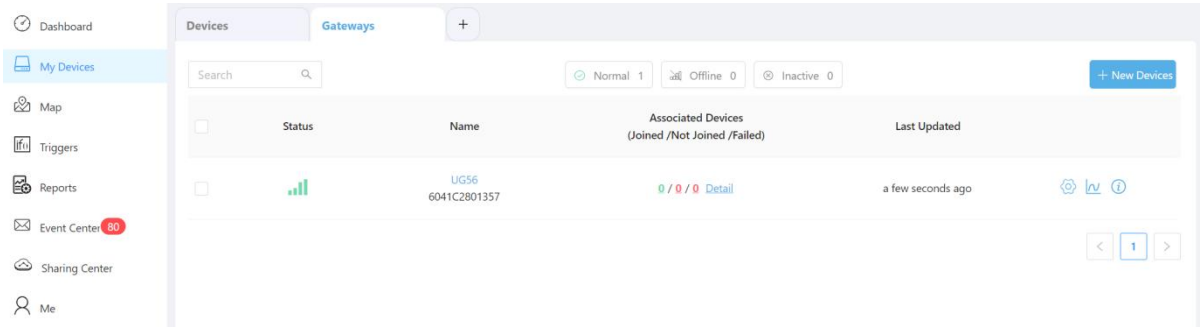
5. Detector Maintenance

- The working life of the detector is 3 years, remember to replace the device after then.
- Avoid exposing the device to NH_3 and H_2S with high concentrations over a long period time, or it may damage the device and decrease the performance.
- The newly decorated or re-decorated room should be ventilated for some time before installing the detector.
- To ensure the air inlets are not blocked, wipe the device with a clean dry cloth, do not use a very wet cloth, alcohol, harsh chemicals or detergents which may damage the detector.
- Do not paint or cover the device, which may block the air inlets and interface.
- Do not modify, disassemble, strike or crush the device, which will cause the fault alarms.
- During the transportation and storage, keep out of direct sunlight, keep the temperature within 35°C and not more than 55°C, and keep the humidity not below 15%RH.

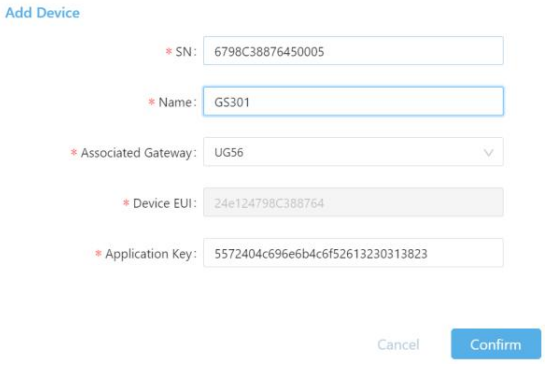
6. Milesight IoT Cloud Management

GS301 sensor can be managed by Milesight IoT Cloud platform. Milesight IoT Cloud is a comprehensive platform the provides multiple services including devices remote management and data visualization with the easiest operation procedures. Please register a Milesight IoT Cloud account before operating following steps.

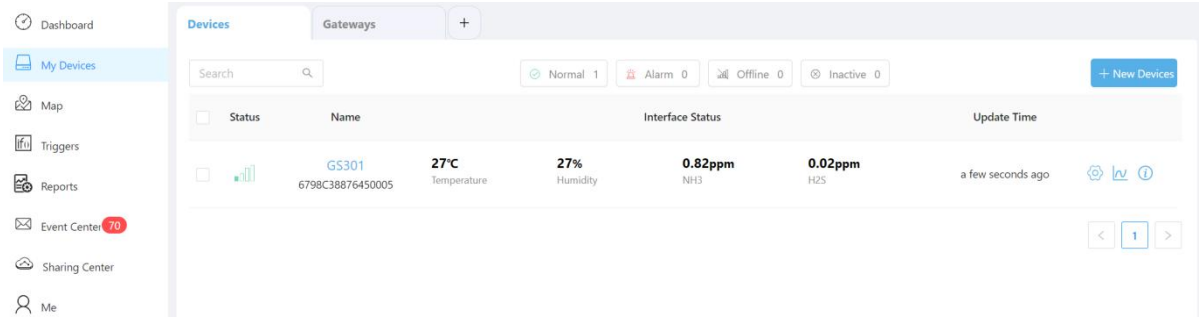
1. Ensure Milesight LoRaWAN® gateway is online in Milesight IoT Cloud. For more info about connecting gateway to cloud please refer to gateway's user guide.



2. Go to **My Device** page and click **+ New Device**. Fill in the SN of device and select associated gateway.



3. After the device is online in Milesight IoT Cloud, you can check the data via webpage or mobile App and create dashboard for it.



7. Device Payload

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

Channel1	Type1	Data1	Channel2	Type2	Data2	Channel 3	...
1 Byte	1 Byte	N Bytes	1 Byte	1 Byte	M Bytes	1 Byte	...

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

7.1 Basic Information

GS301 sensors report basic information of sensor whenever joining the network.

Channel	Type	Description
ff	01(Protocol Version)	01=>V1
	09 (Hardware Version)	01 40 => V1.4
	0a (Software Version)	01 14 => V1.14
	0b (Power On)	Device is on
	0f (Device Type)	00: Class A, 01: Class B, 02: Class C
	16 (Device SN)	16 digits

Example:

ff0bff ff0101 ff166798c38876450005 ff090100 ff0a0101 ff0f00					
Channel	**Type**	**Value**	**Channel**	**Type**	**Value**
ff	0b (Power On)	ff (Reserved)	ff	01 (Protocol Version)	01(V1)
Channel	**Type**	**Value**	**Channel**	**Type**	**Value**
ff	16 (Device SN)	6798c3887645 0005	ff	09 (Hardware version)	0100 (V1.0)
Channel	**Type**	**Value**	**Channel**	**Type**	**Value**
ff	0a (Software Version)	0101 (V1.1)	ff	0f (Device Type)	00 (Class A)

7.2 Sensor Data

GS301 device will report the sensor data according to reporting interval or threshold reporting interval.

Item	Channel	Type	Description
Battery Level	01	75	UINT8, Unit: %
Temperature	02	67	INT16, Unit: °C, Resolution: 0.1 °C
Humidity	03	68	UINT8, Unit: %RH, Resolution: 0.5 %RH
Ammonia (NH_3)	04	7d	INT16, Unit: ppm, Resolution: 0.01 ppm
Hydrogen Sulfide (H_2S)	05	7d	INT16, Unit: ppm, Resolution: 0.01 ppm

Note: During polarization period, GS301 will send the value of NH_3 and H_2S as “047dfeff” and “057dfeff”.

Example:

017564 02670001 036856 047d0200 057d0100					
Channel	**Type**	**Value**	**Channel**	**Type**	**Value**
01	75 (Battery Level)	64=>100%	02	67 (Temperature)	00 01=>01 00=>256 Temp=256*0.1 =25.6°C
Channel	**Type**	**Value**	**Channel**	**Type**	**Value**
03	68 (Humidity)	56=>86 Hum=86 *0.5 =43%	04	7d(Ammonia (NH_3))	02 00=>00 02=>2 NH_3=2*0.01=0.02 ppm
Channel	**Type**	**Value**	**Channel**	**Type**	**Value**
05	7d (Hydrogen Sulfide (H_2S))	01 00=>00 01 =1 H_2S=1*0.01= 0.01ppm			

7.3 Downlink Commands

GS301 supports downlink commands to configure the device. The application port is 85 by default.

Channel	Type	Description
ff	03(Set Reporting Interval)	2 Bytes, unit: s
	06 (Set Threshold Alarm)	9 Bytes, CTRL(1B)+Min(2B)+Max(2B)+00000000(4B) **CTRL:** Bit0~Bit2: 000-disable 001-below (minimum threshold) 010-above (maximum threshold) 011-within 100-below or above Bit3~Bit5: id 001: NH_3

		010: H_2S 011: NH_3 (Abnormal Odor threshold in D2D Settings) 100: H_2S (Abnormal Odor threshold in D2D Settings) 101: NH_3 (Normal Odor threshold in D2D Settings) 110: H_2S (Normal Odor threshold in D2D Settings) Bit6~Bit7: 00
	10 (Reboot)	ff (Reserved)
	2f (Set LED Indicator)	1 Byte, 00: Disable 01: Enable
	3e (Set Buzzer)	1 Byte, 00: Disable 01: Enable
	66 (Set the Exceed Reporting Interval)	2 Bytes, unit: s

Example:

1. Set reporting interval as 20 minutes.

ff03b004		
Channel	**Type**	**Value**
ff	03 (Set Reporting Interval)	b0 04=>04 b0=1200s =20 minutes

2. Reboot the device.

ff10ff		
Channel	**Type**	**Value**
ff	10 (Reboot)	ff (Reserved)

3. Disable the LED Indicator.

ff2f00		
Channel	**Type**	**Value**
ff	2f (Set LED Indicator)	00 (Disable)

4. When NH_3 is over 2ppm, it will trigger the threshold alarm .

ff060a0000c80000000000		
Channel	**Type**	**Value**
ff	06 (Set Threshold Alarm)	CTRL: 0a=>0000 1010 (NH_3 over threshold) Min: 0000=>0 Max: c800=>00c8=>200*0.01=2ppm

Appendix

Ammonia (NH_3) Levels and Guidelines

NH_3 Concentration	Description
0~0.10 ppm	Not perceptible or very weak
0.10~0.60 ppm	Weak
0.60~2.00 ppm	Distinct
2.00~10.00 ppm	Strong

Hydrogen Sulfide (H_2S) Levels and Guidelines

H_2S Concentration	Description
0~0.01 ppm	Not perceptible or very weak
0.01~0.06 ppm	Distinct
0.06~0.7 ppm	Strong
0.7~5.00 ppm	Difficult to bear

-END-