



Bathroom Odor Detector Sensor

Featuring LoRaWAN®

GS301

User Guide



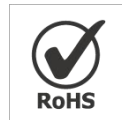
Safety Precautions

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.

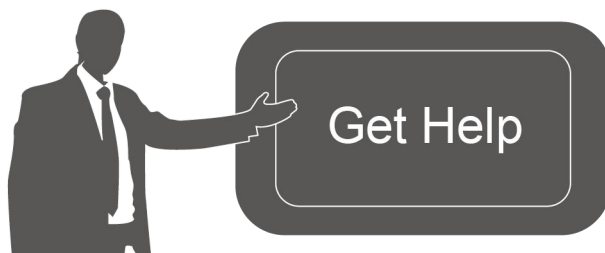
Declaration of Conformity

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



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For assistance, please contact

Milesight technical support:

Email: iot.support@milesight.com

Support portal: support.milesight-iot.com

Tel: 86-592-5085280

Fax: 86-592-5023065

Address: Building C09, Software Park III,
Xiamen 361024, China

Revision History

Date	Doc Version	Description
Jan.5, 2023	V 1.0	Initial version
Dec. 18, 2024	V 1.1	1. Support to display and report sensor ID; 2. Add zero-point calibration for NH ₃ and H ₂ S; 3. Report H ₂ S data with resolution 0.001ppm.

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1. Product Introduction

1.1 Overview

GS301 is a 4-in-1 LoRaWAN® bathroom odor detector to detect ammonia (NH₃) and hydrogen sulfide (H₂S) gas according to electrochemical principle. GS301 is also able to detect temperature and humidity to fully aware of the environment of bathrooms. When the NH₃ or H₂S 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 device remotely and flexibly. Moreover, GS301 supports Milesight D2D to enable ultra-low latency control without gateways.

1.2 Features

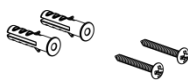
- Built-in high accuracy electrochemical gas detection sensor with more than 3-year-long life expectancy
- Built-in multiple sensors including NH₃, H₂S, temperature and humidity
- Built-in batteries to achieve wireless power supply and decrease in installation cost
- Equipped with buzzer and LED indicator 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

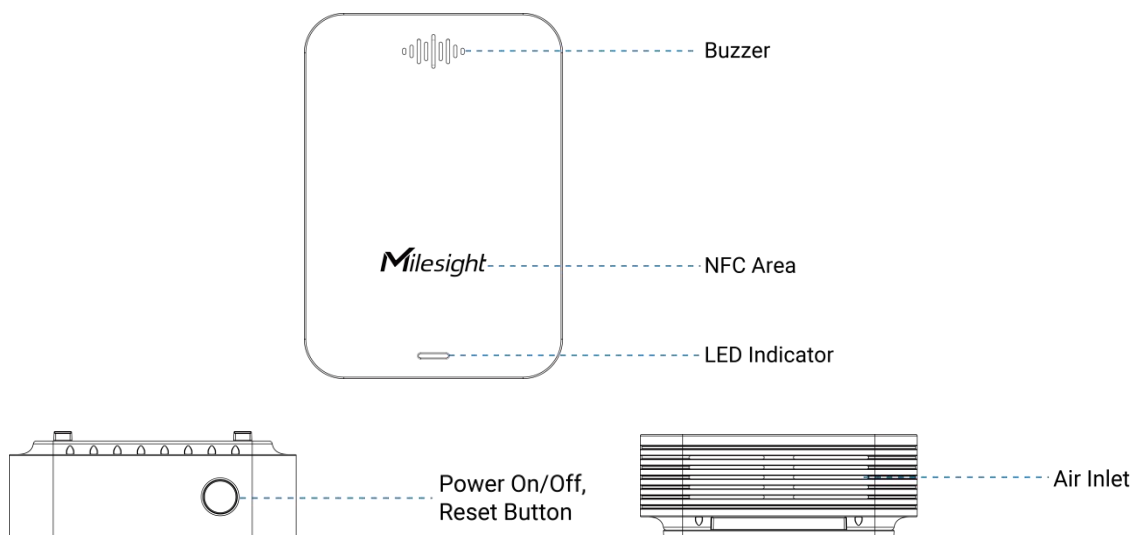


1 × Warranty Card



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

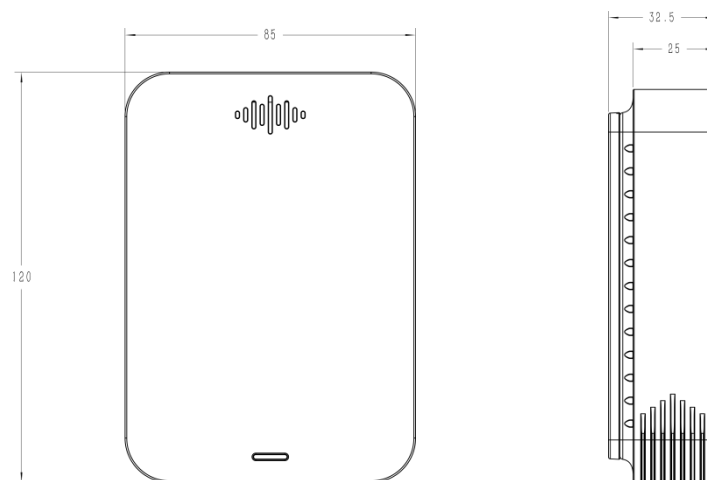
2.2 Hardware Overview



2.3 LED and Button Patterns

Function	Action	LED (Enabled)
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 ₂ S exceeds the threshold	Quickly Blinks

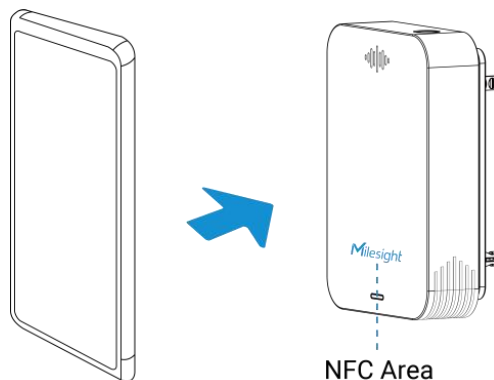
2.4 Dimensions(mm)



3. Operation Guide

3.1 Basic Configuration

1. 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, select reading mode as NFC.
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 and displayed as

usual, NH₃ and H₂S values will be shown as “Polarizing” on ToolBox page.

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

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

3.2 LoRaWAN Settings

Configure join type, App EUI, App Key and other information. You can also keep all settings by default.

Device EUI

24E124798C507250

* APP EUI

24e124c0002a0001

* Application Port

- 85 +

Join Type

OTAA

* Application Key

LoRaWAN Version

V1.0.3

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 5 th to 12 th digits of SN.
Network Session Key	Nwkskey for ABP mode, default is 5572404C696E6B4C6F52613230313823.
Application	Appskey for ABP mode, default is 5572404C696E6B4C6F52613230313823.

Session Key													
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. * Support Frequency EU868 Frequency/MHz <table> <tr><td>868.1</td><td>☒</td></tr> <tr><td>868.3</td><td>☒</td></tr> <tr><td>868.5</td><td>☒</td></tr> <tr><td>867.1</td><td>☐</td></tr> <tr><td>867.3</td><td>☐</td></tr> <tr><td>867.5</td><td>☐</td></tr> </table> 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	868.1	☒	868.3	☒	868.5	☒	867.1	☐	867.3	☐	867.5	☐
868.1	☒												
868.3	☒												
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	* Support Frequency US915 Enable Channel Index ⓘ 0-71 <table> <thead> <tr> <th>Index</th><th>Frequency/MHz ⓘ</th></tr> </thead> <tbody> <tr> <td>0 - 15</td><td>902.3 - 905.3</td></tr> <tr> <td>16 - 31</td><td>905.5 - 908.5</td></tr> <tr> <td>32 - 47</td><td>908.7 - 911.7</td></tr> <tr> <td>48 - 63</td><td>911.9 - 914.9</td></tr> <tr> <td>64 - 71</td><td>903 - 914.2</td></tr> </tbody> </table>	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
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												
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 $\leq$ 35 mins: the device will send a specific number of LinkCheckReq MAC packets to the network server every reporting interval or 2*reporting interval to validate connectivity; If there is no response, the device will re-join the network. Reporting interval $>$ 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. Note: Only OTAA mode supports rejoin mode.												
Set the number of packets sent	When rejoin mode is enabled, set the number of LinkCheckReq packets sent. Note: the actual sending number is Set the number of packets sent + 1.												
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.

3.3 Basic Settings

Reporting Interval(min)

Temperature Unit ⓘ

LED Indicator ⓘ ☒

Buzzer ☐

Change Password ☐

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 ₂ S exceeds the threshold.
Buzzer	Disable or enable buzzer for alarming when the value of NH ₃ or H ₂ S 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 to 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

Numerical Calibration:

ToolBox supports numerical calibration for temperature and humidity. The device will add the

calibration value to raw value and report the final values.

Temperature ☒

Current Value(°C)	Final Value(°C)
24	23.9

Calibration Value(°C)

-0.1

Humidity ☐

Zero-point Calibration:

ToolBox supports zero-point calibration for NH_3 and H_2S . When you click the calibration button, the device will calibrate the NH_3 or H_2S value of current environment to 0 ppm. It is recommended to place the device to a clean environment when performing zero calibration.

Ammonia	set to 0
Hydrogen Sulfide	set to 0

Note: Zero-point calibration is supported only when sensor module version is 1.1.2.7 or later. The sensor module version can be checked via sensor ID.

<

Basic Information

Model

GS301-915M

SN

Device EUI

Firmware Version

V1.2

Hardware Version

V1.1

Sensor ID

7462460000000000
0-6034250000000000
00-01010207

3.4.2 Threshold Settings

ToolBox supports 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.

Ammonia ⓘ ☒

Over / ppm

2.00

Hydrogen Sulfide ⓘ ☒

Over / ppm

0.060

Exceed Threshold Reporting Interval(min)

2

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. Enable D2D function, and define an unique Milesight D2D key to be the same as Milesight D2D agent device. (Default Milesight D2D Key: 5572404C696E6B4C6F52613230313823).

Device Network

LoRaWAN D2D

Enable ☒

D2D Key

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 NH₃ or H₂S 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.

Abnormal Odor

Ammonia ⓘ ☐

Hydrogen Sulfide ⓘ ☐

Control command

0

Normal Odor

Ammonia ⓘ ☒

Below or equal to / ppm

2.00

Hydrogen Sulfide ⓘ ☐

Control command

0

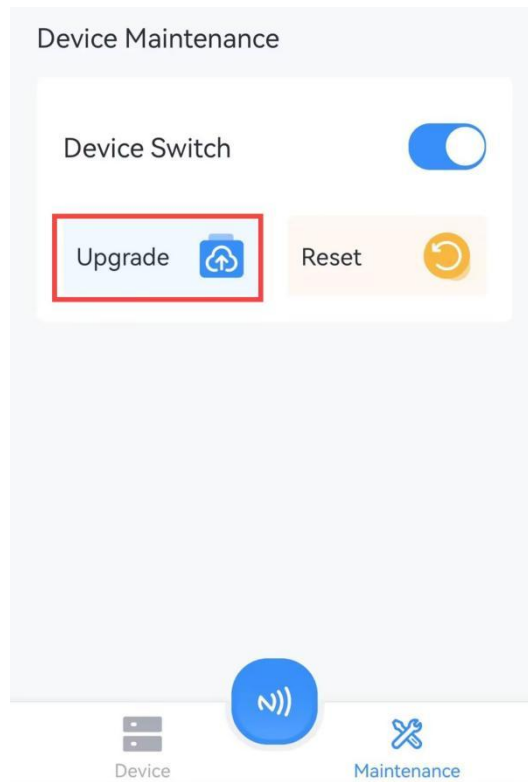
3.5 Maintenance

3.5.1 Upgrade

1. Download firmware from Milesight website to your smartphone.
2. Click **Upgrade** to import firmware and upgrade the device.

Note:

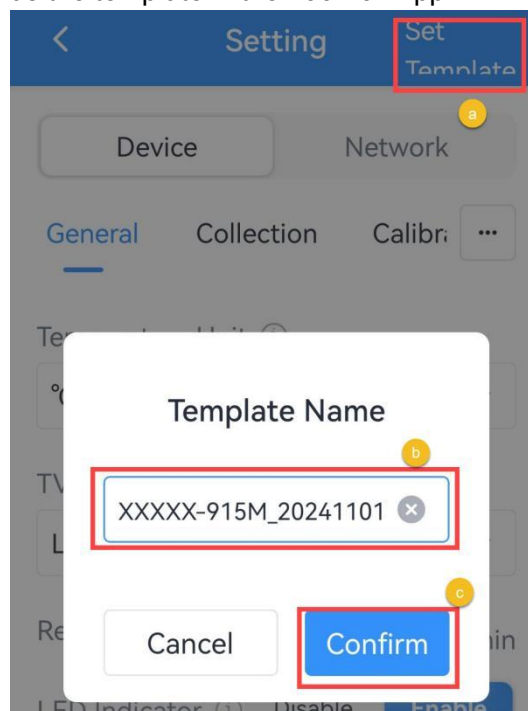
- 1) Operation on ToolBox is not supported during the upgrade.
- 2) Only Android version ToolBox supports the upgrade feature.



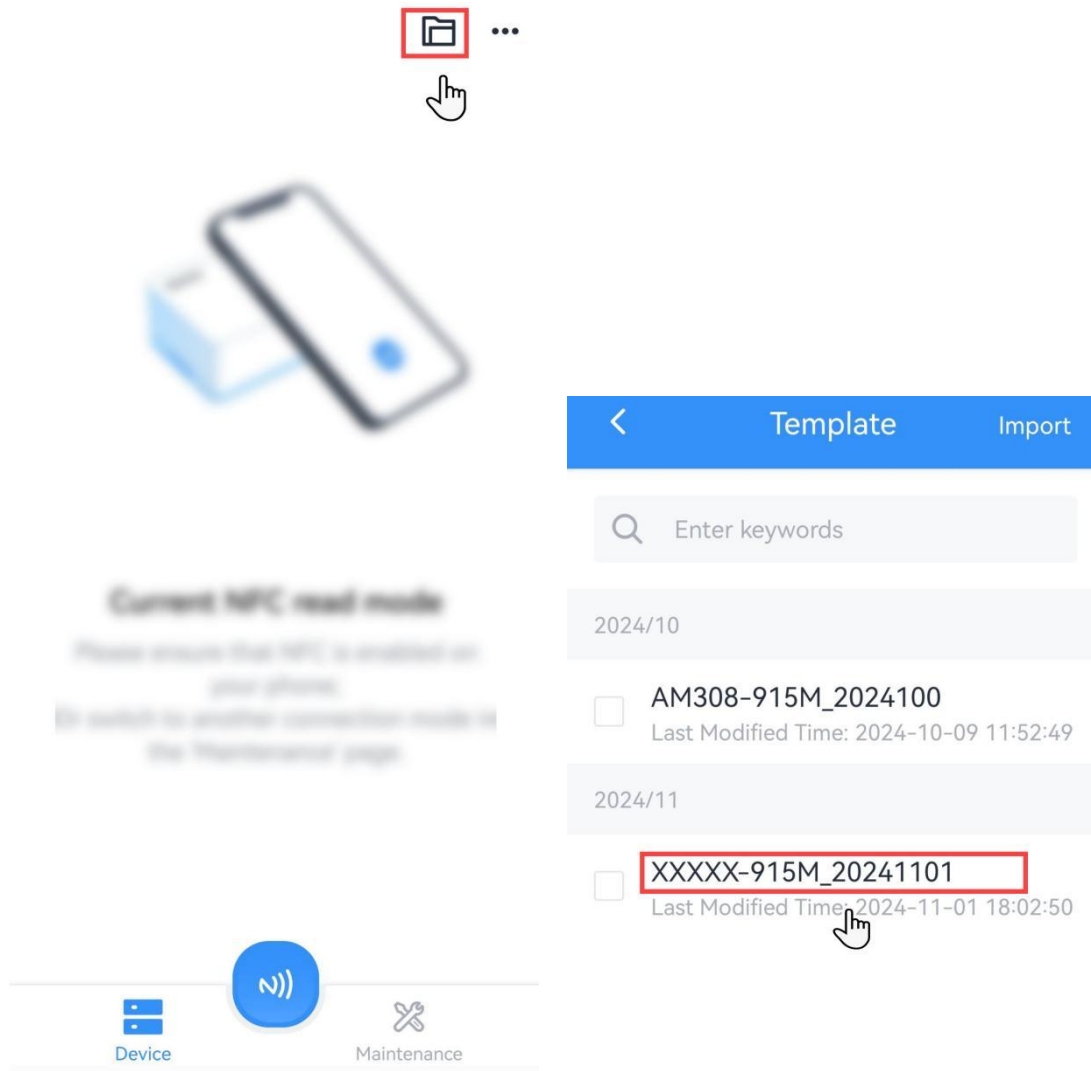
3.5.2 Backup

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.

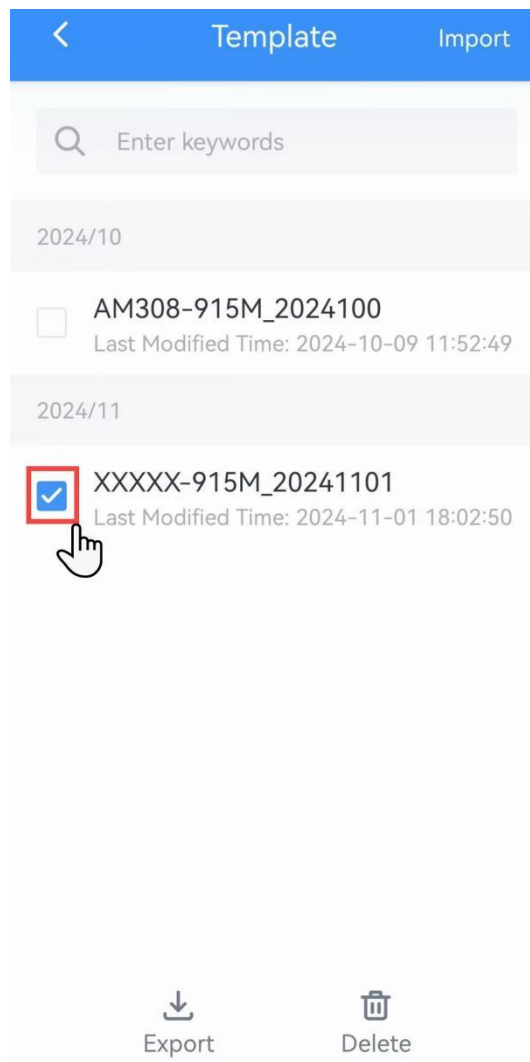
1. Attach the NFC area of smartphone to the device to read the device.
2. Go to **Settings** page on the App to edit the configuration as required, click **Set Template** to save current configuration as the template in the ToolBox App.



3. Go to **Template** page, select and click the target template, then click **Write** and attach the NFC area of smartphone to the target device to import the configuration.



Note: Check the box of target template to delete it, or export this template as JSON format file and save it to the smartphone.

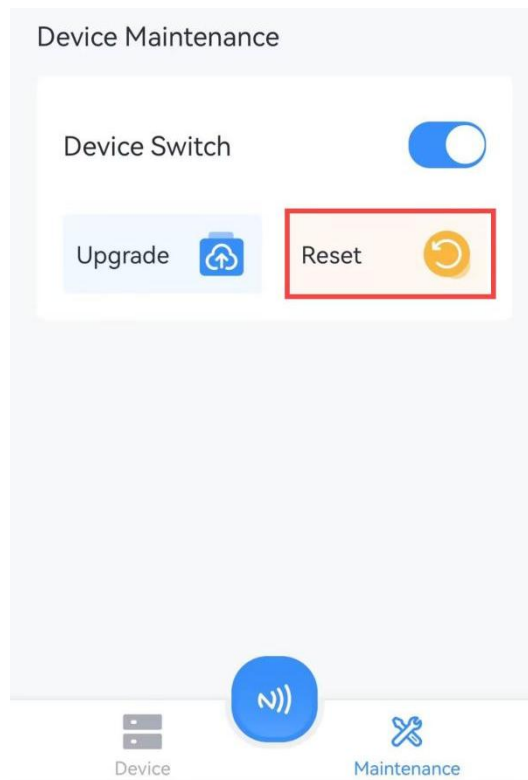


3.5.3 Reset to Factory Default

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: Click **Reset**, then attach smartphone's NFC area to the device.



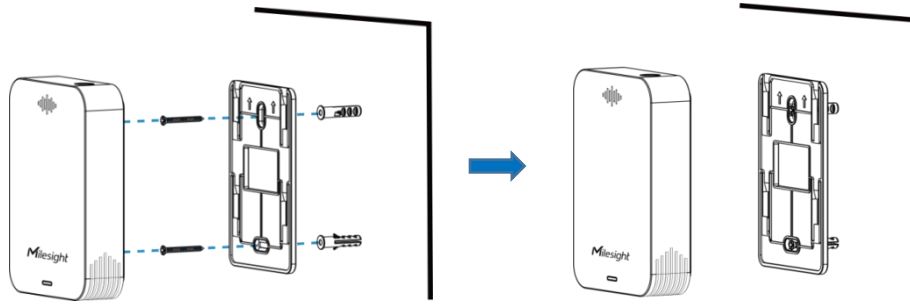
4. Installation

Locations to avoid

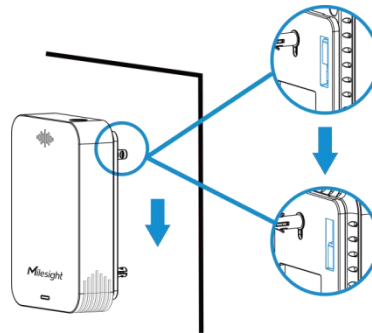
- In a area expect for the operating temperature or larger temperature difference;
- Damp or very humid location expect for operating humidity (0 to 95%);
- The place close to heat source and even sunlight;
- In any outdoor places;
- Dusty or dirty environments may block the air inlets;
- Behind metal 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.



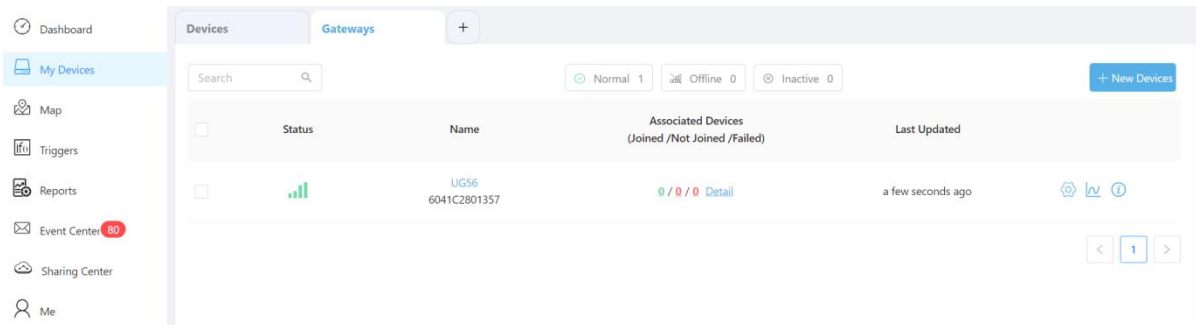
5. Detector Maintenance

- 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 that 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.

Add Device

* SN: 6798C38876450005

* Name: GS301

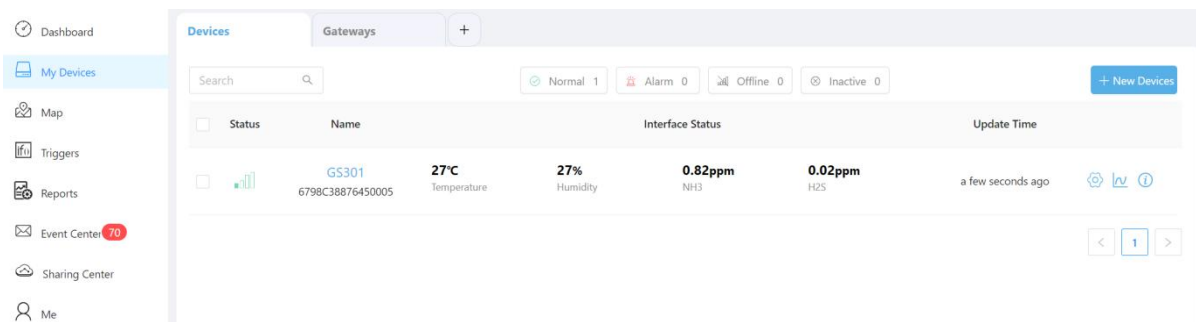
* Associated Gateway: UG56

* Device EUI: 24e124798C388764

* Application Key: 5572404c696e6b4c6f52613230313823

[Cancel](#) [Confirm](#)

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. Communication Protocol

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.

Item	Channel	Type	Description
Protocol Version	ff	01	01=>V1
Hardware Version		09	01 40 => V1.4
Software Version		0a	01 14 => V1.14
Power On		0b	Device is on
Device Type		0f	00: Class A, 01: Class B, 02: Class C
Device SN		16	16 digits
Sensor ID		7c	43 digits, Hex to ASCII Note: when frequency is US915/AU915/AS923 and spreading factor is SF10 or later, the device will not send this ID.

Example:

ff0bff ff0101 ff166798c38876450005 ff090100 ff0a0101 ff0f00					
ff7c3734363234363030303030303030302d36303334323530303030303030303030					
02d303130313032303700					
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)	6798c38876450005	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)
Channel	Type	Value			
ff	7c (Sensor ID)	Hex to ASCII: 7462460000000000 00-603425000000 0000-01010207			

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	INT16/10, Unit: °C

Humidity	03	68	UINT8/2, Unit: %RH
Ammonia (NH ₃)	04	7d	UINT16/100, Unit: ppm
Hydrogen Sulfide (H ₂ S)	05	7d	Note: this only report when firmware version is 1.1. UINT16/100, Unit: ppm
Hydrogen Sulfide (H ₂ S)	06	7d	UINT16/1000, Unit: ppm
Calibration Result	07	ea	5 Bytes, Byte 1: 00=NH ₃ , 01=H ₂ S Byte 2: 00=reset to factory default, 01=set calibration value Byte 3-4: calibration value (set value of current environment), NH ₃ =UINT16/100, H ₂ S=UINT16/1000, unit: ppm Byte 5: 00=calibration success, 01=sensor module not support calibration, 02=sensor connection abnormal

Note: when the sensor reports value as ffff or ff, it means collection error; when the sensor reports value as fffe, it means polarizing.

Examples:

1. Periodic Report:

017564 02670001 036856 047d0200 067d1800					
Channel	Type	Value	Channel	Type	Value
01	75 (Battery Level)	64=>100%	02	67 (Temperature)	00 01=>0100 =>256/10=25.6°C
Channel	Type	Value	Channel	Type	Value
03	68 (Humidity)	56=>86/2 =43%	04	7d(NH ₃)	02 00=>00 02 =2/100=0.02 ppm
Channel	Type	Value	Channel	Type	Value
06	7d (H ₂ S)	18 00=>00 18 =24/1000 =0.024 ppm			

2. Alarm Report:

047dc800		
Channel	Type	Value
04	7d(NH ₃)	c8 00=>00 c8=200/100=2 ppm

3. Zero point calibration result:

07ea0001000000		
Channel	Type	Value
07	ea (Calibration Result)	00=NH ₃ 01=Set calibration value 00 00=>set current environment value as 0 00=calibration success

7.3 Downlink Commands

GS301 supports downlink commands to configure the device. The application port is 85 by default. If the command takes effect, it will reply FE+type+command; if not, it will not send replies.

Item	Channel	Type	Description
Reporting Interval	ff	03	2 Bytes, unit: s
Threshold Alarm		06	9 Bytes, CTRL(1B)+Min. Threshold (2B)+Max. Threshold(2B)+00000000(4B) CTRL: Bit0~Bit2: 000-disable 001-below (minimum threshold) 010-over (maximum threshold) 011-within 100-below or above Bit7~Bit3: id 00001: NH ₃ 00011: NH ₃ (Abnormal Odor threshold in D2D Settings) 00101: NH ₃ (Normal Odor threshold in D2D Settings) 00111: H ₂ S 01000: H ₂ S (Abnormal Odor threshold in D2D Settings) 01001: H ₂ S (Normal Odor threshold in D2D Settings)

			Max./Min. Threshold: NH ₃ =UINT16/100, H ₂ S=UINT16/1000, unit: ppm
Reboot		10	ff
LED Indicator		2f	00: Disable, 01: Enable
Buzzer		3e	00: Disable, 01: Enable
Exceed Reporting Interval		66	2 Bytes, unit: s
Enquire Sensor Lifetime		7d	ff Reply: 00=normal, 01=close to end, 02=end to life
Calibration		8d	4 Bytes, Byte 1: 00=NH ₃ , 01=H ₂ S Byte 2: 00=reset to factory default, 01=set calibration value Byte 3-4: calibration value (set value of current environment), NH ₃ =UINT16/100, H ₂ S=UINT16/1000, unit: ppm

Examples:

1. Set reporting interval as 20 minutes.

ff03b004		
Channel	Type	Value
ff	03 (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 (LED Indicator)	00 (Disable)

4. When NH₃ is over 2ppm, it will trigger the threshold alarm .

ff060a0000c80000000000		
Channel	Type	Value
ff	06 (Threshold Alarm)	CTRL: 0a=>0000 1010 (NH ₃ over threshold) Min: 0000=>0

		Max: $c800 \Rightarrow 00c8 \Rightarrow 200/100 = 2\text{ppm}$
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5. Zero calibration of NH_3 sensor.

ff8d00010000		
Channel	Type	Value
ff	8d (Calibration)	00= NH_3 01=Set calibration value 00 00= $\Rightarrow 0/100 = 0\text{ ppm}$

Reply:

07ea0001000000		
Channel	Type	Value
07	ea (Calibration Result)	00= NH_3 01=Set calibration value 00 00= $\Rightarrow 0/100 = 0\text{ ppm}$ 00=calibration success

6. Enquire the lifetime of the device.

ff7dff		
Channel	Type	Value
ff	7d (Enquire Sensor Lifetime)	ff

Reply:

ff7d00		
Channel	Type	Value
ff	7d (Enquire Sensor Lifetime)	00=Normal

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
0~0.010 ppm	Not perceptible or very weak
0.010~0.060 ppm	Distinct
0.060~0.700 ppm	Strong

0.700~5.000 ppm	Difficult to bear
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