Indoor Ambiance Monitoring Sensor

Featuring LoRaWAN®

AM300(L) Series

User Guide

Applicability

This guide is applicable to AM300(L) series sensors shown as follows, except where otherwise indicated.

Model	Description
AM307(L)	Indoor Ambiance Sensor (Temp, Hum, Light, Motion, CO_2, TVOC, Pressure)
AM308(L)	Indoor Ambiance Sensor (Temp, Hum, Light, Motion, CO_2, TVOC, Pressure, PM2.5, PM10)
AM319(L)	Indoor Ambiance Sensor (Temp, Hum, Light, Motion, CO_2, TVOC, Pressure, PM2.5, PM10, HCHO/O_3)

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. The 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 battery should be removed from the device if it is not to be used for an extended period. Otherwise, the battery might leak and damage the device. Never leave a discharged battery in the battery compartment.
- The device must never be subjected to shocks or impacts.

Declaration of Conformity

AM300(L) series is in conformity with the essential requirements and other relevant provisions of the CE, FCC, and RoHS.

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authorization from Xiamen Milesight IoT Co., Ltd.

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Revision History

Date	Doc Version	Description
Oct.9, 2021	V 1.0	Initial version
Aug. 18, 2022	V1.1	1. Add button lock feature 2. Add downlink commands 3. Add illuminance levels and guidelines
Aug. 22, 2022	V2.0	1. Update TVOC contents based on hardware 2.x 2. Add AM308 model 3. Support data retransmission feature 4. Support downlink commands to ask for historical data
Aug. 31, 2023	V2.1	1. Update mounting bracket picture, delete 86 box mounting 2. Add single channel mode 3. Add AM300L Series
March 29, 2024	V2.2	1. Change the feature of power button; 2. Add CO_2 barometric pressure compensation; 3. Support to adjust TVOC mode; 4. Support downlink command to configure screen content

Contents

1. Product Introduction

1.1 Overview

AM300(L) series is a compact indoor ambience monitoring sensor including motion, humidity, temperature, light, TVOC, CO_2, HCHO/O_3 level, barometric pressure and PM2.5 & PM10 for wireless LoRa network. It is equipped with NFC (Near Field Communication) and can easily be configured via a smartphone or a PC software.

Sensor data are transmitted in real-time using standard LoRaWAN® protocol. LoRaWAN® enables encrypted radio transmissions over long distance while consuming very little power. The user can obtain sensor data and view the trend of data change through Milesight IoT Cloud or through the user's own Network Server.

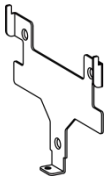
1.2 Features

- Robust LoRaWAN® connectivity for indoor or HVAC environments
- Integrated multiple sensors like temperature, humidity, light, air quality, etc.
- Easy configuration via NFC
- Multiple display mode and clear emoticon on the e-ink screen
- Equipped with traffic light and buzzer to indicate threshold
- Milesight IoT Cloud compliant
- Battery or DC power supply

2. Hardware Introduction

2.1 Packing List

1 × AM300(L) Series Device

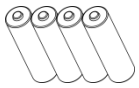


1 × Mounting Bracket

1 × 3M Double-Sided Tape

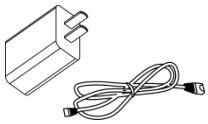
3 × Wall Mounting Kits

1 × Theft-Deterring Screw



4 ×

ER14505 Li-SOCl$_2$ Batteries (AM30x(L) Only)



1 ×

Type-C Cable (1.2 m) & Power Adapter (AM319(L) Only)

1 ×

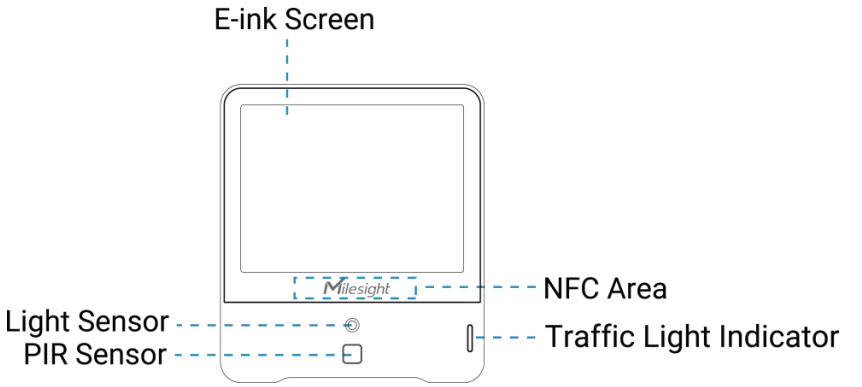
Quick Guide

1 ×

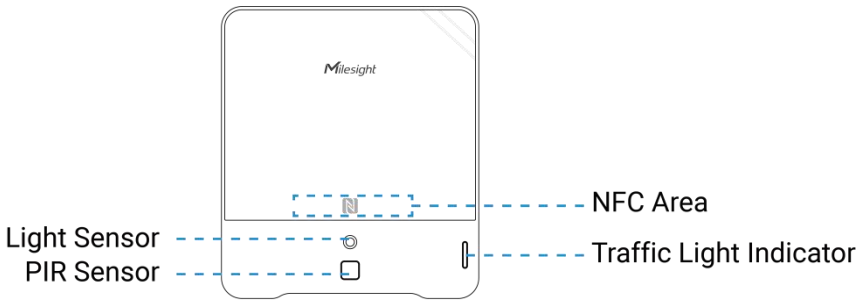
Warranty Card

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

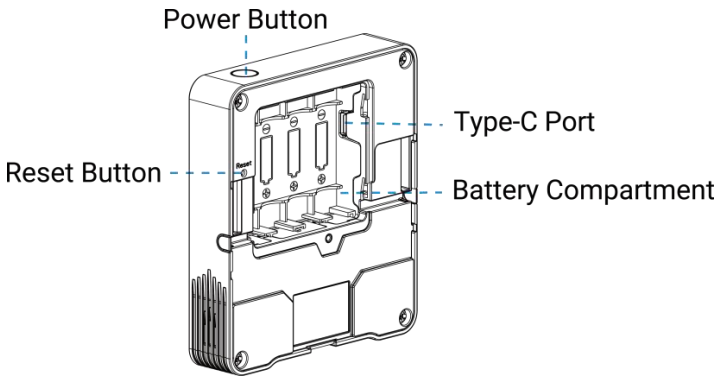
2.2 Hardware Overview



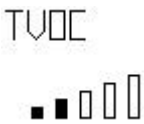
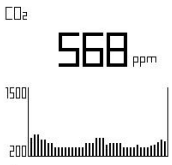
AM300 Series



AM300L Series



2.3 E-ink Screen Description (AM300 Series Only)

Icon	Description
	Battery level (AM30x Only)
	Battery is exhausted (AM30x Only).
	Sync time with software or mobile App.
	The device joins the network.
	The device fails to join the network.
	Temperature
	Humidity
	Level 0：0-5 lux Level 1：6-50 lux Level 2：51-100 lux Level 3：101-500 lux Level 4：501-2000 lux Level 5：> 2000 lux
	Level 0：≤1.99 Level 1：2.00-2.50 Level 2：2.51-2.99 Level 3：3.00-3.99 Level 4：4.00-4.99 Level 5：≥5.00
	Show CO_2 levels history tendency from 200 to 1500 ppm
	CO_2/TVOC/PM2.5/PM10/HCHO/O_3 exceeds the Polluted threshold
	CO_2/TVOC/PM2.5/PM10/HCHO/O_3 exceeds the Bad threshold
	Excellent Environment
	When one of the concentrations of air pollutants of CO_2, TVOC, PM2.5, PM10, HCHO/O_3 exceeds the Polluted threshold
	When one of the concentrations of air pollutants of CO_2, TVOC, PM2.5, PM10, HCHO/O_3 exceeds the Bad threshold

Note:

- AM300 series will update screen data every 1 minute and do a full-screen refresh every 30 minutes (AM319) or 60 minutes (AM307 and AM308) in order to remove ghosting.
- When AM300 series detects the temperature beyond the range from 0°C to 40°C, the screen will close automatically.
- The screen display mode can be adjusted via ToolBox or downlink command, the display content can be configured via downlink commands.
- The emoticon definition is related to threshold settings.

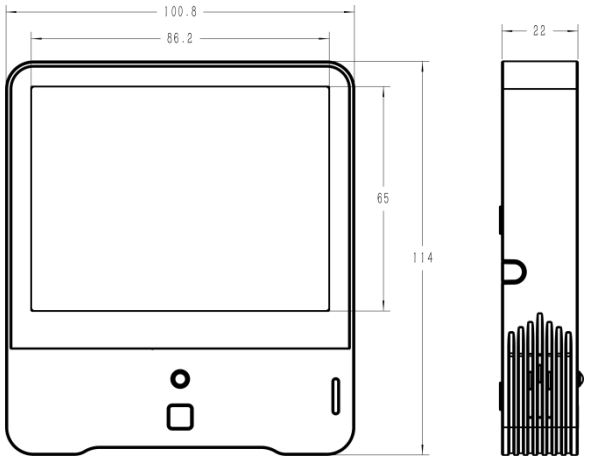
2.4 Button and Traffic Light

Function	Action	Light Status
Power ON/OFF	Press and hold the power button for more than 3 seconds.	Power On: Off → On
		Power Off: On → Off
Refresh Screen Display Data	Quick press the power button once.	Blinks once
Reset to Factory Default	Press and hold the reset button for more than 10 seconds.	Quickly Blinks
Air Quality Level Indication	Indicate the 3 levels of air quality according to threshold setting. When one of the concentrations of air pollutants of CO_2, TVOC, PM2.5, PM10 or HCHO/O_3 exceeds the threshold, the light color will change to orange or red	Excellent: Blinks/Always On (Configurable)
		Polluted: Blinks/Always On (Configurable)
		Bad: Blinks/Always On (Configurable)

Note:

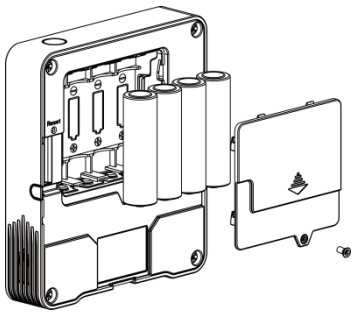
- If the traffic light is disabled, it will not show air quality level indication.
- AM319(L) supports Traffic Light as Blinking or Always On to indicate Polluted or Bad indoor ambience, while AM307(L) and AM308(L) only support Blinking mode.

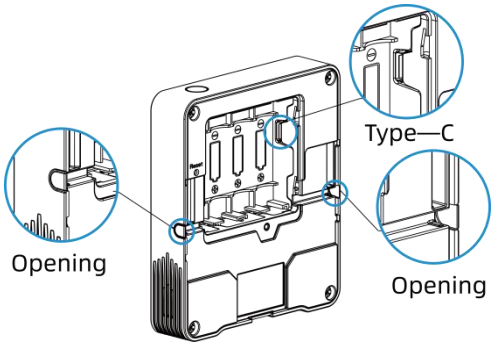
2.5 Dimensions(mm)



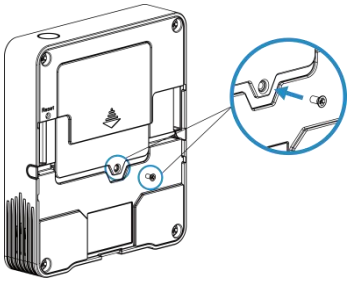
3. Power Supply

1. Release the screw at the back of device and remove the rear cover.
2. Install the batteries or type-C cable to the device. If the device is powered via type-C port, then left or right side should make an opening to pass through the type-C cable.





3. Fix the rear cover back to device with the fixing screw.



Note:

- AM307(L) and AM308(L) can be powered via USB type-C port or by ER14505 Li-SOCl$_2$ batteries. When batteries and external power are both used, external power will be the preferred power supply option.
- AM319(L) supports powered via USB type-C port only.
- Type-C port can't be used to charge battery.
- Make sure all batteries are newest when install, or battery life will be reduced.

4. Operation Guide

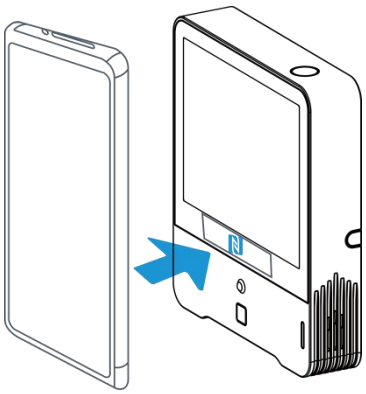
4.1 Log in the ToolBox

AM300(L) series can be monitored and configured via ToolBox App or ToolBox software. Please select one of them to complete configuration.

4.1.1 NFC Configuration

1. Download and install Milesight ToolBox App from Google Play or Apple App Store.
2. Enable NFC on the smartphone and launch Milesight ToolBox.
3. Attach the smartphone with NFC area to the device, click **NFC Read** 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. In order to protect the security of the device, please change password when first configuration. The default password is **123456**.



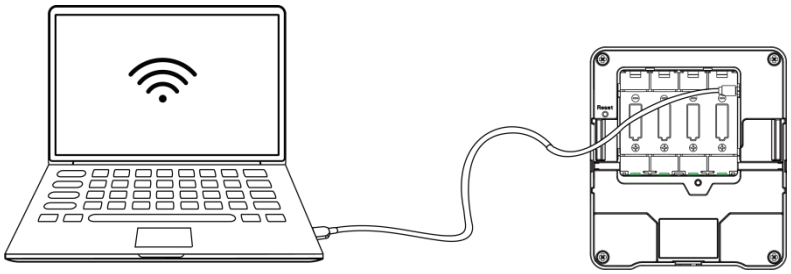
Note:

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

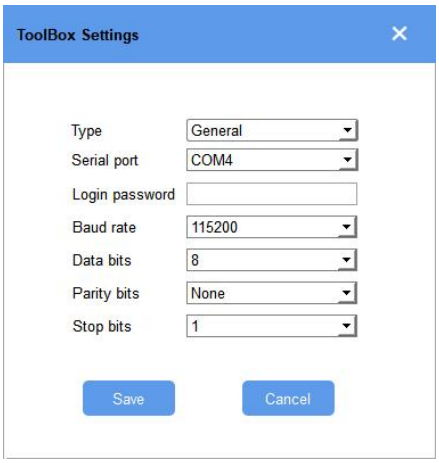
2) If the smartphone fails to read/write configurations via NFC, keep the phone away and back to try again.

4.1.2 USB Configuration

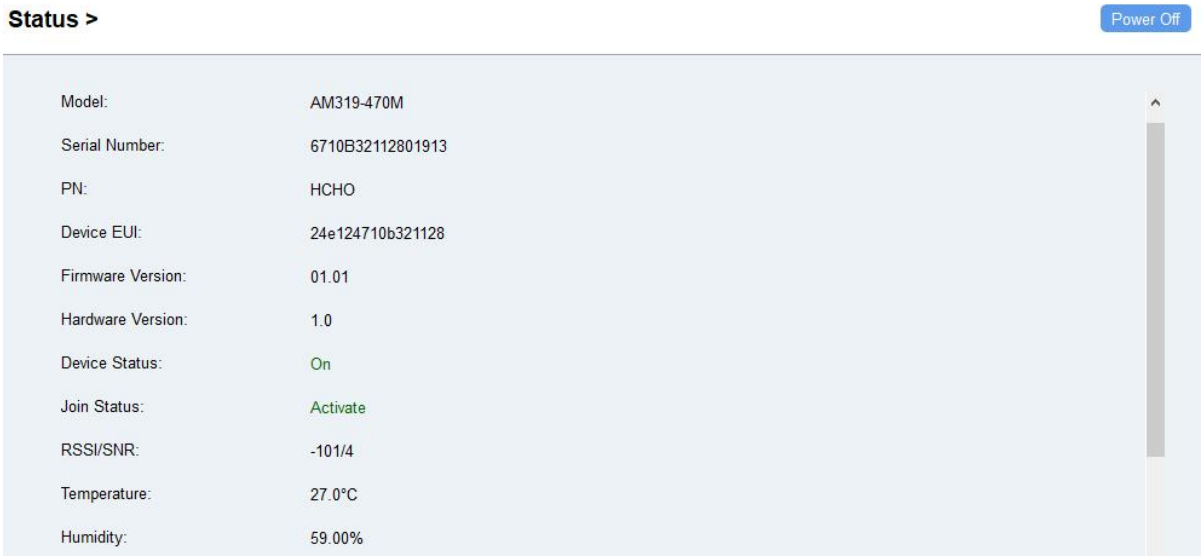
1. Download ToolBox software from Milesight official website.
2. Connect the device to a computer via Type-C port.



3. Open the ToolBox and select type as **General**, then click password to log in ToolBox. (Default password: **123456**)



4. After logging in the ToolBox, users can turn on/off device and change other settings.

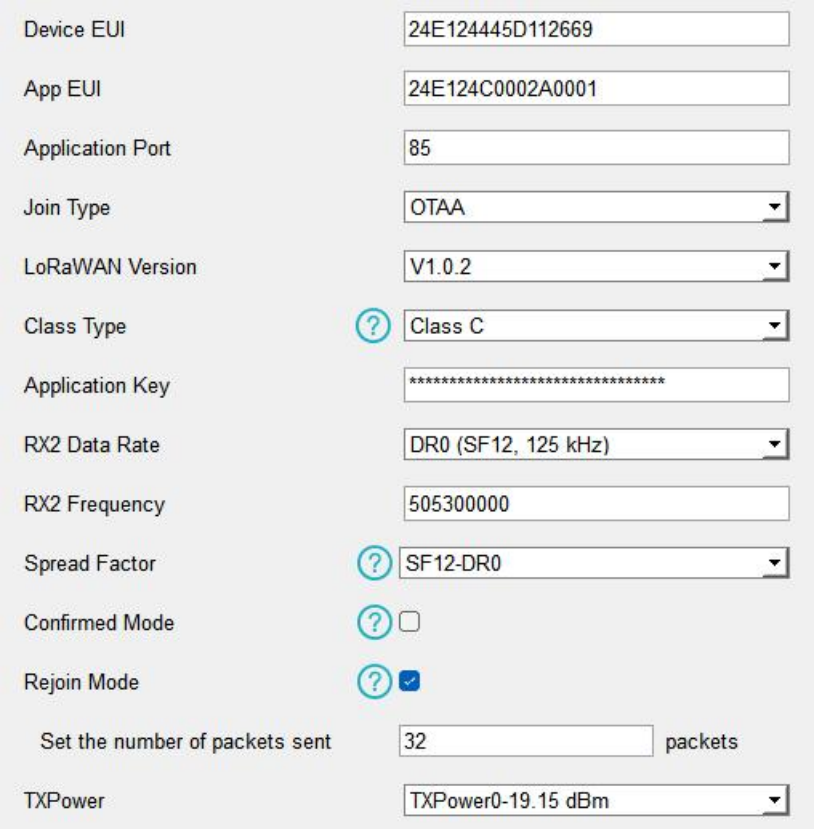


4.2 LoRaWAN Settings

LoRaWAN settings is used for configuring the transmission parameters in LoRaWAN® network.

Basic LoRaWAN Settings:

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, default port is 85.
Join Type	OTAA and ABP mode are available.
LoRaWAN Version	V1.0.2, V1.0.3 are available.
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 Key	Nwkskey for ABP mode, default is 5572404C696E6B4C6F52613230313823.
Application Session Key	Appskey for ABP mode, default is 5572404C696E6B4C6F52613230313823.
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 network server, it will resend data once.
Rejoin Mode	Reporting interval ≤ 35 mins: the device will send a specific number of LinkCheckReq 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. 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.
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 packet sent** + 1.
ADR Mode	Allow network server to adjust datarate of the device.
Tx Power	Transmit power of the device.

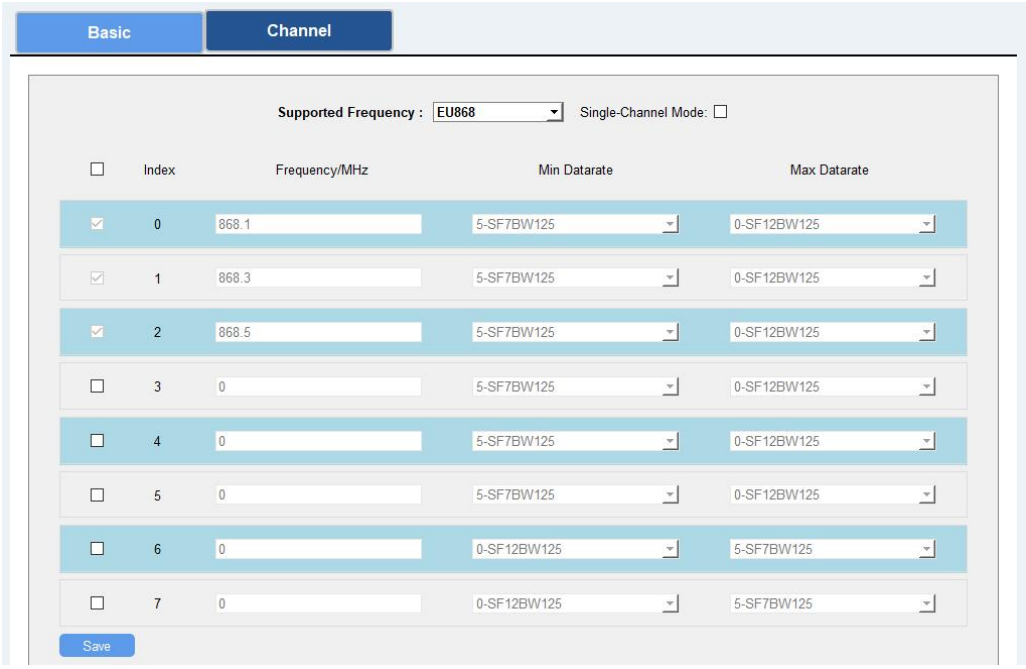
Note:

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.

LoRaWAN Frequency Settings:

Select supported frequency and select channels to send uplinks. Make sure the channels match the LoRaWAN® gateway.

Note: When Single-Channel Mode is enabled, only one channel can be selected to send uplinks and the ADR will not work. Please enable Single-Channel Mode if you connect device to DS7610.

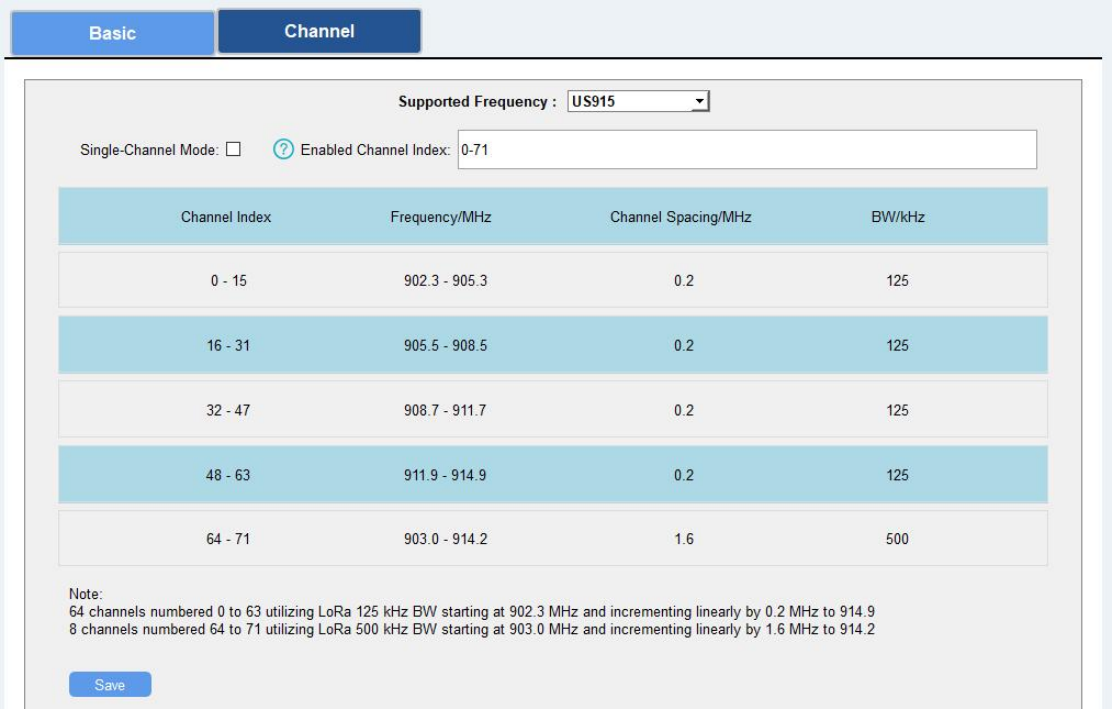


If frequency is one of CN470/AU915/US915, you can enter the index of the channel that you want to enable in the input box, making them separated by commas.

Examples:

1, 40: Enabling Channel 1 and Channel 40

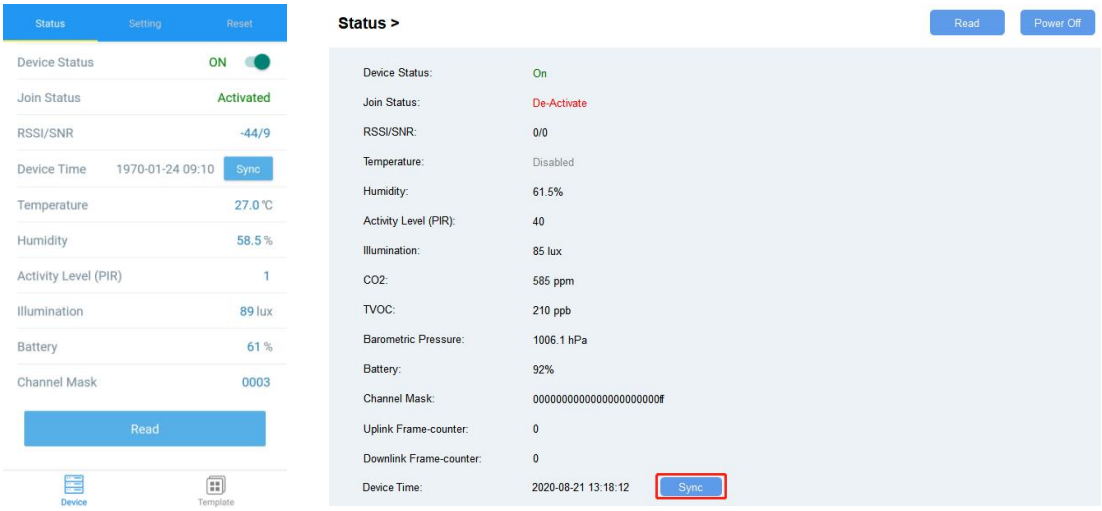
1-40: Enabling Channel 1 to Channel 40
1-40, 60: Enabling Channel 1 to Channel 40 and Channel 60
All: Enabling all channels
Null: Indicates that all channels are disabled



4.3 Time Synchronization

ToolBox Sync:

Go to **Device > Status** of ToolBox App to click **Sync** to sync the time, or go to **Status** page of ToolBox software to sync the time.



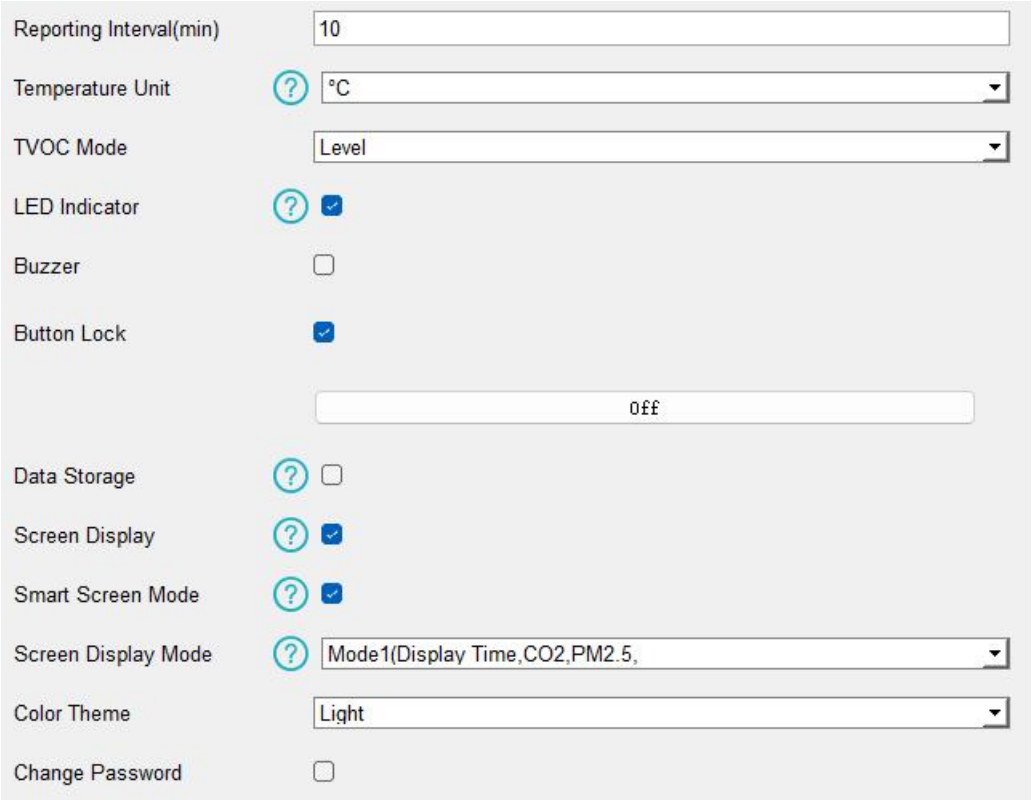
Network Server Sync:

Go to **LoRaWAN Settings > Basic** of ToolBox software or **Device > Settings > LoRaWAN Settings** of ToolBox App to change device LoRaWAN® version as 1.0.3, then the device will send MAC

commands to enquire the time from network server every time it joins the network. This should ensure the network server supports this feature.

4.4 Basic Settings

Go to **Device Settings > Basic** of ToolBox software or **Device > Settings > General Settings** of ToolBox App to change the reporting interval, screen mode, etc.



Parameters	Description
Reporting Interval	Reporting interval of transmitting current sensor values and battery level to network server. Default: 10 mins, Range: 1-1080 mins
Temperature Unit	Change the displayed unit of temperature data. **Note:** 1) The temperature unit in the reporting package is fixed as °C. 2) Please modify the threshold settings if the unit is changed.
TVOC Mode	Change the unit of reported and displayed TVOC data.
LED Indicator	Enable or disable the traffic light indicator to indicate air quality level. **AM307(L) & AM308(L):** Blink **AM319(L):** Always On, Blink
Buzzer	Enable or disable the buzzer. If enabled, the buzzer will response when one of concentrations of air pollutants exceeds the **Bad** threshold. It will

	automatically stop when the concentration values are lower than the Bad threshold.
Check Button	When enabled, users can press the power button to stop the buzzer beep.
Button Lock	When enabled, users can choose to lock the feature of power button: refresh display, power on, or power off.
Data Storage	Disable or enable data storage locally.
Data Retransmission	Disable or enable data retransmission.
Change Password	Change the password for ToolBox App or software to read/write this device.
AM300 Series Only	
Screen Display	Disable or enable screen display.
Smart Screen Mode	When PIR value is 0 (Vacant) and last for 20 mins, the screen will stop updating to save power.
Screen Display Mode	Select the screen display contents. **AM307** Mode 1: Time&Date, CO_2, Temperature, Humidity Mode 2: CO_2, Temperature, Humidity, TVOC, light Mode 3: Time&Date, CO_2, Temperature, Humidity, TVOC, light **AM308** Mode 1: Time&Date, CO_2, PM2.5&PM10, Temperature, Humidity Mode 2: CO_2, PM2.5&PM10, Temperature, Humidity, TVOC, light Mode 3: Time&Date, CO_2, PM2.5&PM10, Temperature, Humidity, TVOC, light **AM319** Mode 1: Time&Date, CO_2, PM2.5&PM10, Temperature, Humidity Mode 2: CO_2, PM2.5&PM10, $HCHO/O_3$, Temperature, Humidity, TVOC, light Mode 3: Time&Date, CO_2, PM2.5&PM10, $HCHO/O_3$, Temperature, Humidity, TVOC, light **Note:** when TVOC mode is concentration, light will not included in the display mode.
Color Theme	Select screen display background color as Light or Dark.

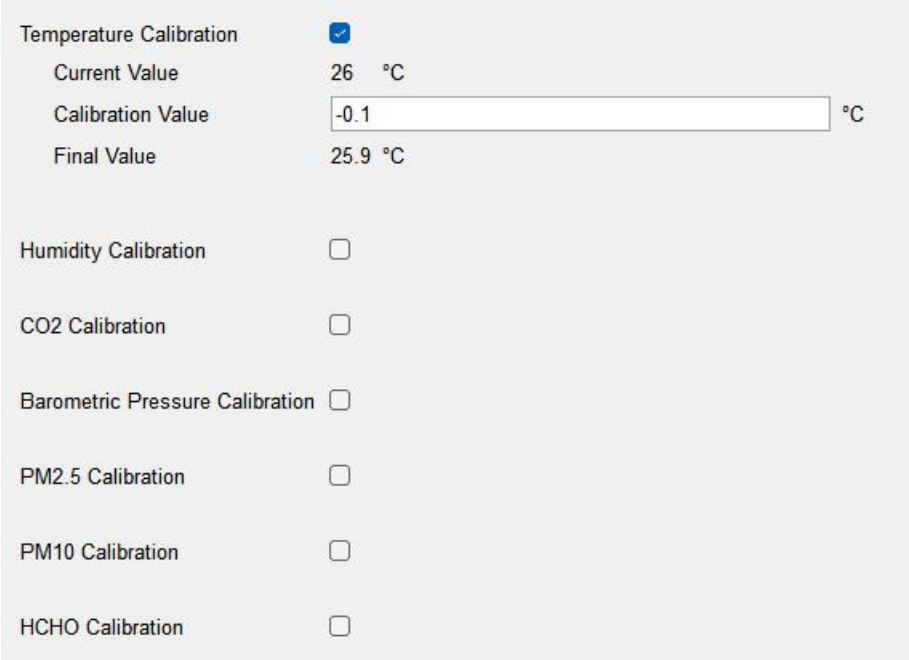
4.5 Advanced Settings

4.5.1 Data Collection Settings

Go to **Device Settings > Basic** of ToolBox software or **Device > Settings > Data Collection Settings** of ToolBox App to select the data you need to monitor. Among them, temperature, humidity and CO_2 are not allowed to disable. If any item is disabled, it will disappear from the screen.

4.5.2 Calibration Settings

ToolBox supports numerical calibration for all items. Go to **Device Settings > Basic** of ToolBox software or **Device > Settings > Calibration Settings** of ToolBox App to type the calibration value and save, the device will add the calibration value to raw value.



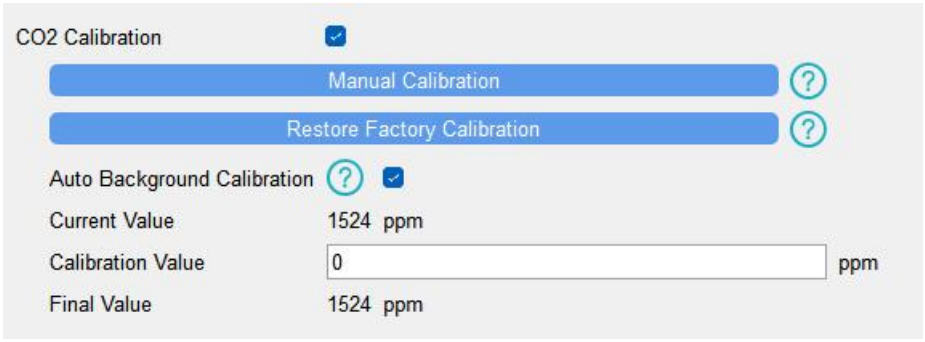
Besides numerical calibration, ToolBox provides more calibration methods for CO_2:

Manual Calibration: Put the device in an open outdoor environment for more than 10 minutes and click this button to calibrate the CO_2 value.

Restore Factory Calibration: Clean the manual calibration and turn back to factory calibration.

Auto Background Calibration: When enabled, keep the device work in a well-ventilated environment for 180 hours (around 7 days), then disable the calibration.

Barometric Pressure Compensation: this only works when barometric sensor is enabled.



4.5.3 Threshold Settings

Go to **Device Settings > Basic** of ToolBox software or **Device > Settings > Threshold Settings** of ToolBox App to enable the threshold settings and input the threshold.

For temperature, it will upload the current data once instantly when temperature is over or below the threshold. Note that when you change the temperature unit, please re-configure the threshold.

For CO_2, TVOC, PM2.5, PM10 and HCHO/O_3, it supports defining Excellent, Polluted and Bad threshold for traffic light, buzzer and screen alarms. Besides, when one of concentrations of air pollutants exceeds the Bad threshold, AM300 series will upload the current data once instantly.

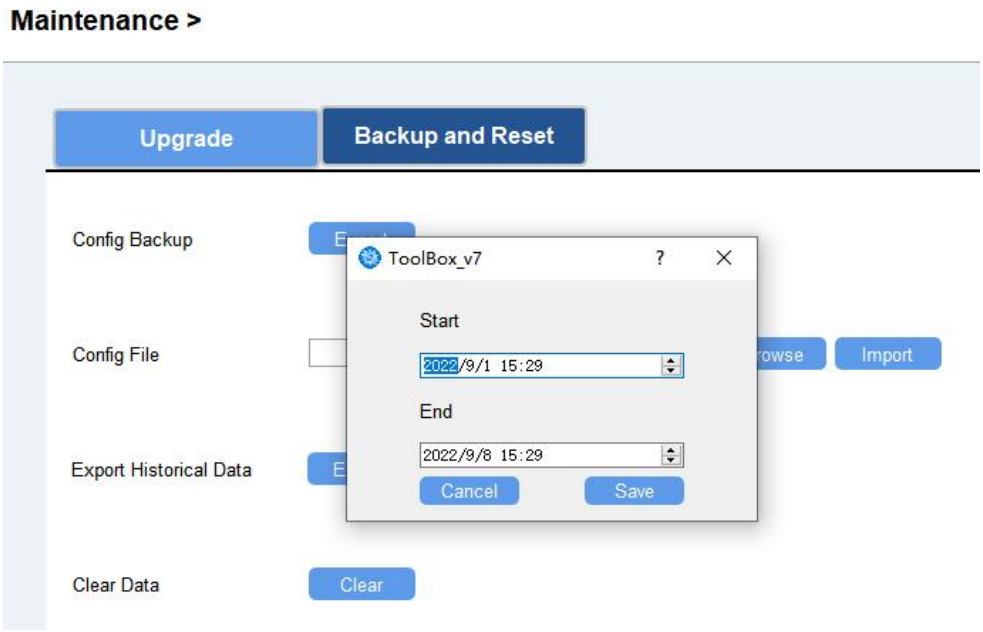
4.5.4 Data Storage

AM300(L) series supports storing more than 18000 data records locally and exports data via ToolBox App or ToolBox software. The device will record the data according to reporting interval even not joining network.

1. Ensure the device time is correct (see section Time Synchronization);
2. Go to **Device Settings > Basic** of ToolBox software or **Device > Settings > General Settings** of ToolBox App to enable data storage feature.
3. Go to **Maintenance > Basic** of ToolBox software or **Device > Maintenance** of ToolBox App, click **Export**, then select the data time range and click **Save** to export data.

Note: ToolBox App can only export last 14 days' data. If you need to export more data, please use ToolBox software.

4. Click **Clear** to clear all stored data inside the device.



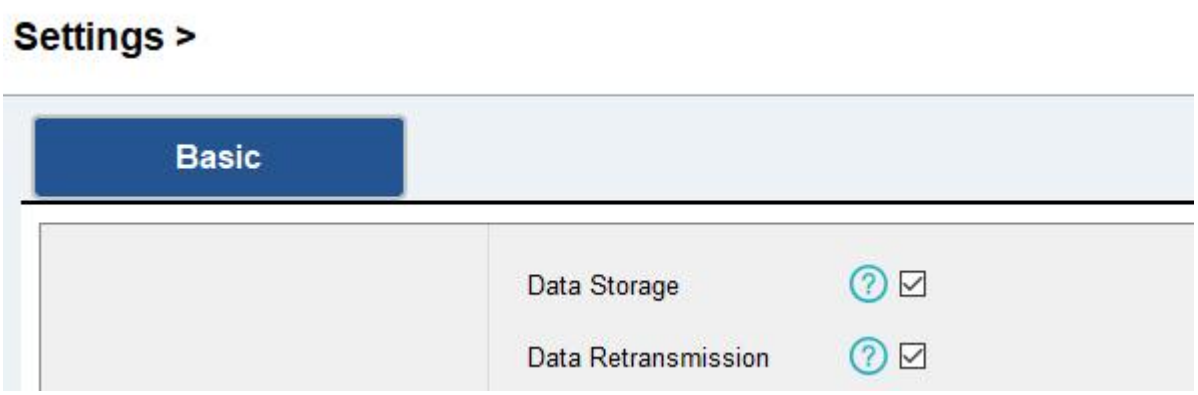
4.5.5 Data Retransmission

AM300(L) series sensor supports data retransmission to ensure network server can get all data even if network is down for some times. There are two ways to get the lost data:

- Network server sends downlink commands to enquire the historical data for specifying time range, see section Historical Data Enquiry;
- When network is down if no response from LinkCheckReq MAC packets for a period of time, the device will record the network disconnected time and re-transmit the lost data after device re-connects the network.

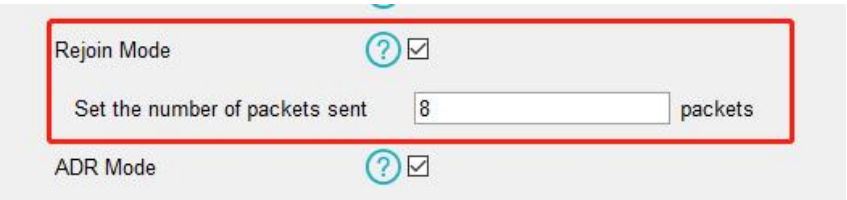
Here are the steps for data retransmission:

1. Enable data storage feature and data retransmission feature;



2. Enable rejoin mode feature and set the number of packets sent. Take below as example, the device will send LinkCheckReq MAC packets to the network server regularly to check if the network is disconnected; if there is no response for 8+1 times, the join status will change to

de-active and the device will record a data lost time point(the time to join the network).



3. After the network connected back, the device will send the lost data from the point in time when the data was lost according to the reporting interval.

Note:

1) If the device is rebooted or re-powered when data retransmission is not completed, the device will re-send all retransmission data again after device is reconnected to the network;

2) If the network is disconnected again during data retransmission, it will only send the latest disconnection data;

3) The retransmission data format is started with "20ce", please refer to see section Historical Data Enquiry.

4) Data retransmission will increase the uplinks and shorten the battery life.

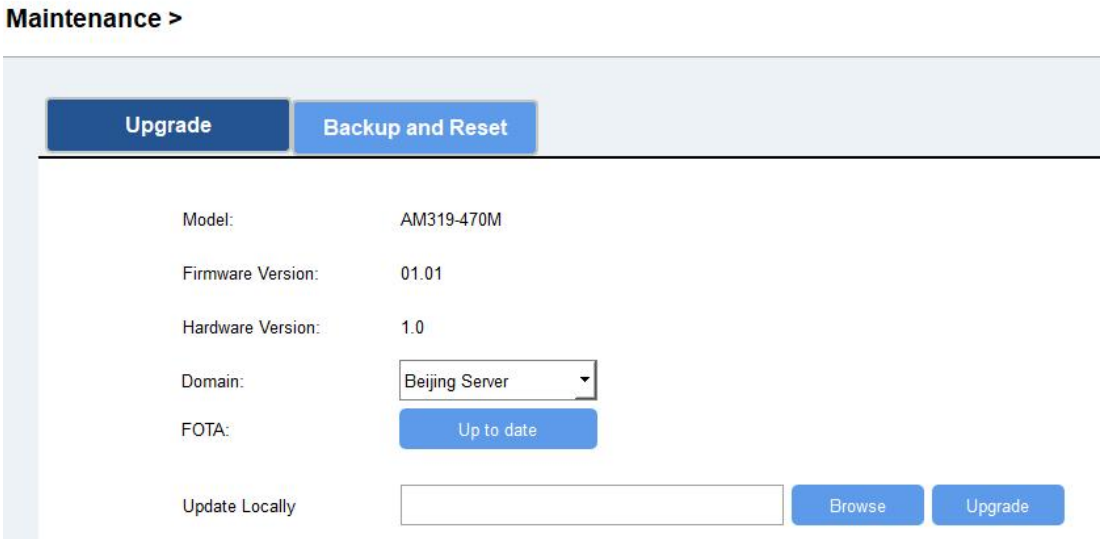
4.6 Maintenance

4.6.1 Upgrade

ToolBox Software:

1. Download firmware from Milesight official website to your PC.

2. Go to **Maintenance > Upgrade** of ToolBox software, click **Browse** to import firmware and upgrade the device.

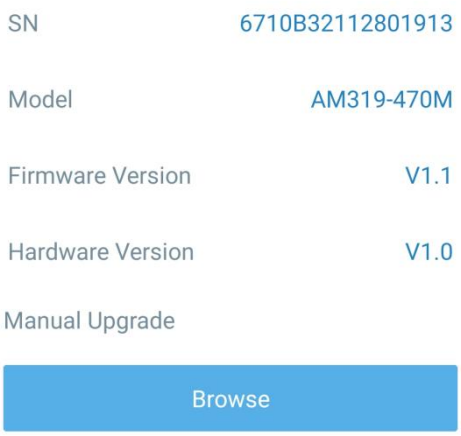


ToolBox App:

1. Download firmware from Milesight official website 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.

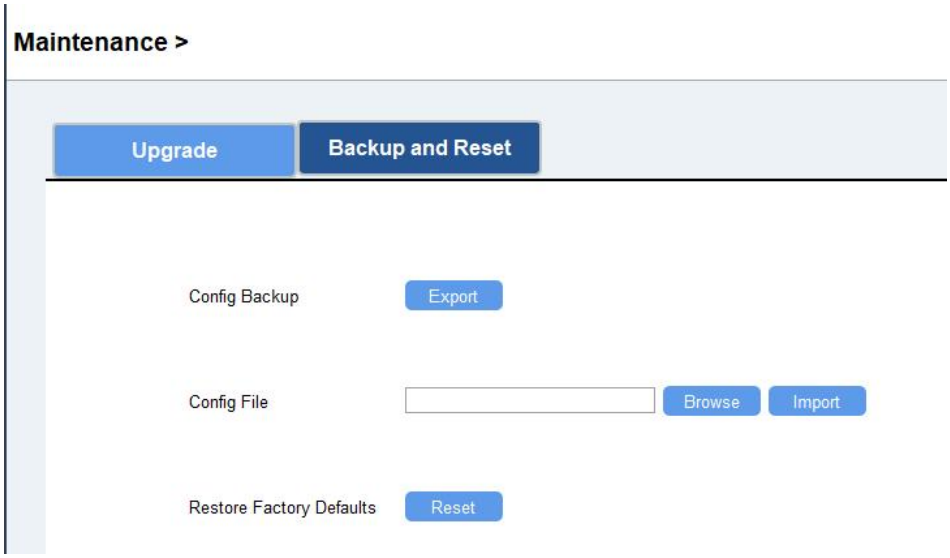


4.6.2 Backup

AM300(L) series 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.

ToolBox Software:

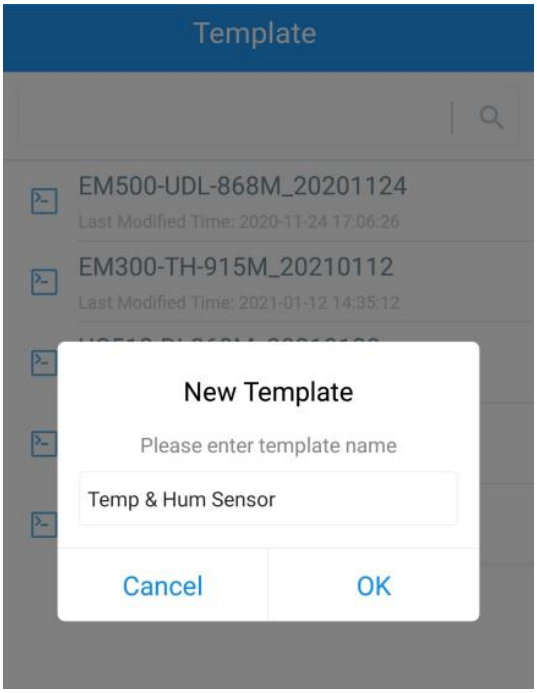
1. Go to **Maintenance > Backup and Reset** of ToolBox software, click **Export** to backup the device configuration.
2. Click **Browse** to import the backup file, then click **Import** to load the configuration.



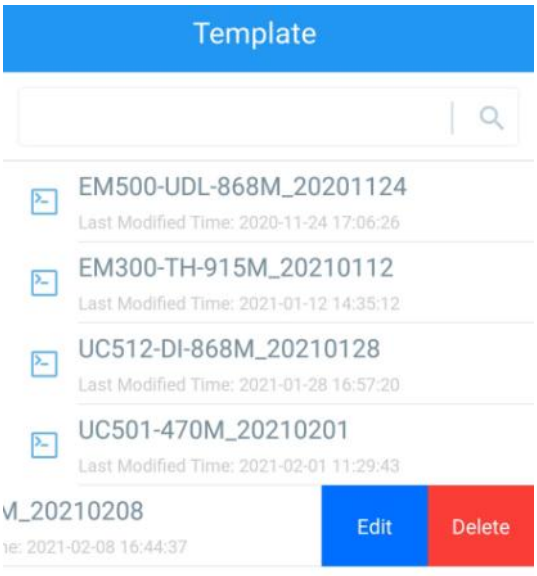
ToolBox App:

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 saved in the smartphone and click **Write**, then attach it to another device to write configuration.



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



4.6.3 Reset to Factory Default

Please select one of following methods to reset device:

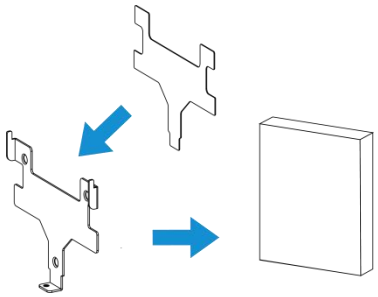
Via Hardware: Hold on reset button more than 10s.

Via ToolBox Software: Go to **Maintenance > Backup and Reset** to click **Reset**.
Via ToolBox App: Go to **Device > Maintenance** to click **Reset**, then attach smart phone with NFC area to device to complete reset.

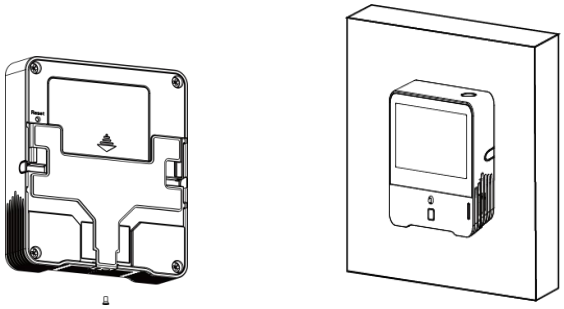
5. Installation

Fixed by 3M Tape:

1. Paste 3M tape to the back of the mounting bracket, then tear the other side and place it on a flat surface.

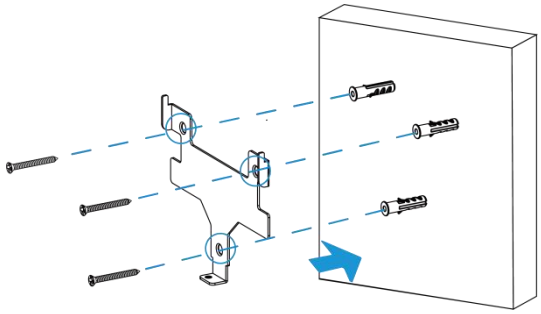


2. Put the device on the mounting bracket, then fix the bottom of the device to the bracket with the theft-deterring screw.

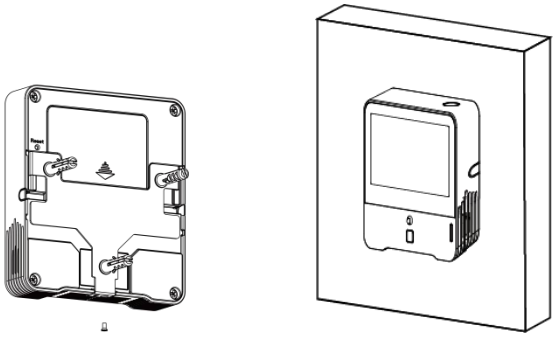


Fixed by Screws:

1. Fix the wall plugs into the wall, then fix the mounting bracket to the wall plugs with screws.



2. Put the device on the mounting bracket, then fix the bottom of the device to the bracket with a fixing screw.



Note:

In order to ensure the best detection and LoRaWAN® communication effect, it is recommended to install AM300(L) series as follows:

- There should not be any isolates or barriers in PIR and light detection range.
- Do not mount the device where the temperature is below/above operating range and temperature varies greatly.
- Stay far away from any heat source or cold source like oven, refrigerator.
- Do not mount the device close to where airflow varies greatly like windows, vent, fan and air conditioner.
- Do not mount the device upside down.
- Do not place the device right to the window or door. If you have to, you'd better pull the curtain.
- It is recommended to install at least 1.5 m high from floor.

6. Device Maintenance

- The working life of HCHO sensor is 6 years, and the working life of O_3 sensor is 2 years. Please contact Milesight to purchase sensor replacement chips and remove the back cover of device to replace the sensors.
- 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.
- During the transportation and storage, do not take the device out of default antistatic bags.
- It is suggested to place device under well-ventilated environment, otherwise the accuracy of TVOC will drop.
- There is possible TVOC accuracy drift if you store without power for a long time in different devices. 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

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.

6.1 Basic Information

AM300(L) series 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
	2e (LED Mode)	00: Off, 01: Always On, 02: Blink
	3e (Buzzer)	00: Off, 01: On

Example:

ff166710b32620711912 ff090200 ff0a0101 ff0f02					
Channel	**Type**	**Value**	**Channel**	**Type**	**Value**
ff	16 (Device SN)	6710b32620711912	ff	09 (Hardware version)	0200 (V2.0)
Channel	**Type**	**Value**	**Channel**	**Type**	**Value**
ff	0a (Software version)	0101 (V1.1)	ff	0f (Device Type)	02 (Class C)

6.2 Sensor Data

AM300(L) series sensors report sensor data according to reporting interval (10mins by default).

Item	Channel	Type	Description
Battery Level	01	75	UINT8, Unit: %, AM30x(L) Only

Temperature	03	67	INT16/10, Unit: °C
Humidity	04	68	UINT8/2, Unit: %RH
PIR Status	05	00	01: Occupied 00: Vacant
Light Level	06	cb	00：0-5 lux 01：6-50 lux 02：51-100 lux 03：101-500 lux 04：501-2000 lux 05：> 2000 lux
CO_2	07	7d	UINT16, Unit: ppm
TVOC Level	08	7d	UINT16/100
TVOC Concentration	08	e6	UINT16, unit: μg/m³
Barometric Pressure	09	73	UINT16/10, Unit: hPa
HCHO	0a	7d	UINT16/100, Unit: mg/m³
PM 2.5	0b	7d	UINT16, Unit: μg/m³
PM 10	0c	7d	UINT16, Unit: μg/m³
O_3	0d	7d	UINT16, Unit: ppm
Buzzer Status	0e	01	00: buzzer is disabled 01: buzzer is beeping Note: this only upload when one of the concentrations of air pollutants of CO_2, TVOC, PM2.5, PM10, HCHO/O_3 exceeds the Bad threshold

Example:

1. AM307 Periodic Package

0367ea00 04688a 050001 06cb01 077dcd04 087d5e01 09735127					
Channel	**Type**	**Value**	**Channel**	**Type**	**Value**
03	67 (Temperature)	ea 00 => 00 ea = 234 Temp=234/10=23.4°C	04	68 (Humidity)	8a=>138 Hum=138/2=69%RH
Channel	**Type**	**Value**	**Channel**	**Type**	**Value**
05	00	01: Occupied	06	cb (Light Level)	01= level 1 (6-50 lux)

Channel	**Type**	**Value**	**Channel**	**Type**	**Value**
07	7d	cd 04 => 04 cd =1229 ppm (CO_2)	08	7d	5e 01 => 01 5e =350 TVOC Level=350/100 =3.50
Channel	**Type**	**Value**			
09	73 (Barometric Pressure)	51 27=>27 51=10044 Pressure=10065 /10=1006.5 hPa			

2. AM308 Periodic Package

0367ea00 04688a 050001 06cb01 077dcd04 087d5e01 09735127 0b7d3b00 0c7d4300					
Channel	**Type**	**Value**	**Channel**	**Type**	**Value**
03	67 (Temperature)	ea 00 => 00 ea = 234 Temp=234/10=23.4°C	04	68 (Humidity)	8a=>138 Hum=138/2 =69%RH
Channel	**Type**	**Value**	**Channel**	**Type**	**Value**
05	00	01: Occupied	06	cb (Light Level)	01= level 1 (6-50 lux)
Channel	**Type**	**Value**	**Channel**	**Type**	**Value**
07	7d	cd 04 => 04 cd =1229 ppm (CO_2)	08	7d	5e 01 => 01 5e =350 TVOC=350*0.01=3.50
Channel	**Type**	**Value**	**Channel**	**Type**	**Value**
09	73 (Barometric Pressure)	51 27=>27 51=10044 Pressure=10065/ 10=1006.5 hPa	0b	7d	3b 00=>00 3b=59 μg/m^3 (PM 2.5)
Channel	**Type**	**Value**			
0c	7d	43 00=>00 43=67 μg/m^3 (PM 10)			

3. AM319-HCHO Periodic Package

0367ea00 04688a 050001 06cb01 077dcd04 087d5e01 09735127 0a7d0700 0b7d3b00 0c7d4300					
Channel	**Type**	**Value**	**Channel**	**Type**	**Value**

03	67 (Temperature)	ea 00 => 00 ea = 234 Temp=234/10=23.4°C	04	68 (Humidity)	8a=>138 Hum=138/2=69%RH
Channel	**Type**	**Value**	**Channel**	**Type**	**Value**
05	00	01: Occupied	06	cb (Light Level)	01= level 1 (6-50 lux)
Channel	**Type**	**Value**	**Channel**	**Type**	**Value**
07	7d	cd 04 => 04 cd =1229 ppm (CO_2)	08	7d	5e 01 => 01 5e =350 TVOC=350*0.01=3.50
Channel	**Type**	**Value**	**Channel**	**Type**	**Value**
09	73 (Barometric Pressure)	51 27=>27 51=10044 Pressure=10065/10=1006.5 hPa	0a	7d	07 00=>00 07=7/100 =0.07 mg/m^3 (HCHO)
Channel	**Type**	**Value**	**Channel**	**Type**	**Value**
0b	7d	3b 00=>00 3b=59 μg/m^3(PM 2.5)	0c	7d	43 00=>00 43=67 μg/m^3 (PM 10)

4. CO_2 value exceeds the Bad threshold.

077d0a060e0100					
Channel	**Type**	**Value**	**Channel**	**Type**	**Value**
07	7d	0a 06 => 06 0a =1546 ppm	0e	01	00=>Buzzer is disabled

6.3 Downlink Commands

AM300(L) series sensors support downlink commands to configure the device. The application port is 85 by default.

Item	Channel	Type	Description
Reporting Interval	ff	03	2 Bytes, unit: s
Reboot		10	ff
UTC Time Zone		17	INT16/10
CO_2 Calibration		1a	00 (Restore Factory Calibration) 03 (Manual Calibration)
CO_2 Auto Background Calibration		39	AM30x(L): 0000000000-Disable, 0100000000-Enable

			AM319(L): 00: Disable, 01: Enable
CO_2 Barometric Pressure Compensation		f4	00: Disable, 01: Enable
Button Lock		25	00: Disable 01: Lock Power Off 02: Lock Power On 04: Lock Refresh Display 07: Lock All Features
Enquire LED and Buzzer Mode		2c	00
LED Mode		2e	00: Disable 01: Always On (AM319&AM319L Only) 02: Blink
Stop the Buzzer		3d	00
Buzzer Mode		3e	00: Disable, 01: Enable
Data Storage		68	00: Disable, 01: Enable
Data Retransmission		69	00: Disable, 01: Enable
Data Retransmission Interval		6a	3 Bytes Byte 1: 00 Byte 2-3: interval time, unit:s range: 30~1200s (600s by default)
TVOC Unit		eb	00: Level, 01: μg/m^3

Screen Settings (AM300 Series Only):

Item	Channel	Type	Description
Screen Display	ff	2d	00: Disable, 01: Enable
Screen Display Mode		3c	01: Mode 1, 02: Mode 2, 03: Mode 3
Screen Alarm		66	00: Disable, 01: Enable

<table>
<tr>
<td>Screen Content</td>
<td></td>
<td>f0</td>
<td>Byte 1-2: ffff
Byte 3-4: content status per bit, 0=disable, 1=enable
<table>
<tr><th>Bit</th><th>Screen Content</th></tr>
<tr><td>0</td><td>temperature</td></tr>
<tr><td>1</td><td>humidity</td></tr>
<tr><td>2</td><td>CO_2</td></tr>
<tr><td>3</td><td>Light</td></tr>
<tr><td>4</td><td>TVOC</td></tr>
<tr><td>5</td><td>Emoticon</td></tr>
<tr><td>6</td><td>Character</td></tr>
<tr><td>7</td><td>PM2.5</td></tr>
<tr><td>8</td><td>PM10</td></tr>
<tr><td>9</td><td>HCHO/O_3</td></tr>
</table>
Bit 15-10: 000000</td>
</tr>
</table>

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. Enquire traffic light and buzzer mode.

ff2c00		
Channel	**Type**	**Value**
ff	2c (Enquire LED and Buzzer mode)	00(Reserved)

Reply:

ff2e02 ff3e00					
Channel	**Type**	**Value**	**Channel**	**Type**	**Value**
ff	2e(LED Mode)	02=Blink	ff	3e (Buzzer Mode)	00=Off

3. Reboot the device.

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

4. Set time zone to GMT-4.

ff17d8ff		
Channel	**Type**	**Value**
ff	17 (Set Time Zone)	d8 ff => ffd8 = -40/10 = -4

		The time zone is GMT-4

5. Disable the e-ink screen display.

ff2d00		
Channel	**Type**	**Value**
ff	2d (Screen Display)	00: Disable the display

6. Disable the display of emoticon and characters.

fff0ffff 9f03		
Channel	**Type**	**Value**
ff	f0 (Screen Content)	9f 03=>03 9f = 0000 0011 1001 1111 Bit5 and Bit6=0 means emoticon and characters disable

6.4 Historical Data Enquiry

AM300(L) series sensors support sending downlink commands to enquire historical data for specified time point or time range. Before that, ensure the device time is correct and data storage feature was enabled to store the data.

Command format:

Channel	Type	Description
fd	6b (Enquire data in time point)	4 Bytes, unix timestamp
fd	6c (Enquire data in time range)	Start time (4 bytes) + End time (4 bytes), unix timestamp
fd	6d (Stop query data report)	ff
ff	6a (Report Interval)	3 Bytes, Byte 1: 01 Byte 2: interval time, unit: s, range: 30~1200s (60s by default)

Reply format:

Channel	Type	Description
fc	6b/6c	00: data enquiry success 01: time point or time range invalid 02: no data in this time or time range
20	ce (Historical Data)	Data time stamp (4 Bytes) + Data Contents (Mutable)

Note:

1. The device only uploads no more than 300 data records per range enquiry.
2. When enquiring the data in time point, it will upload the data which is closest to the search point within the reporting interval range. For example, if the device reporting interval is 10 minutes and users send command to search for 17:00's data, if the device find there is data stored in 17:00, it will upload this data; if not, it will search for data between 16:50 to 17:10 and upload the data which is closest to 17:00.

Example: Enquire historical data between 2022/9/8 17:43:31 to 2022/9/9 01:45:20.

fd6c c3291a63 b09a1a63		
Channel	**Type**	**Value**
fd	6c (Enquire data in time range)	Start time: c3291a63 => 631a29c3 = 1662659011 =2022/9/8 17:43:31 End time: b09a1a63 => 631a9ab0 = 1662659011 =2022/9/9 01:45:20

Reply:

fc6c00		
Channel	**Type**	**Value**
fc	6c (Enquire data in time range)	00: data enquiry success

20ce56991a63 ff00 7300 00 00 f802 6400 9127 2200 2600			
Channel	**Type**	**Time Stamp**	**Value**
20	ce (Historical Data)	56991a63 => 2022/9/9 01:39:34	Temperature: ff00=>00ff=25.5°C Humidity: 7300=>0073=57.5% PIR: 00=> Vacant Light: 00=>Level 0 CO_2: f802=>02f8=760 ppm TVOC: 6400=>0064=1.00 Pressure: 9127=>2791=1012.9 hPa PM2.5: 2200=>0022=34 μg/m^3 PM10: 2600=>0026=38 μg/m^3

Appendix

Carbon Dioxide Levels and Guidelines

CO_2 Level	Description
400ppm	Normal outdoor air level.
400-1000ppm	Typical level indoors with good ventilation.
1000-2000ppm	Poor air quality - requires ventilation.

≥2000ppm	Headaches, sleepiness and stagnant, stale, stuffy air. Poor concentration, loss of attention, increased heart rate and slight nausea may also be present.
5000ppm	Workplace exposure limit (as 8-hour TWA) in most jurisdictions.
>40000ppm	Exposure may lead to serious oxygen deprivation resulting in permanent brain damage, coma, even death.

TVOC Levels and Guidelines

IAQ Rating	TVOC (μg/m^3)	Air Quality
≤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 months)
≥5.00	>10000	Bad (not recommended)

Note: the conversion from μg/m3 to ppb by the factor is about 0.5.

Illuminance Levels and Guidelines

Level	Illuminance/Lux	Environment Description
Level 0	0-5	No light or minimal street light, twilight.
Level 1	6-50	Cloudy indoor.
Level 2	51-100	Family living room, hallways.
Level 3	101-500	Offices, show rooms, study library, laboratories.
Level 4	501-2000	Supermarkets, drawing work, detailed mechanical workshops, operation theater.
Level 5	>2000	Performance of very prolonged and exacting visual tasks.

-END-