Indoor Ambiance Monitoring Sensor

Featuring LoRaWAN®

AM100(L) Series

User Guide

Applicability

This guide is applicable to AM100(L) series sensors shown as follows, except where otherwise indicated.

Model	Description
AM102(L)	Indoor Ambiance Sensor(Temp, Hum)
AM103(L)	Indoor Ambiance Sensor(Temp, Hum, CO_2)

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.
- 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.

Declaration of Conformity

AM100(L) series is in conformity with the essential requirements and other relevant provisions of the CE, FCC, and RoHS.

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. 20, 2022	V 1.0	Initial version
Feb. 15, 2023	V1.1	1. Add single channel mode 2. Add data storage and retransmission feature 3. Add hibernate feature and support to disable/enable last update time
Aug. 31, 2023	V1.2	Add AM102/AM102L Model

Contents

1. Product Introduction

1.1 Overview

AM100(L) series is a compact indoor ambience monitoring device including humidity, temperature, and CO_2 sensor for wireless LoRaWAN® 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 which 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

- Integrated temperature, humidity and CO_2 sensor
- Easy configuration via NFC
- Vivid emoticon & traffic light indicator to understand the comfort level
- Standard LoRaWAN® supported
- Milesight IoT Cloud compliant

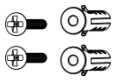
2. Hardware Introduction

2.1 Packing List

1 × AM100(L) Series Sensor

2 × ER14505 Li-SOCl$_2$ Batteries

1 × 3M Double-Sided Tape



2 × Wall Mounting Kits

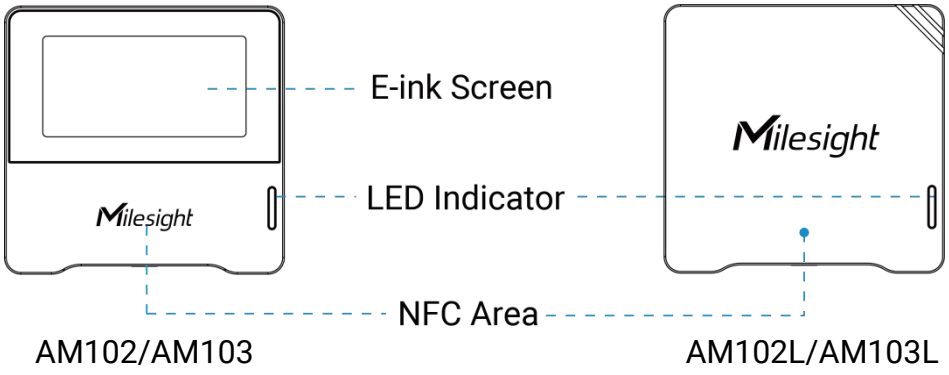
1 × Theft-Deterring Screw

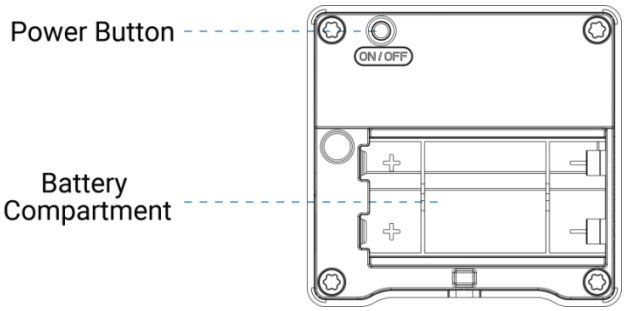
1 × Quick Guide

1 × Warranty Card

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

2.2 Hardware Overview





2.3 E-ink Screen (AM102 & AM103 Only)

Icon	Description
	Battery level
Last Update 22:22	The time of the last collected sensor data
	The device has joined the network
	The device has not joined the network
20.3 °C	Temperature
58.3 RH %	Humidity
AM103 Only	
560 CO_2 PPm Last Update 22:22	Show the CO_2 concentration and history trends
	When the CO_2 concentration exceeds the Polluted threshold
	When the CO_2 concentration exceeds the Bad threshold

	Excellent Environment
	When the CO_2 concentration exceeds the Polluted threshold
	When the CO_2 concentration exceeds the Bad threshold

Note:

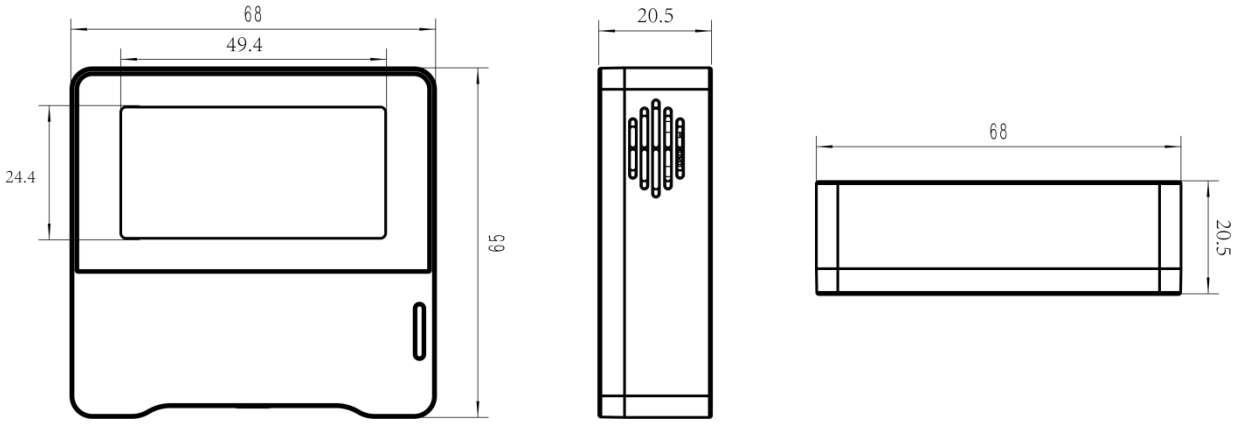
- AM102 or AM103 will update data on the screen every 2 minutes if Screen Smart Mode is disabled;
- AM102 or AM103 will do a full-screen refresh after 30 times update in order to remove ghosting.
- When AM102 or AM103 detects the temperature beyond the range from 0°C to 40°C, the screen will close automatically.
- Please refer section 4.5.2 for Excellent/Polluted/Bad threshold settings.

2.4 Button and LED Indicator

Function	Action	LED Indicator
Power ON/OFF	Press and hold the power button for more than 3 seconds	Power On: Off → On Power Off: On → Off
Reset to Factory Default	Press and hold the power button for more than 10 seconds	Quickly Blinks
Check On/Off Status	Quickly press the power button	Light On: Device is on. Light Off: Device is off.
CO_2 Level Indication (AM103/AM103 L Only)	When the CO_2 concentration exceeds the threshold	Excellent: Blinks Polluted: Blinks Bad: Blinks

Note: If the LED Indicator is disabled, it will not show air quality level indication.

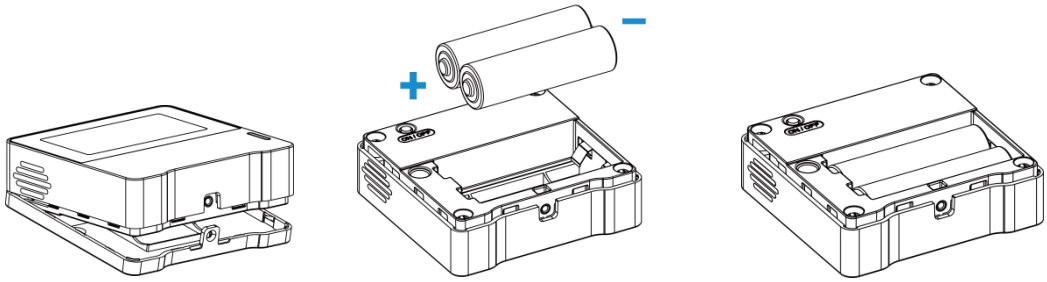
2.5 Dimensions (mm)



3. Power Supply

Remove the rear cover of device to install the batteries, do not reverse the direction of batteries when installing.

Note: The device can only be powered by ER14505 Li-$SOCl_2$ batteries not alkaline batteries.

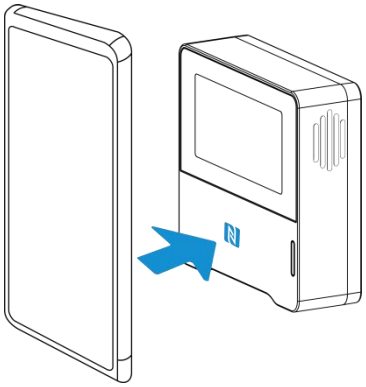


4. Operation Guide

4.1 Log in the ToolBox

The device can be configured via a NFC supported mobile phone.

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 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**.



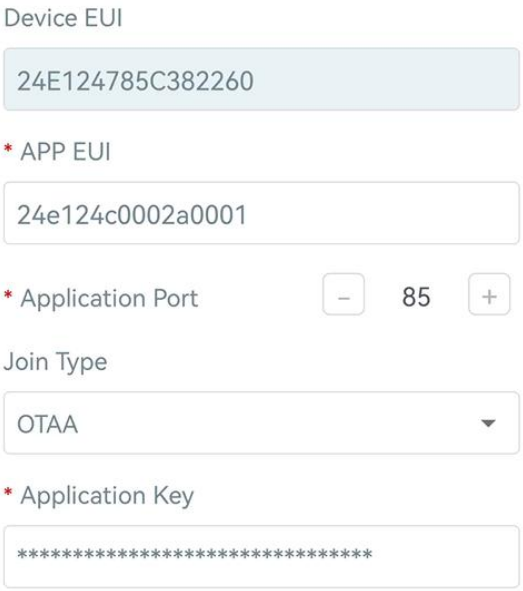
Note:

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.

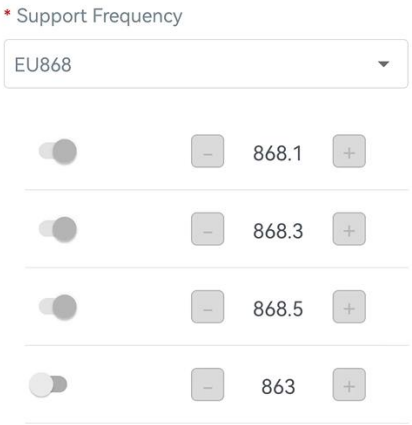
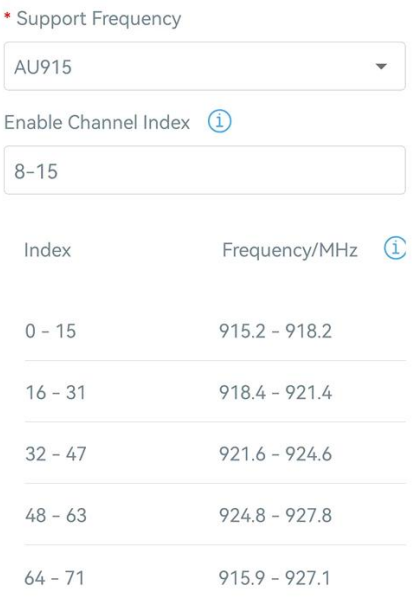
3) The device can also be configured by ToolBox software via a dedicated NFC reader provided by Milesight IoT, you can also configure it via TTL interface inside the device.

4.2 LoRaWAN Settings

Go to **Device > Settings > LoRaWAN Settings** of ToolBox App 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 modes 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.
LoRaWAN Version	V1.0.2 and V1.0.3 are available.
Work Mode	It's fixed as Class A.
RX2 Data Rate	RX2 data rate to receive downlinks.
RX2 Frequency	RX2 frequency to receive downlinks. Unit: Hz
Channel	Select Standard-Channel mode or Single-Channel mode. When Single-Channel

Mode(AM103/AM 103L Only)	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 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.

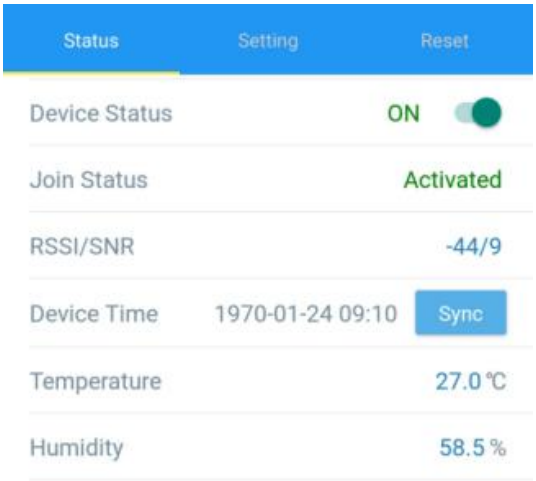
Note:

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.

4.3 Time Synchronization

ToolBox Sync:

Go to **Device > Status** of ToolBox App to click **Sync** to sync the time.

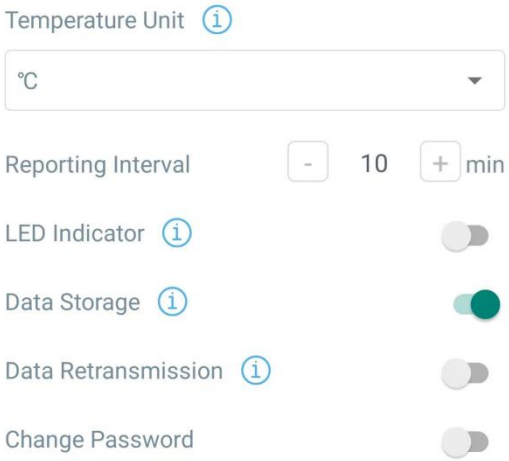


Network Server Sync:

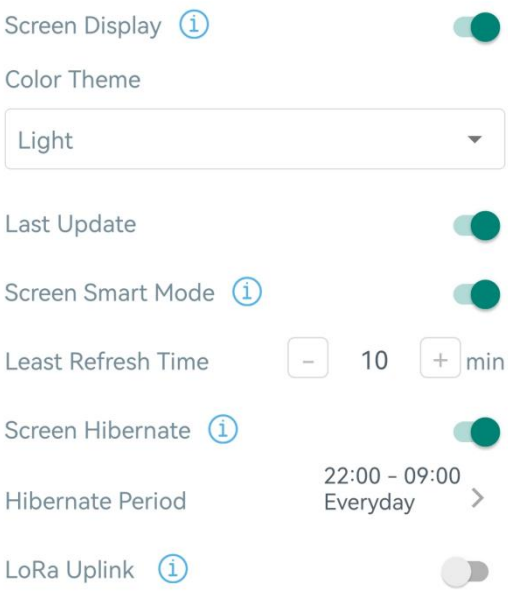
Go to **Device > Settings > LoRaWAN Settings** to change LoRaWAN® version as 1.0.3, then the device will MAC command to ask for time from network server every time it joins the network. This should ensure the network server supports this feature and the time is UTC+0 time zone by default.

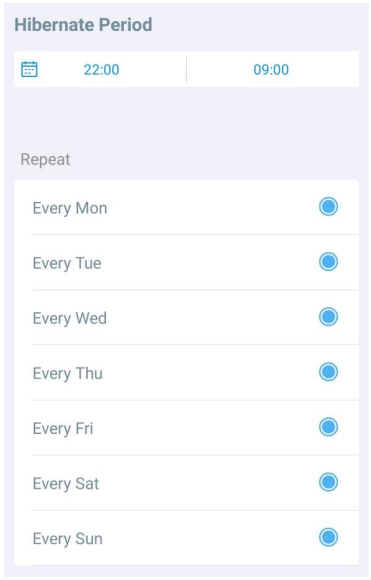
4.4 Basic Settings

Go to **Device > Settings > General Settings** to change the reporting interval, screen mode, etc.



Parameters	Description
Temperature Unit	Change the temperature unit displayed on the ToolBox and screen. **Note:** 1) The temperature unit in the reporting package is fixed as °C. 2) Please modify the threshold settings if the unit is changed.
Reporting Interval	Reporting interval of transmitting current sensor values to network server. Default: 10 mins, Range: 1-1080 mins
LED Indicator	**AM102(L):** Enable or disable the indicator to blink every 13s to indicate the device running well. **AM103(L):** Enable or disable the indicator to indicate CO_2 threshold.
Data Storage	Disable or enable data storage locally. (see section 4.5.3 to export data)
Data Retransmission	Disable or enable data retransmission. (see section 4.5.4)
Change Password	Change the password for ToolBox App or software to read/write this device.



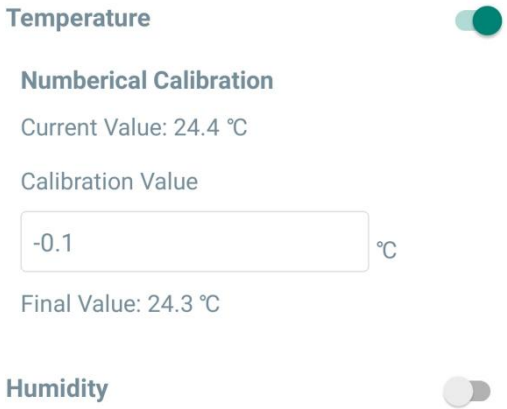
Screen Settings (AM102/AM103 Only)	
Parameters	**Description**
Screen Display	Enable or disable screen display.
Color Theme	Select screen display background color as Light or Dark.
Last Update	Enable or disable the Last Update time displayed on the screen.
Screen Smart Mode	When the current collected value is close to the last value (tem ≤ ±0.5°C and hum ≤ ±3% and CO_2 ≤ ±50 ppm), the screen will stop updating to save power.
Least Refresh Time	When screen smart mode is enabled, set the least time to fresh the screen. Range: 2-1080 mins
Hibernate Mode	The screen will hibernate during a time period.
Hibernate Period	Set the period of screen hibernate. 

LoRa Uplink	Enable or disable to send LoRaWAN uplinks during hibernate. It's disabled by default.

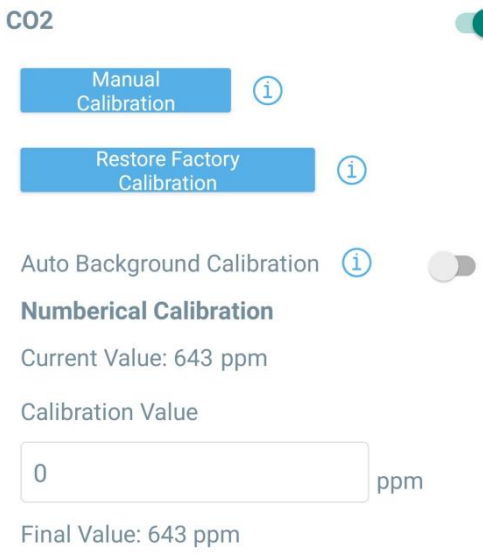
4.5 Advanced Settings

4.5.1 Calibration Settings

ToolBox supports numerical calibration for all items. Go to **Device > Settings > Calibration Settings** to type the calibration value and save, the device will add the calibration value to raw value, then display and upload the final value.



Besides numerical calibration, ToolBox provides more CO_2 calibration methods for AM103(L):
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 7 days, then disable the calibration.

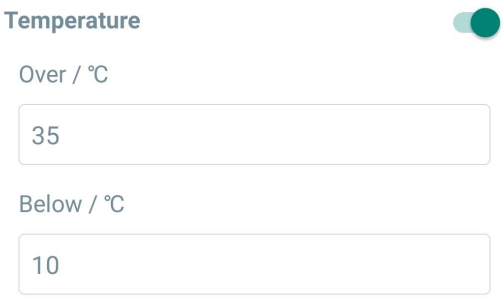


4.5.2 Threshold Settings

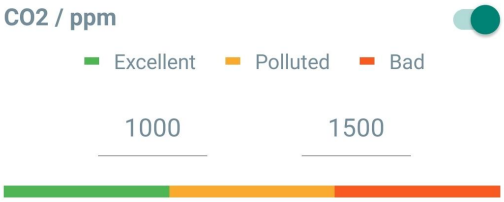
Go to **Device > Settings > Threshold Settings** to enable and configure the temperature and CO_2

threshold settings.

Temperature threshold: 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.



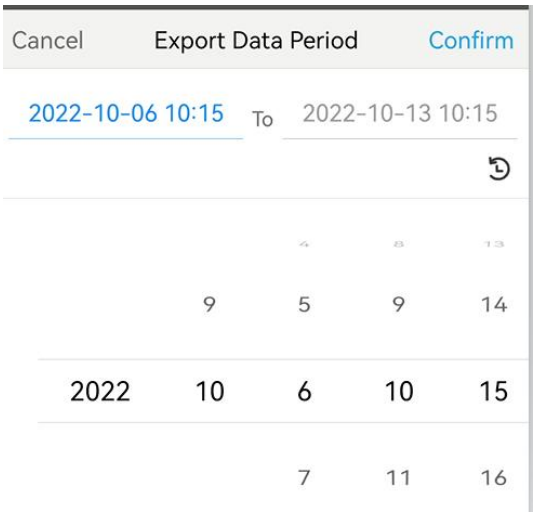
CO_2 threshold: it supports defining Excellent, Polluted and Bad threshold for traffic light and screen alarms. Besides, when it exceeds the Bad threshold, AM103(L) will upload the current data once instantly.



4.5.3 Data Storage

AM103(L) supports storing 640 data records and AM102(L) supports storing 1280 data records locally and exports data via ToolBox App. The device will record the data according to reporting interval even not joining network.

1. Go to **Device > Settings > General Settings** to enable data storage feature.
2. Go to **Device > Maintenance** to click **Export**, then select the data time range and click **Confirm** to export data. ToolBox App can export last 14 days' data at most.



3. Click **Data Cleaning** to clear all stored data inside the device.

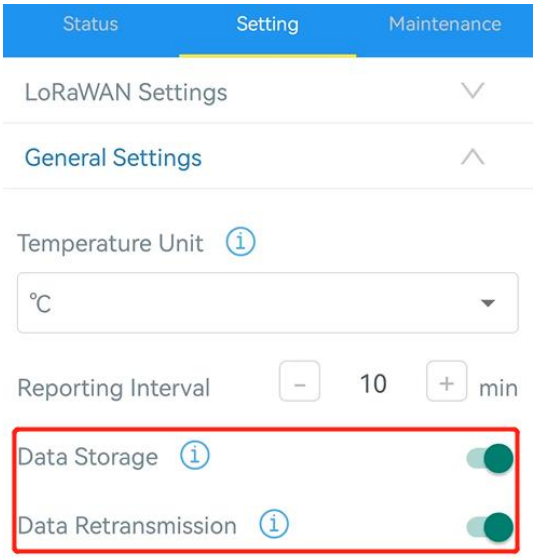
4.5.4 Data Retransmission

AM100(L) series 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:

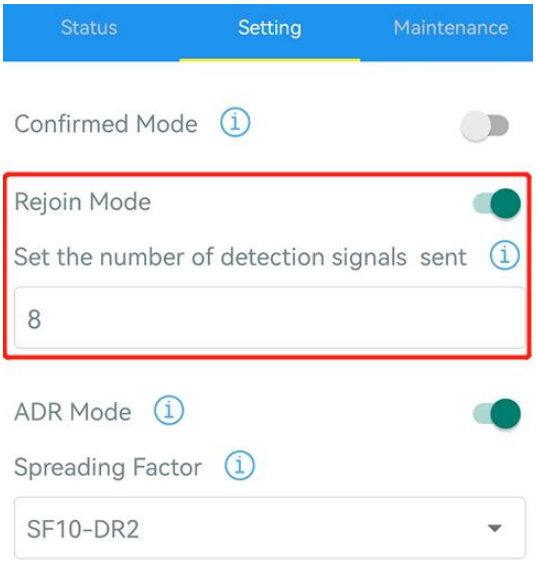
- Network server sends downlink commands to enquire the historical data for specifying time range, see section 6.4;
- When network is down if no response from LinkCheckReq MAC packets for a period of time, the device will record the network disconnected time and re-transmit the lost data after device re-connects the network.

Here are the steps for data retransmission:

1. Ensure the device time is correct (see section 4.3);
2. Enable data storage feature and data retransmission feature;



3. Go to **Device > Settings > LoRaWAN Settings** to 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).



4. 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 6.4.

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

4.6 Maintenance

4.6.1 Upgrade

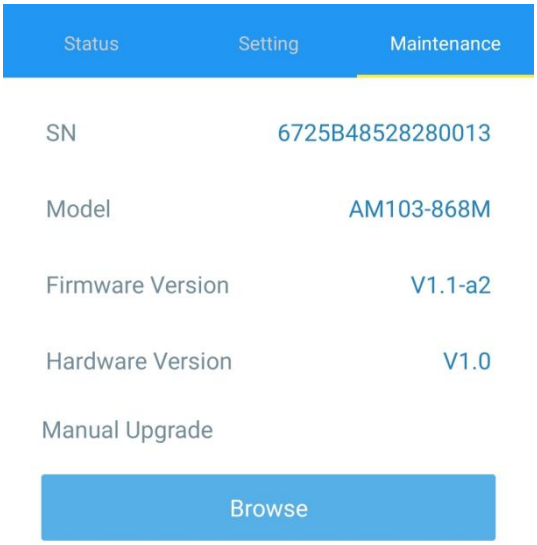
1. Download firmware from Milesight official website to your smartphone.

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.

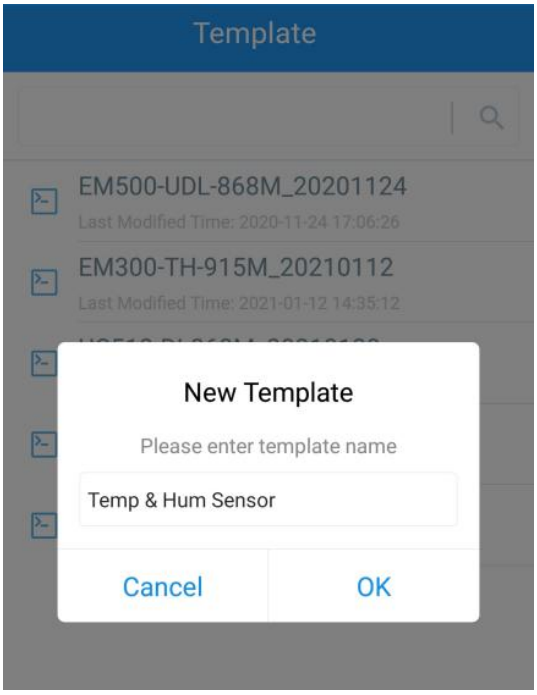


4.6.2 Backup

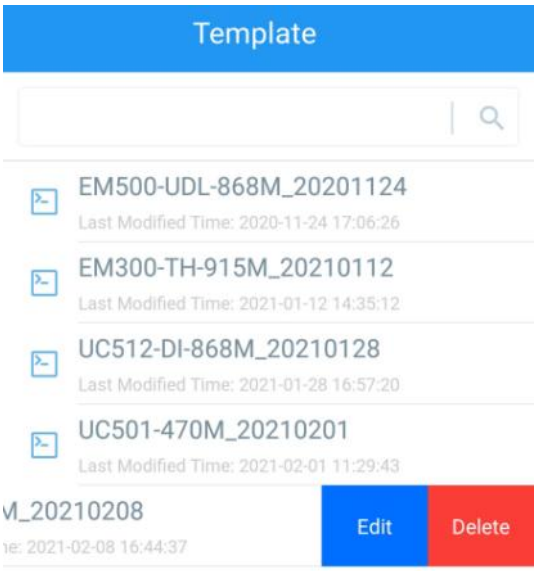
AM100(L) series supports configuration backup for easy and quick device configuration in bulk. Backup is allowed only for devices with the same model and LoRaWAN® frequency band.

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:

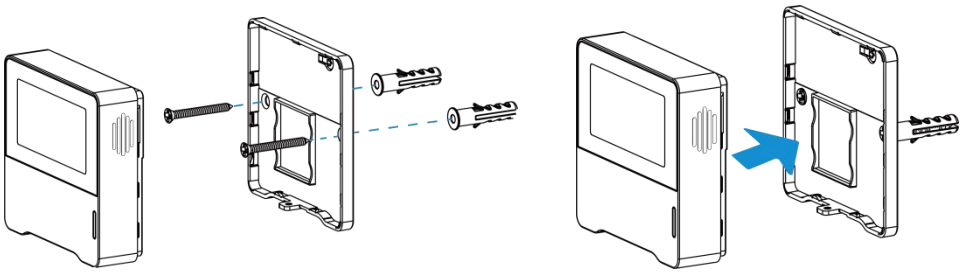
Via Hardware: Hold on power button for more than 10s.

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

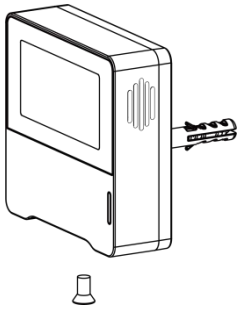
5. Installation

Fixed by Screws:

1. Remove the rear cover of the device, screw the wall plugs into the wall and fix the rear cover with screws on it, then install back the device.

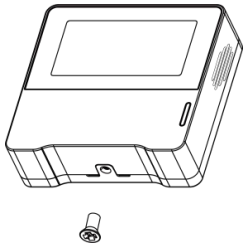


2. Fix the bottom of the device to the rear cover with the theft-deterring screw.

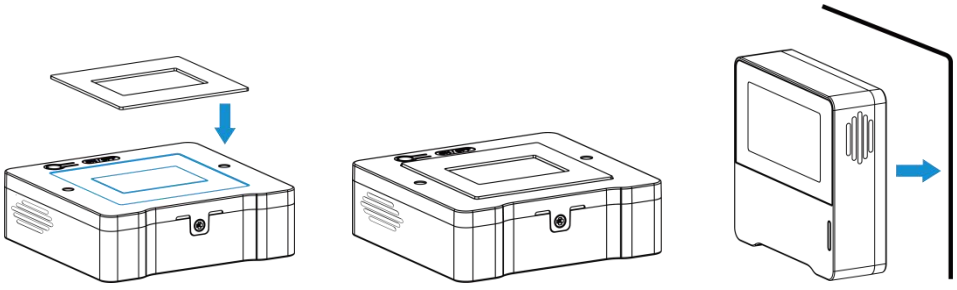


Fixed by 3M Tape:

1. Fix the bottom of the device to the rear cover with the theft-deterring screw.



2. Paste 3M double-sided tape to the back of the device, then tear the other side and place it on a flat surface.



Note:

In order to ensure the best detection and LoRaWAN® communication work, it is recommended to install device as follows:

- 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 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

AM100(L) series 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
	18 (Sensor Status)	**Byte 0:** 00 means all sensors **Byte 1:** 0=disabled, 1=enabled and every bit means every kind of sensor Bit 0: temp, Bit 1: hum, Bit 4: CO_2

Example:

ff0bff ff166710b32620711912 ff090100 ff0a0101 ff0f00 ff180013					
Channel	**Type**	**Value**	**Channel**	**Type**	**Value**
ff	0b (Power On)	ff (Reversed)	ff	16 (Device SN)	6710b32620711912
Channel	**Type**	**Value**	**Channel**	**Type**	**Value**
ff	09 (Hardware version)	0100 (V1.0)	ff	0a (Software version)	0101 (V1.1)
Channel	**Type**	**Value**	**Channel**	**Type**	**Value**

ff	0f (Device Type)	00 (Class A)	ff	18 (Sensor Status)	00 => All Sensors 13 = 0001 0011 => All sensors are enabled

6.2 Sensor Data

AM100(L) series report sensor data according to reporting interval (10 mins by default).

Item	Channel	Type	Description
Battery Level	01	75	UINT8, Unit: %
Temperature	03	67	INT16, Unit: °C, Resolution: 0.1 °C
Humidity	04	68	UINT8, Unit: %, Resolution: 0.5 %
CO_2	07	7d	UINT16, Unit: ppm

Examples:

1. AM102(L) Periodic Package

0367ff00 04684f					
Channel	**Type**	**Value**	**Channel**	**Type**	**Value**
01	75 (Battery Level)	64 => 100%	03	67 (Temperature)	ff00 => 00ff =255 Temp = 255*0.1 = 25.5°C
Channel	**Type**	**Value**			
04	68 (Humidity)	4f => 79 Hum = 79*0.5 = 39.5%			

2. AM103(L) Periodic Package

0367ff00 04684f 077d1303					
Channel	**Type**	**Value**	**Channel**	**Type**	**Value**
01	75 (Battery Level)	64 => 100%	03	67 (Temperature)	ff00 => 00ff =255 Temp = 255*0.1 = 25.5°C
Channel	**Type**	**Value**	**Channel**	**Type**	**Value**
04	68 (Humidity)	4f => 79 Hum = 79*0.5 = 39.5%	07	7d (CO_2)	13 03 => 03 13 = 787 ppm

3. CO_2 value exceeds the Bad threshold.

Channel	Type	Value

07	7d	0a 06 => 06 0a = 1546 ppm

6.3 Downlink Commands

AM100(L) series support 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
	10 (Reboot)	ff
	1a (CO_2 Calibration)	00: Factory Calibration Restored 03: Manual Calibration
	39 (CO_2 Auto Background Calibration)	5 Bytes, **Byte 1:** 00-disable, 01-enable **Bytes 2-5:** b4009001
	2d (Screen Display)	00: disable, 01: enable
	2f (LED Indicator)	00: disable, 01: enable
	54 (Set CO_2 Threshold)	**Byte 1:** 00: disable, 01: enable **Byte 2-3:** Bad threshold value **Byte 4-5:** Polluted threshold value **Note:** Polluted threshold value must be lower than bad threshold value.
	56 (Screen Smart Mode)	00: disable, 01: enable
	68 (Data Storage)	00: disable, 01: enable
	69 (Data Retransmission)	00: Disable, 01: Enable
	6a (Data Retransmission Interval)	3 Bytes Byte 1: 00 Byte 2-3: interval time, unit:s range: 30~1200s (600s by default)
	75 (Hibernate Mode)	7 Bytes, **Byte 1-hibernate mode:** 00-disable, 01-enable **Byte 2-LoRa uplink:** 00-disable, 01-enable **Byte 3-4:** start time, unit: min **Byte 5-6:** end time, unit: min **Byte 7:** bit0=0, bit 1-7: Monday to Sunday, 0=disable, 1=enable

		Note: if start time equals end time, it means all day.
	85 (Last Update)	00: disable, 01: enable
	86 (Least Refresh Time)	2 Bytes, unit: min, range: 2~1800 mins

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 e-ink screen display.

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

4. Set CO_2 bad threshold as 1500ppm and polluted threshold as 1000 ppm.

ff5401dc05e803		
Channel	**Type**	**Value**
ff	54 (Set CO_2 Threshold)	Byte 1: 01 = enable Byte 2-3: dc 05 => 05 dc = 1500 ppm (Bad threshold) Byte 4-5: e8 03 => 03 e8 = 1000 ppm (Polluted threshold)

5. Enable screen hibernate and LoRa uplink, set the hibernate time between 22:00 to next day 9:00 on week days (Monday to Friday).

ff750101 2805 1c02 3e		
Channel	**Type**	**Value**
ff	75 (Screen Hibernate)	Byte 1: 01 = screen hibernate enable Byte 2: 01 =LoRa uplink enable Byte 3-4: 28 05=>05 28=1320 mins =22:00 Byte 5-6: 1c 02 => 02 1c = 540 mins =9:00 Byte 7: 3e=00111110 bit1-5=1 means Monday to Friday enable

6.4 Historical Data Enquiry

AM100(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 2-3: 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)	AM102(L): Data time stamp (4 Bytes) + Temperature(2 Bytes)+Humidity (1 Byte) AM103(L): Data time stamp (4 Bytes) + Temperature(2 Bytes)+Humidity (1 Byte) + CO_2 (2 Bytes)

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:

1. Enquire historical data between 2023/02/15 10:00:54 to 2023/02/15 11:45:40.

fd6c d63cec63 6455ec63		
Channel	**Type**	**Value**
fd	6c (Enquire data in time	Start time: d63cec63 => 63ec3cd6 =

	range)	1676426454 =2023/02/15 10:00:54 End time: 6455ec63 => 63ec5564 = 1676432740 =2023/02/15 11:45:40

Reply:

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

20ce 5c44ec63 d30059d302			
Channel	**Type**	**Time Stamp**	**Value**
20	ce (Historical Data)	5c44ec63 => 2023/02/15 10:33:00	Temperature: d300=>00d3=21.1°C Humidity: 59=>89=44.5% CO_2: d302=>02d3=723 ppm

Appendix

Carbon Dioxide Levels and Guidelines

CO_2 Level	Description
400 ppm	Normal outdoor air level.
400-1000 ppm	Typical level indoors with good ventilation.
1000-2000 ppm	Poor air quality - requires ventilation.
≥ 2000 ppm	Headaches, sleepiness and stagnant, stale, stuffy air. Poor concentration, loss of attention, increased heart rate and slight nausea may also be present.
5000 ppm	Workplace exposure limit (as 8-hour TWA) in most jurisdictions.
> 40000 ppm	Exposure may lead to serious oxygen deprivation resulting in permanent brain damage, coma, even death.

-END-