Milesight AM100 Series LoRaWAN Motion and Light Intensity Sensor User Guide

AM100 Series
User Guide
Milesight IoT

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

Model	Description
AM104	Indoor Ambiance Sensor(Temp, Hum, Light, Motion)
AM107	Indoor Ambiance Sensor(Temp, Hum, Light, Motion, CO2, TVOC, Pressure)

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.
- Do not place the device outdoors where the temperature is below/above the 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 responsible 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 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
Tel: 86-592-5085280
Fax: 86-592-5023065
Address: 4/F, No.63-2 Wanghai Road, 2nd Software Park, Xiamen, China

Revision History

Date	Doc Version	Description
Apr. 7, 2020	V 1.0	Initial version
May 19, 2020	V 1.1	App pictures replacement
Aug. 26, 2020	V 1.2	Add screen display mode and configuration examples
Sept.14, 2020	V 1.3	Add screen alarm settings
Nov. 19, 2020	V 2.0	Layout replace
Mar. 2, 2021	V 2.1	Change model from AM100/AM102 to AM104/AM107

Contents

Product Introduction

Overview

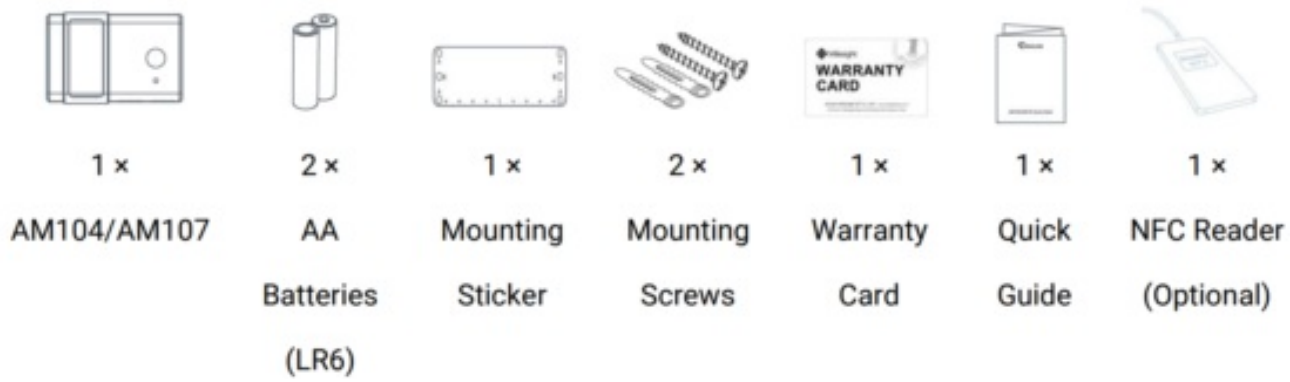
AM100 series is a compact indoor ambiance monitoring sensor including motion, humidity, temperature, light, TVOC, CO2, and barometric pressure for a wireless LoRa network. AM100 series is a battery-powered device and is designed to be wall-mounted. It is equipped with NFC (Near Field Communication) and can easily be configured via a smartphone or PC software.
Sensor data are transmitted in real-time using the standard LoRaWAN ® protocol. LoRaWAN ® enables encrypted radio transmissions over long distances 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.

Features

- Robust LoRa connectivity for indoor or HVAC environments
- Integrated multiple sensors like temperature, humidity, light, air quality, etc.
- Easy configuration via NFC
- Visual display via E-Ink screen
- Standard LoRaWAN® support
- Milesight IoT Cloud compliant
- Low power consumption (about 1-year battery life)
- Standard AA alkaline battery

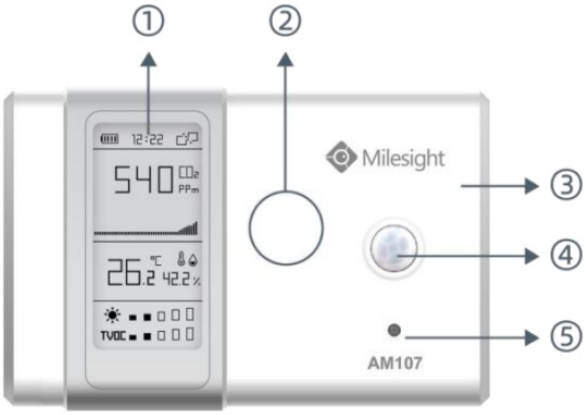
Hardware Introduction

Packing List

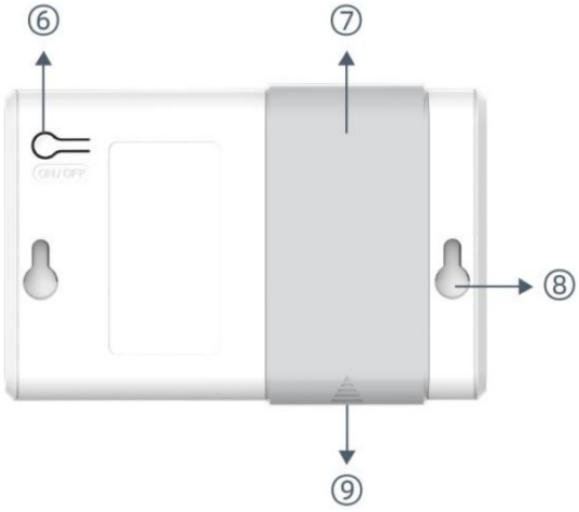


⚠ If any of the above items are missing or damaged, please contact your sales representative.

Hardware Overview



Front Panel:
①E-ink screen
② NFC Area
③ LoRa Antenna (Internal)
④PIR Sensor
⑤Light Sensor

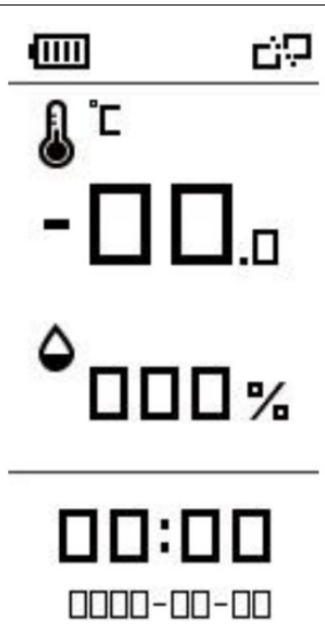
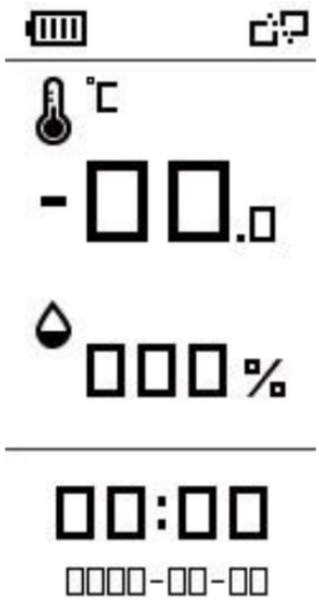
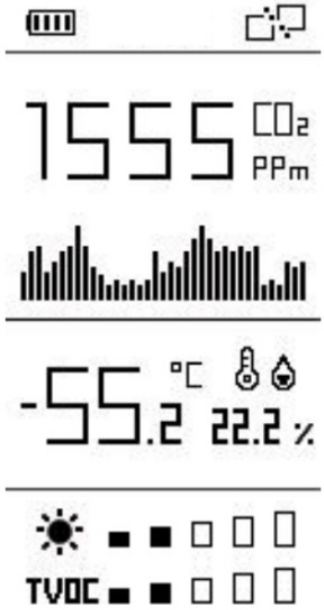
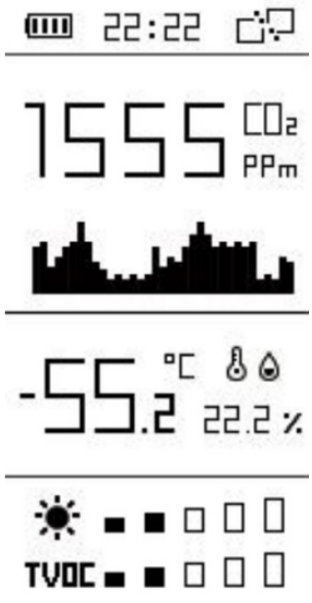


Back Panel:
⑥Power button
⑦Battery Cover
⑧Mounting Holes
⑨Type-C Port

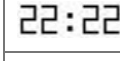
E-link Screen

Screen Description

AM100 series provide 3 types of display modes:

AM104		
Mode 1	**Mode 2**	**Mode 3**
		
AM107		
Mode 1	**Mode 2**	**Mode 3**
		

To learn what an icon means, find it below.

Icon	Description	Screen Update
	Battery level	24 hours
	Sync time with software or mobile App	1 min
	The device joins the network. The device fails to join the network.	According to the join status
	Temperature	1 min
	Humidity	1 min
	Luminance Level 0 0-5 lux Level 1 6-50 lux Level 2 51-100 lux Level 3 101-400 lux Level 4 401-700 lux Level 5 ≥701 lux	1 min
	Total volatile organic compounds Level 0 0-100 ppb Level 1 101-200 ppb Level 2 201-250 ppb Level 3 251-300 ppb Level 4 301-350 ppb Level 5 351-400 ppbShow alarm when TVOC exceeds the threshold value. (400 ppb by default)	1 min
	Show CO2 history tendency from 0 to 1400ppm.	2 min

	Show alarm when CO2 exceeds the threshold value.(1200 ppm by default)	

Note:

- AM100 series will do a full-screen refresh every 30 minutes in order to remove ghosting.
- Please refer to section 4.5.3 for TVOC and CO2 threshold settings.
- AM100 series shows the current value on the screen and uplink the average value of the reporting interval to the gateway.

Screen Mode Switch

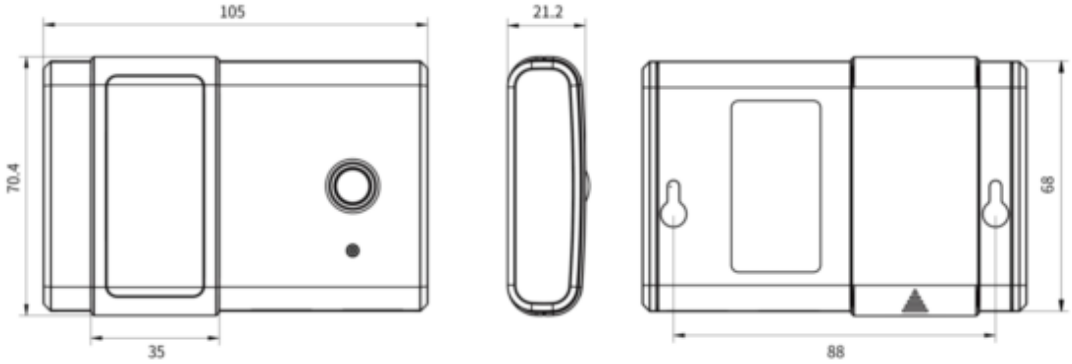
- Here are 3 methods to switch between the three modes:
- Power button: Quick press the power button to switch the mode.
- Mobile App: Go to Milesight ToolBox App menu “Device > Setting > General Settings” to select the screen display mode.
- Software: Go to the Toolbox menu “Device Settings > Basic > Basic Settings” to select the screen display mode.

Power Button

AM100 series can be turned on/off or reset by the power button on the rear panel.

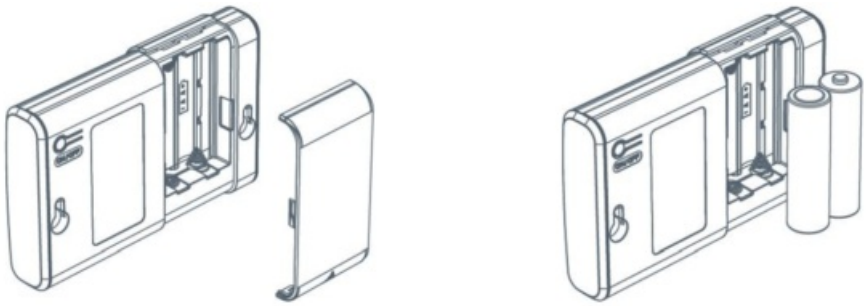
Function	Action
Turn On	Press and hold the power button for more than 3 seconds until the screen changes state.
Turn Off	Press and hold the power button for more than 3 seconds until the screen changes state.
Reset	Press and hold the power button for more than 10 seconds.
Change Screen Mode	Quick press the power button.

Dimensions(mm)



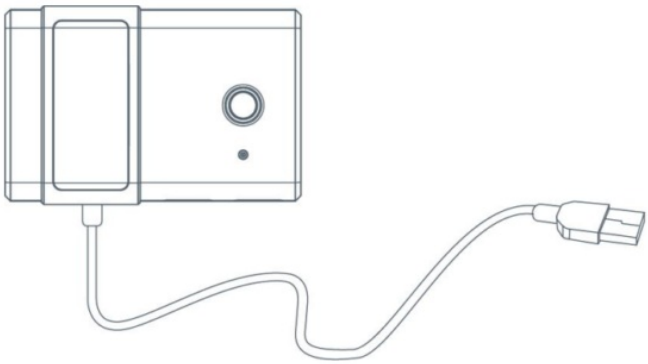
Power Supply

Remove the battery cover and install two new AA/LR6 batteries. Batteries can be replaced on the fly.



Note:

- AM100 series can also be powered by a type-C USB port (5V, 100mA). When batteries and external power are both connected, external power will power the device first.
- USB port can’t be used to charge the battery.



Operation Guide

Log in to the ToolBox

AM100 series can be monitored and configured via the ToolBox App or ToolBox software. Please select one of them to complete the configuration.

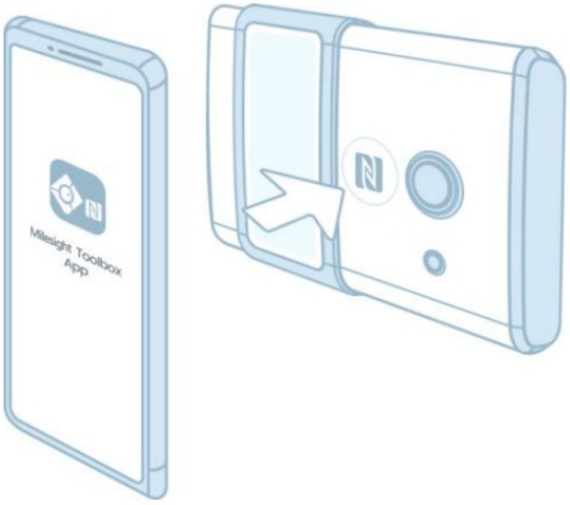
NFC Configuration

Preparation:

- Smartphone (NFC supported)
- Milesight ToolBox App

Steps:

1. Download and install from Google Play or Apple Store.
2. Enable NFC on the smartphone and open the “Milesight ToolBox” App.
3. Attach the smartphone with an NFC area to the device to read basic information.



4. Basic information and settings of devices will be shown on ToolBox if it’s recognized successfully. You can turn on/off the device by tapping the button on the Device Status. In order to protect the security of devices, password validation is required when configuring via unused phones. The default password is 123456.

5. Tap the “Read” button to check the current status and sensor data of the device.
6. Tap the “Write” button to write all your settings to the device.

Note:

1. Ensure the location of the smartphone NFC area and it’s recommended to take off the phone case.
2. If the smartphone fails to read/write configurations via NFC, keep the phone away and back to try again.
3. AM100 series can also be configured by a dedicated NFC reader, which can be purchased from Milesight IoT.

USB Configuration

Preparation:

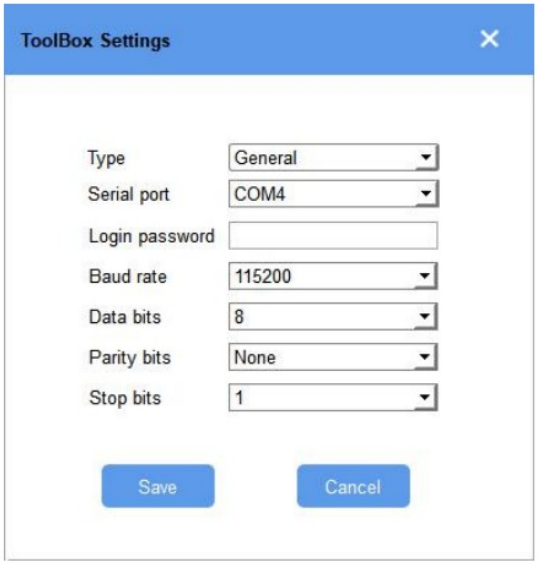
- Type-C USB cable
- PC (Windows 10 is recommended)
- ToolBox: V6.8 and above

Steps:

1. Download ToolBox from the Milesight IoT website.

2. Connect the device to the computer via the Type-C port.

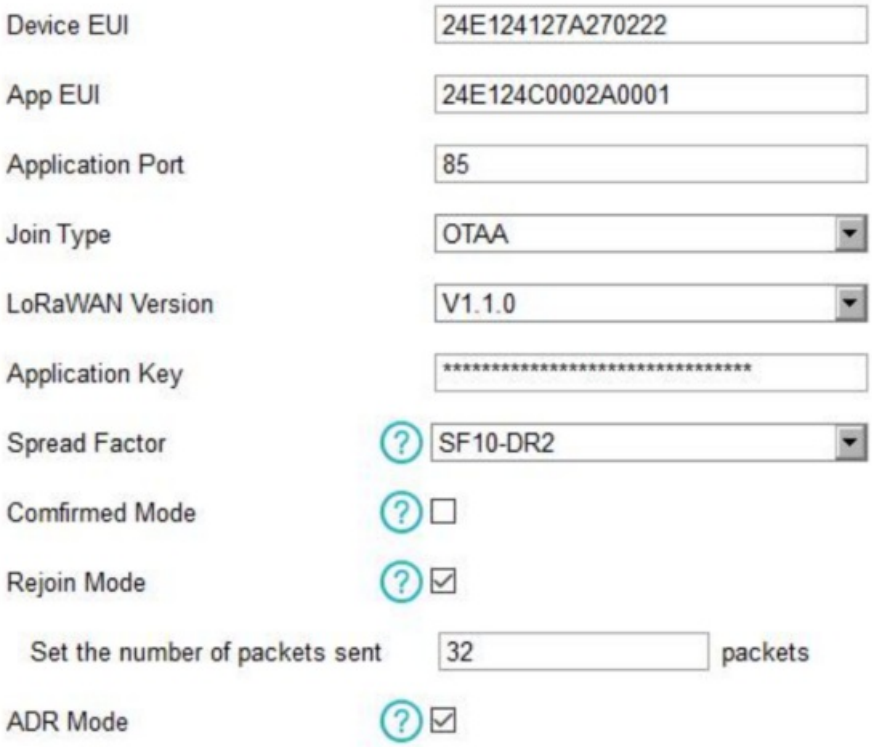
3. Open the ToolBox and select type as “General”, then click password to log in to ToolBox. (Default password: 123456)



4. After logging in to the ToolBox, you can click “Power On” or “Power Off” to turn on/off the device and change other settings.

LoRaWAN Settings

LoRaWAN settings are used for configuring the transmission parameters in the LoRaWAN® network.
Step 1: Go to “LoRaWAN Settings -> Basic” of ToolBox software or “Device->Setting->LoRaWAN Settings” of ToolBox App to configure join type, App EUI, App Key, and other information. You can also keep all settings by default.

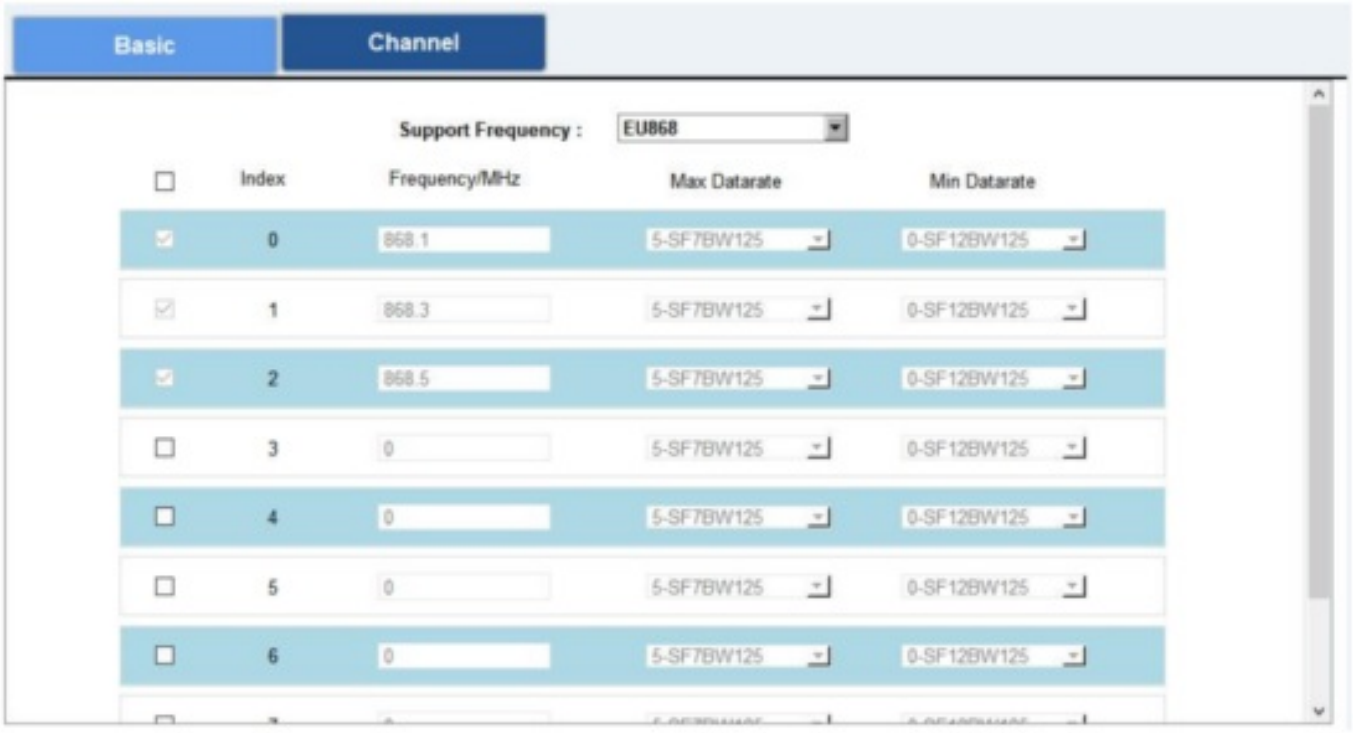

Device EUI
24E124127A270222
App EUI
24E124C0002A0001
Application Port
85
Join Type
OTAA
LoRaWAN Version
V1.1.0
Application Key
****
Spread Factor
SF10-DR2
Comfirmed Mode
Rejoin Mode
Set the number of packets sent
32
packets
ADR Mode

Parameters	Description
Device EUI	The unique ID of the device can also be found on the label.
App EUI	Default App EUI is 24E124C0002A001.
Application Port	The port used for sending and receiving data, the default port is 85.
Join Type	OTAA and ABP modes are available.
LoRaWAN	V1.0.2, V1.0.3, and V1.1 are available.
Version Appl ication	Appkey for OTAA mode, default is 5572404C696E6B4C6F52613230313823.
Key Device Address	Devendra for ABP mode, the default is the 5th to 12th digits of SN.
Network Ses sion Key	Nwkskey for ABP mode, default is 5572404C696E6B4C6F52613230313823.
Application Session Key	Appskey for ABP mode, default is 5572404C696E6B4C6F52613230313823.
Spread Fact or	If ADR is disabled, the device will send data via this spread factor.
Confirmed M ode	If the device does not receive an ACK packet from a network server, it will resend data 3 times at most.
Rejoin Mode	Reporting interval ≤ 30 mins: the device will send specific mounts of LoRaMAC packets to check connection status every 30 mins; If no reply after specific packets, the device will re-join. Reporting interval > 30 mins: the device will send specific mounts of LoRaMAC packets every to check the connection status every reporting interval; If no reply after specific packets, the device will re-join.
ADR Mode	Allow the network server to adjust the data rate of the device.
Tx Power	Based on LoRaWAN® regional parameter document.

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.**
5. **For TTN connection please select the LoRaWAN version as 1.0.2.**

Step 2: Go to “LoRaWAN -> Channel” of ToolBox software or “Setting->LoRaWAN Settings” of ToolBox App to select the supported frequency and select channels to send uplinks. Make sure the channels match the LoRaWAN® gateway.



If the 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:

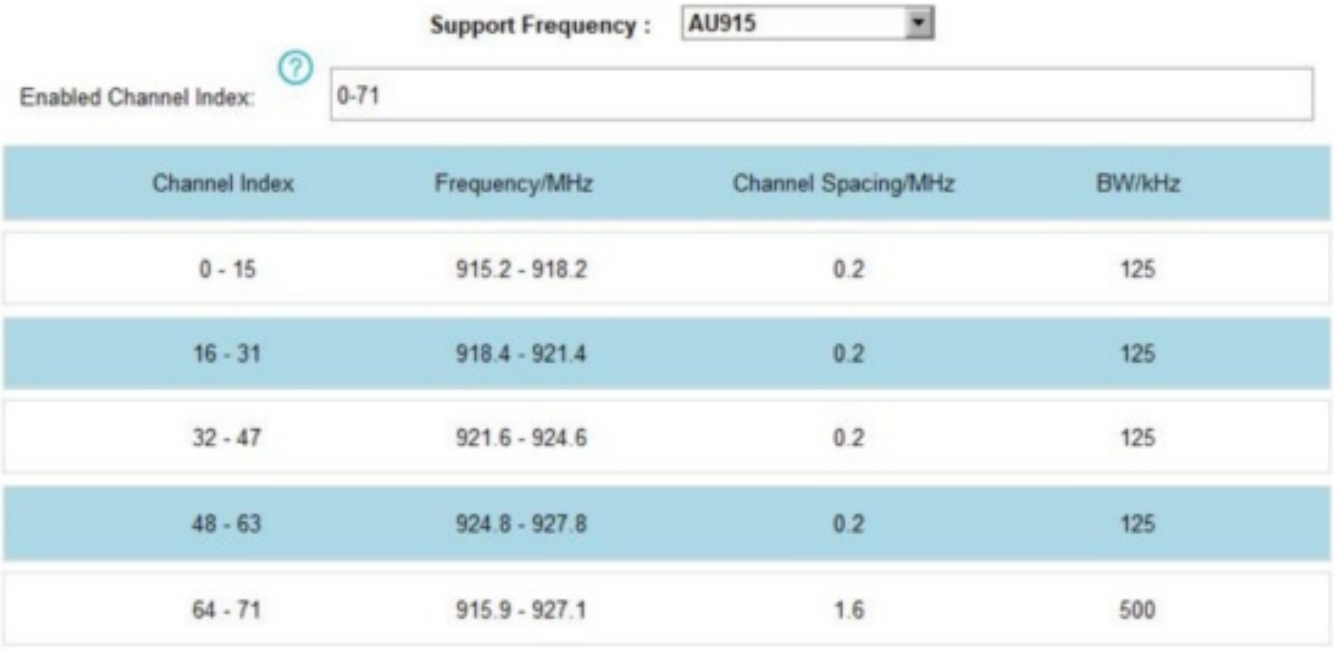
1, 40: Enabling Channel 1 and Channel 40

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



Note:

For the -868M model, the default frequency is EU868;

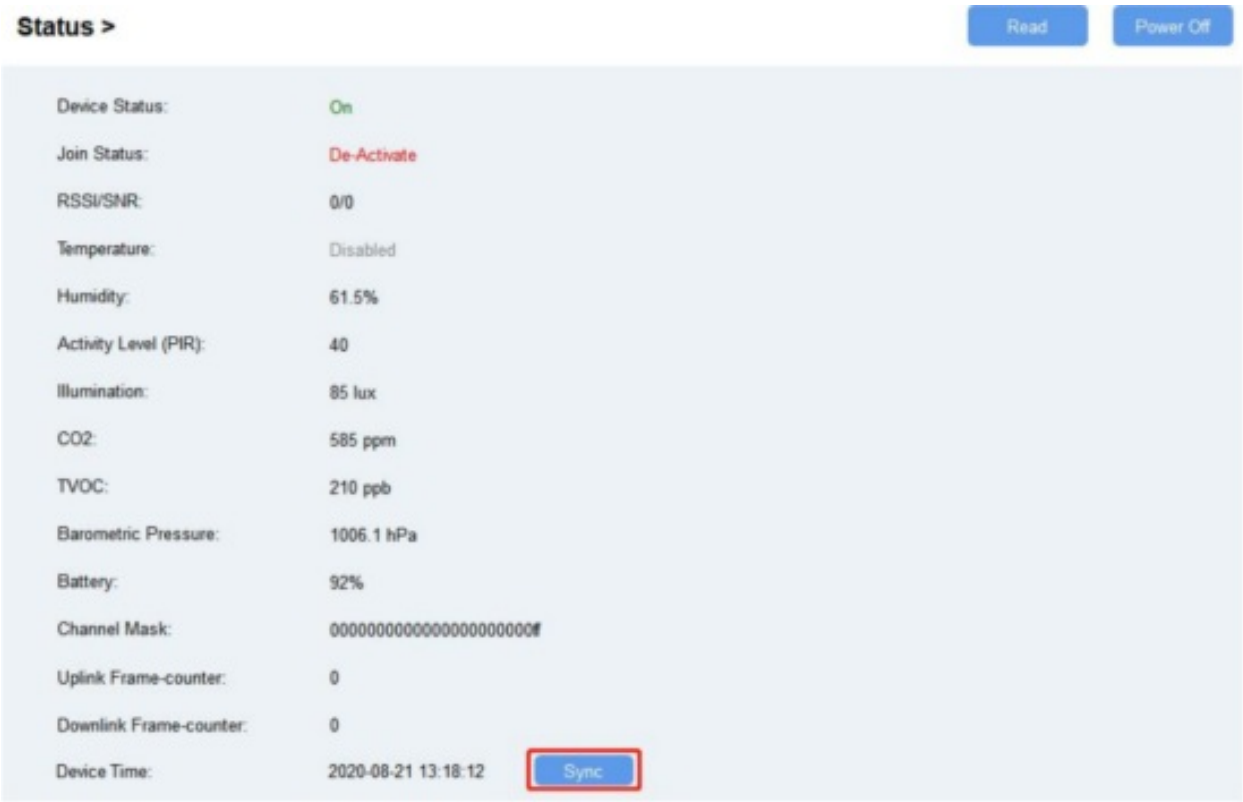
For the -915M model, the default frequency is AU915.

Time Synchronization

Mobile App Configuration:

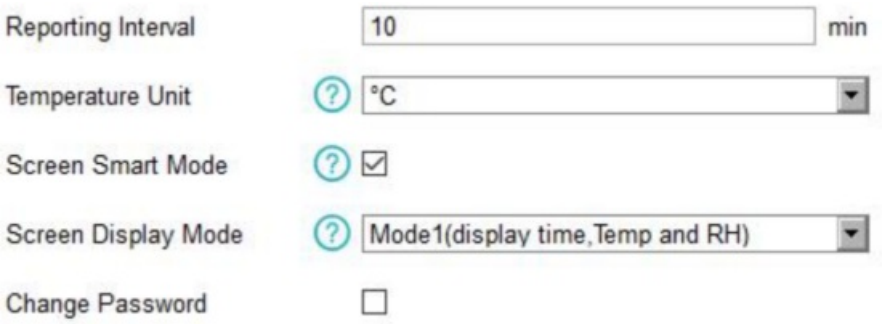
Open Toolbox App and go to “Device ->Status” to click “sync” to sync the time on the screen.

Software Configuration:
Log in to Toolbox and go to the “Status” page to sync the time on the screen.



Basic Settings

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



Parameters	Description
Reporting Interval	Reporting interval of transmitting data to a network server.Default: 600s **Note:** RS232 transmission will not follow the reporting interval.
Temperature Unit	Change the temperature unit displayed on the ToolBox 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.
Screen Smart Mode	When the PIR value is 0 and lasts for 20 mins, the screen will stop updating to save battery life.
Screen Display Mode	Change the screen display contents(see **section 2.3**).
Change Password	Change the password for ToolBox App or software to read/write this device.

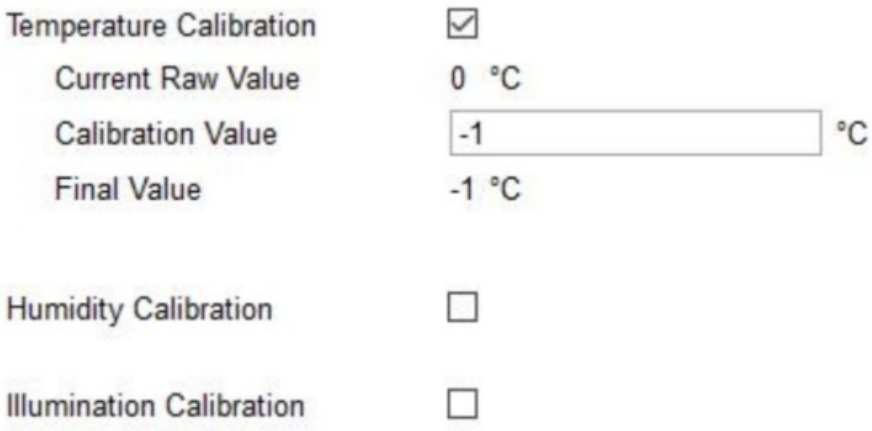
Advanced Settings

Data Collection Settings

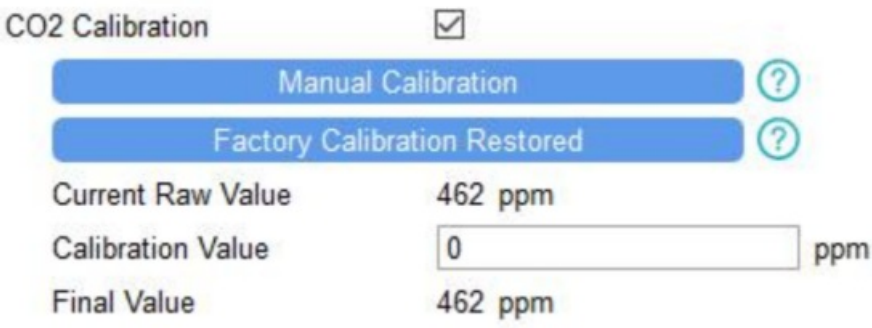
Go to “Device Settings->Basic” of ToolBox software or “Device->Setting->Data Collection Settings” of ToolBox App to select the data you need to monitor. If any item is disabled, the screen will stop updating it and there will no be data on the reporting package.

Calibration Settings

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



Besides numerical calibration, ToolBox provides more calibration methods for CO2:
Manual Calibration: Put the device in an open outdoor environment for more than 10 minutes and click this button to calibrate the CO2 value.
Factory Calibration Restored: Clean the manual calibration and turn it back to factory calibration.



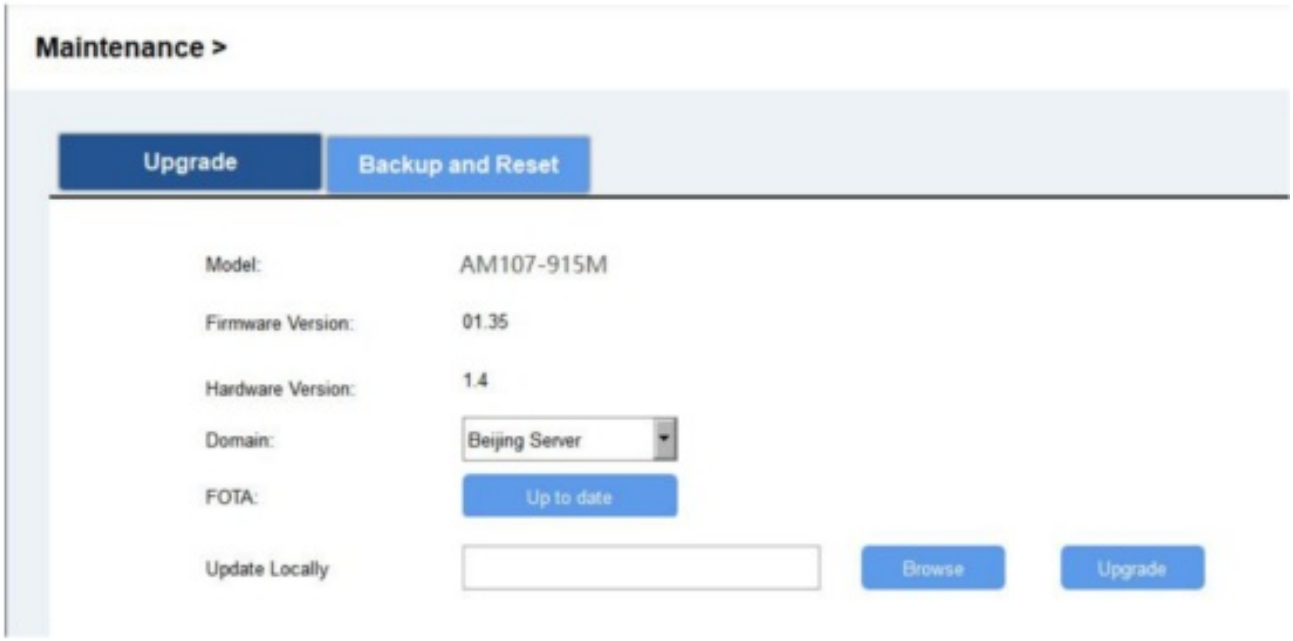
Threshold Settings

AM100 series will upload the current data instantly after the threshold is triggered. AM107 will also show alarms of CO2 and TVOC on the screen.
Go to “Device Settings->Basic” of ToolBox software or “Device->Setting->Threshold Settings” of ToolBox App to enable the threshold settings and input the threshold.

Maintenance

Upgrade

AM100 series support upgrades locally or over the air only via ToolBox software.



Upgrade Locally:
Step 1: Click “Browse” to import firmware from your computer.
Step 2: Click “Upgrade” to start the upgrade.
Upgrade Over the Air:
Step 1: Select the upgraded server according to your region and make sure your computer can access the Internet.
Step 2: Click “Up to date” to search for the latest firmware of devices. If your firmware is the latest version, ToolBox will prompt “Your device is up to date”.
Note: Any operation on ToolBox is not allowed during the upgrade.

Backup

AM100 devices support configuration backup for easy and quick device configuration in bulk.

Backup is allowed only for devices with the same model and LoRa frequency band. Please select one of the following methods to the backup the device:

Via ToolBox Software

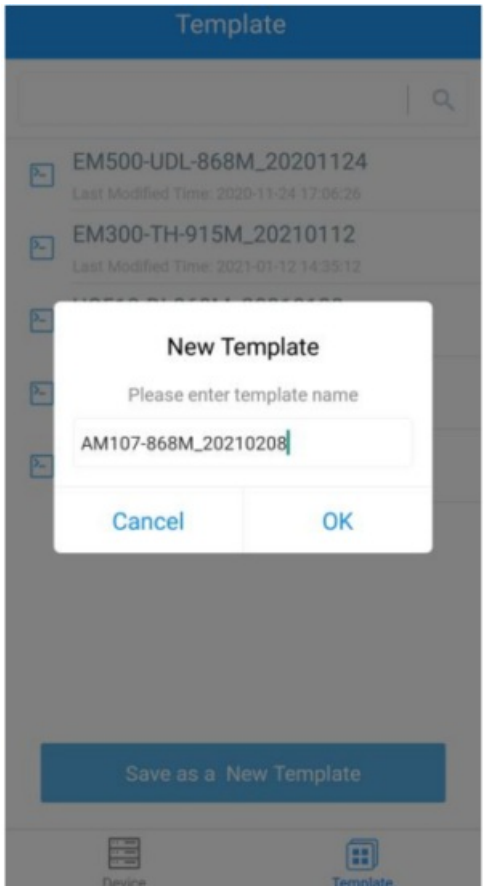
Step 1: Go to “Maintenance->Backup and Reset”, and click “Export” to save the current configuration as json format backup file.

Step 2: Click “Browse” to select the backup file, then click “Import” to import the configurations.

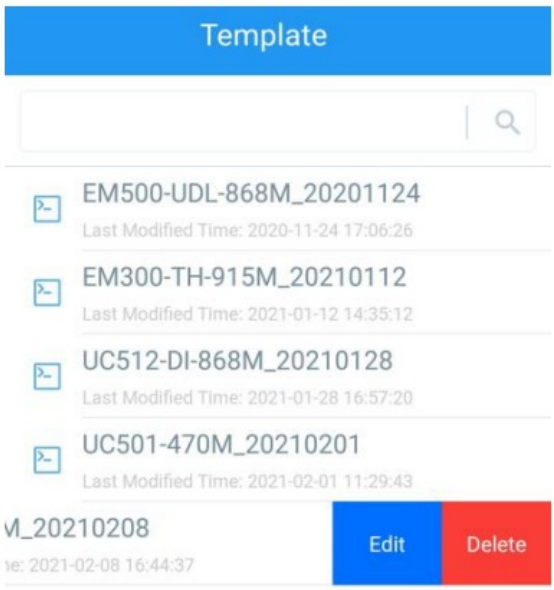
Via Toolbox App

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

Step 2: Select one template file saved in the smartphone and click “Write”, then attach to another device to write the configuration.



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



Reset to Factory Default

Please select one of the following methods to reset the device:
Via Hardware: Hold on to the power button for more than 10s.
Via ToolBox Software: Go to “Maintenance->Backup and Reset” to click “Reset”.

Via Toolbox App: Go to “Device->Reset” to click “Reset”, then attach smartphone with an NFC area to the device to complete the reset.

Installation

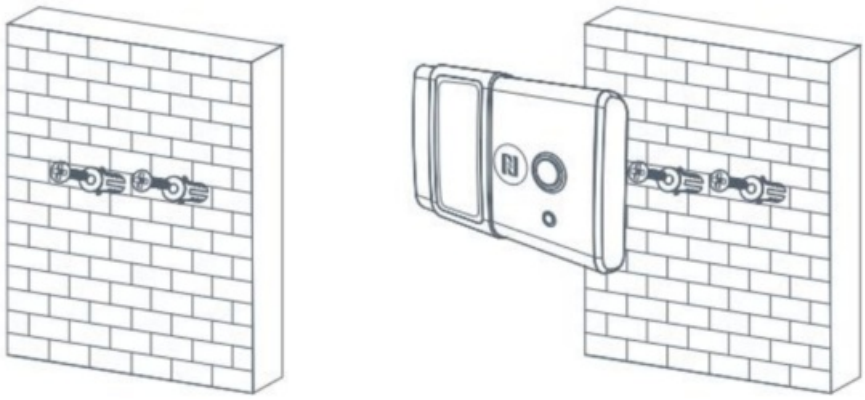
Installation Note

In order to ensure the best detection and LoRaWAN® communication effect, it is recommended to install the AM100 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 sources like an oven, or refrigerator.
- Do not mount the device close to where airflow varies greatly like windows, vents, fans, and air conditioners.
- 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 1.5m high from the floor.

Wall Mounting

1. Attach the mounting sticker to the wall.
2. Drill two mounting holes according to the sticker's mark (around 88mm).
   Note: The connecting line of two holes must be a horizontal line.
3. Drive the wall plugs and wall mounting screws into the wall at the marks using a screwdriver.
4. Mount the device on the wall.

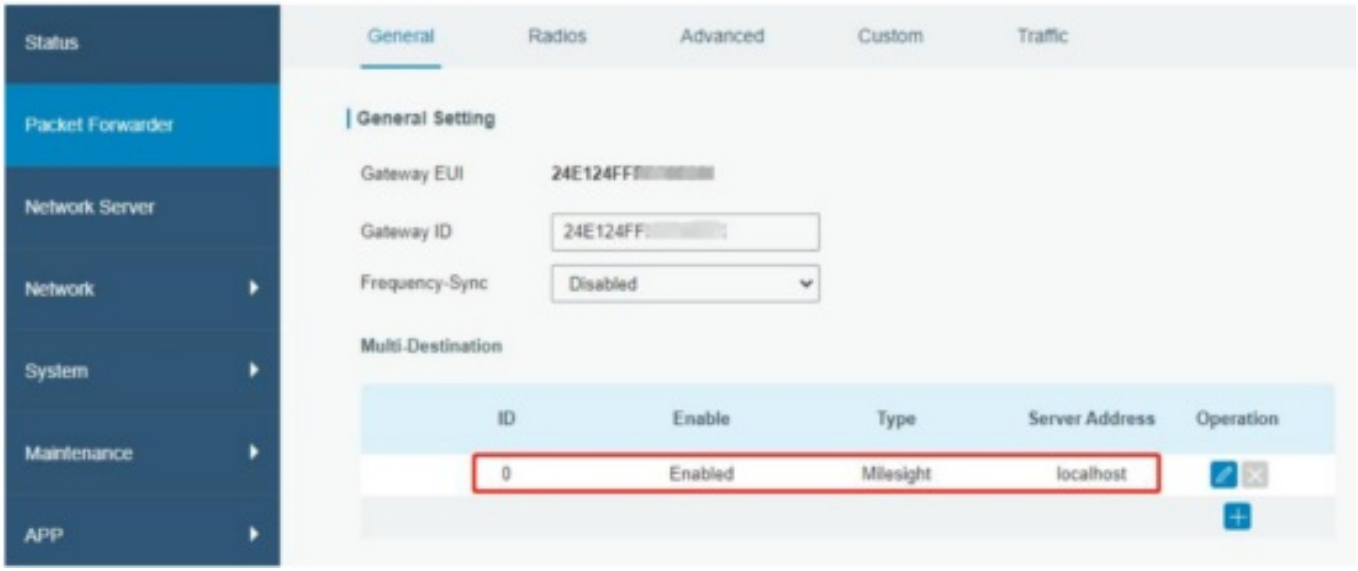


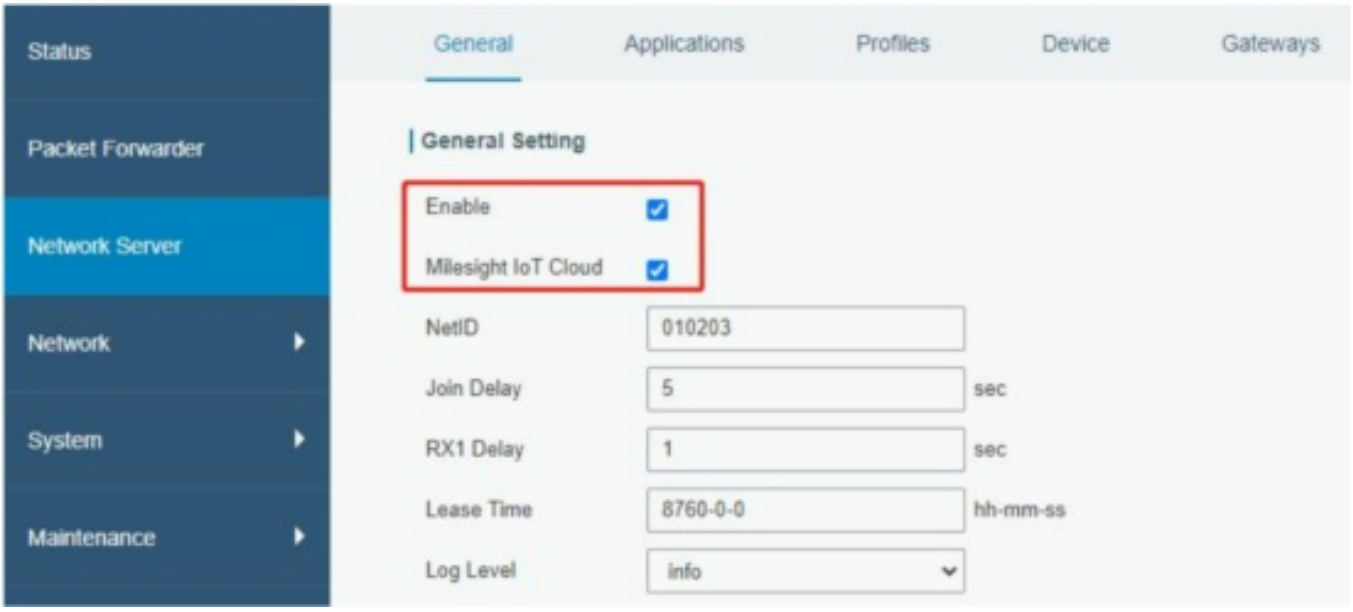
Milesight IoT Cloud Management

AM100 series can be managed by the Milesight IoT Cloud platform. Milesight IoT cloud is a comprehensive platform that provides multiple services including device remote management and data visualization with the easiest operation procedures. Please register a Milesight IoT Cloud account before operating the following steps.

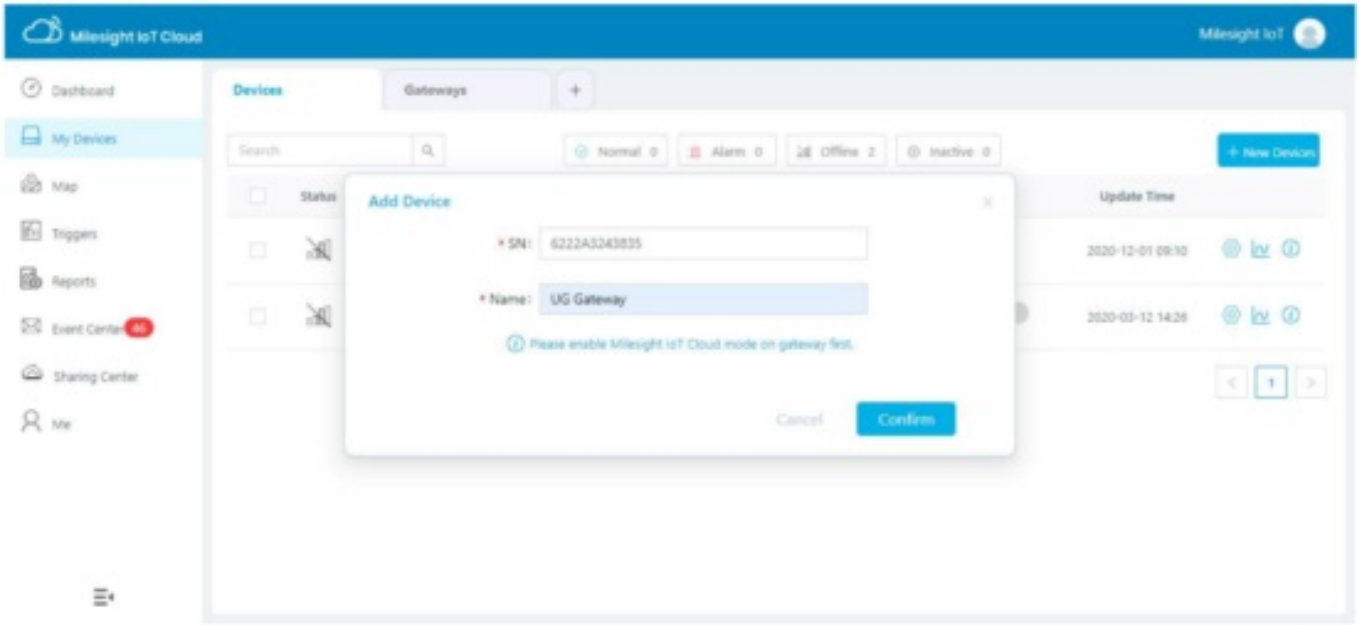
Add a Milesight Gateway

Step 1: Enable “Milesight” type network server and “Milesight IoT Cloud” mode in gateway web GUI.
Note: Ensure gateway has accessed the Internet.

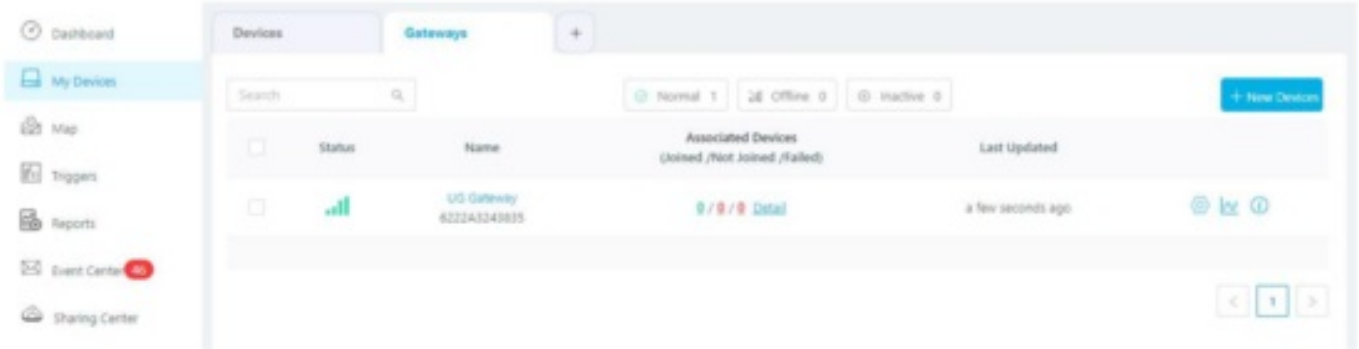




Step 2: Go to the “My Devices” page and click “+New Devices” to add a gateway to Milesight IoT Cloud via SN. Gateway will be added under the “Gateways” menu.



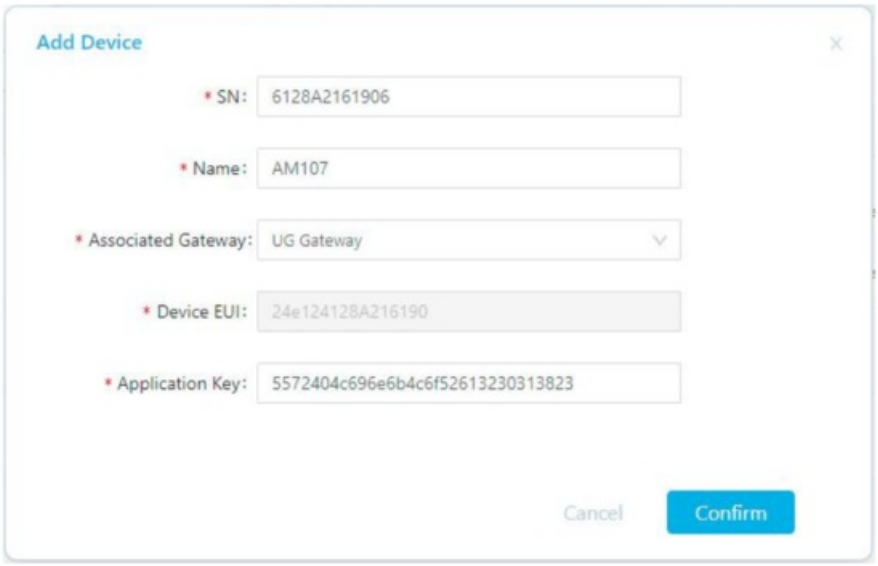
Step 3: Check if the gateway is online in Milesight IoT Cloud.



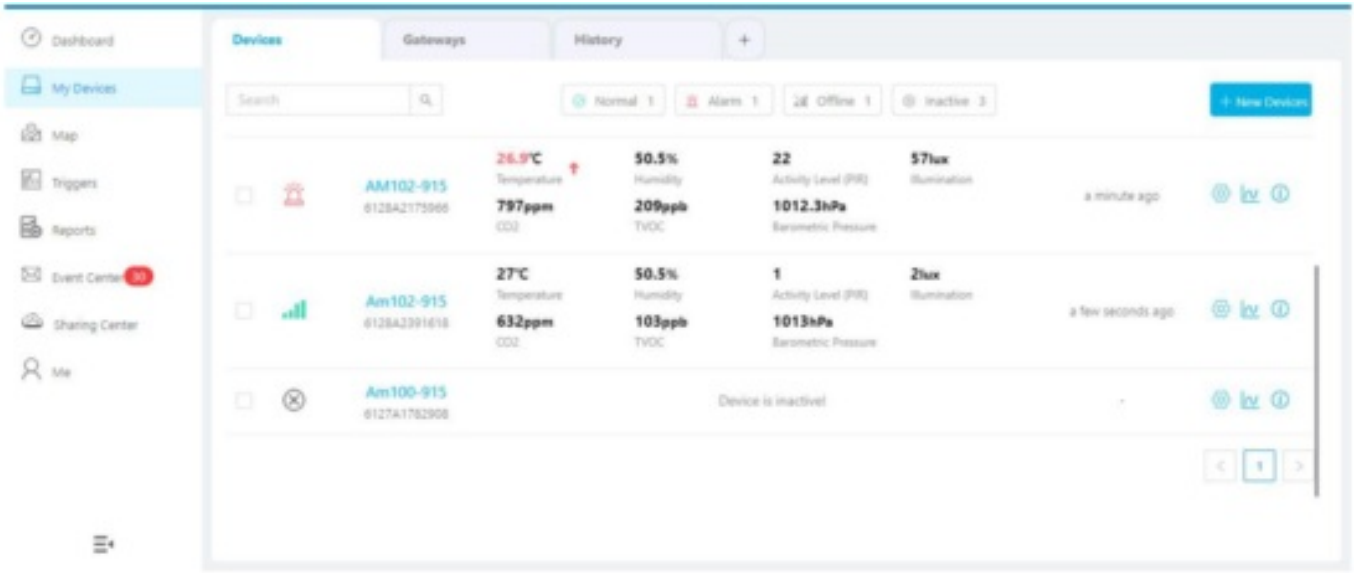
Add AM104/AM107 to Milesight IoT Cloud

Step 1: Go to the “My Devices” page and click “+New Devices”. Fill in the SN of the device and select the

associated gateway.



Step 2: After the device is online in Milesight IoT Cloud, you can check the data via webpage or mobile App and create a dashboard for it.



Device Payload

All data are based on the following format(HEX):

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**.

Basic Information

AM100 series sensors report basic information of sensor everytime joining the network.

Channel	Type	Data Example	Description
ff	01(Milesight Protocol Version)	01	V1
	08 Device SN	61 27 a2 17 41 32	Device SN is 6127a2174132
	09 (Hardware Version)	01 40	V1.4
	0a(Software Version)	01 14	V1.14
	0f(Device Type)	00	Class A
	18 (Sensor Status)	00 7f	00=>all sensors 7f=>0111 1111 means all sensors are open

Sensor Data

AM100 series sensors report sensor data according to reporting intervals (10min by default).
The battery level is reported every 24 hours.

Channel	Type	Data Example	Description
01	75(Battery Level)	64	64=>100 Battery level =100%
03	67 (Temperature)	10 01	10 01 => 01 10 = 272 Temp=272*0.1=27.2°C
04	68(Humidity)	71	71=>113 Hum=113*0.5=56.5%
05	6a(Activity Level)	49 00	49 00 => 00 49 =73 Activity Level = 73
06	65(Illumination)	1c 00 79 00 14 00	Illumination: 1c 00 => 00 1c =28 lux Visible + Infrared: 79 00=> 00 79= 121 Infrared: 14 00=> 00 14= 20
07	7d CO2	67 04	67 04 => 04 67 =1127 CO2 = 1127 ppm
08	7d(TVOC)	07 00	07 00 => 00 07=7 TVOC = 7 ppb
09	73 Barometric Pressure	68 27	68 27=>27 68=10088 Pressure=10088*0.1=1008.8hPa

Downlink Commands

AM100 series sensors support downlink commands to configure the device. The application port is 85 by default.

Channel	Type	Data Example	Description
ff	03(Set Reporting Interval)	b0 04	b0 04 => 04 b0 = 1200s
	18 (Enable/disable sensor)	01 01 (Enable Temperature)	Byte 1: Select Sensor 01: Temperature 02: Humidity 03: PIR 04: Light 05: CO2 06: TVOC 07: Barometric Pressure Byte 2: 00=disable, 01=enable

Appendix

Carbon Dioxide Levels and Guidelines

CO2 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, and even death.

-END-

Documents / Resources

	Milesight AM100 Series LoRaWAN Motion and Light Intensity Sensor [pdf] User Guide AM100 Series, LoRaWAN Motion and Light Intensity Sensor

References

- GitHub - Milesight-IoT/SensorDecoders