

# AM100 Series User Guide



Xiamen Milesight IoT Co., Ltd.

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



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# **Revision History**

Date	Doc Version	Description
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(Firmware 1.17)
Sept. 14, 2020	V 1.3	Add screen alarm settings (Firmware 1.19)
Nov. 19, 2020	V 2.0	Layout replace

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# 1. Product Introduction

## 1.1 Overview

AM100 series is a compact indoor ambience monitoring sensor including motion, humidity, temperature, light, TVOC, CO<sub>2</sub>, barometric pressure for 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 a PC software.

Sensor data are transmitted in real-time using standard LoRaWAN<sup>®</sup> protocol. LoRaWAN<sup>®</sup> 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 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<sup>®</sup> support
- Milesight IoT Cloud compliant
- Low power consumption (about 1 year battery life)
- Standard AA alkaline battery

# 2. Hardware Introduction



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

# 2.2 Product Overview



#### Front Panel:

E-ink screen
 NFC Area
 LoRa Antenna (Internal)
 PIR Sensor
 Light Sensor

#### Back Panel:

6 Power button7 Battery Cover8 Mounting Holes9 Type-C Port

# 2.3 E-link Screen

## 2.3.1 Screen Description

AM100 series provide 3 types of display modes:

AM104					
Mode 1	Mode 2	Mode 3			
<u>9</u> 0 <u>9</u> 0		다. 52:55 🚥			
& <sup>□</sup> - □ □.□	<b>&amp;</b> -5 5.2 ∞	<b>&amp;</b> -5 5.2 ∝			
°000%	° 55.2 %	° 55.2 %			
	* ■ ■ □ □ □	*			
AM107					



#### To learn what an icon means, find it below.

lcon	Description	Screen Update
(111)	Battery level	Once per day
55:55	Sync time with software or mobile APP	1 min
Ð	The device joins the network.	According to
다고	The device fails to join the network.	join status
L	Temperature	1 min
۵	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 ppb Show alarm when TVOC exceeds the	1 min
- <u>ک</u>	threshold value.(400 ppb by default)	

a ah - ahaaa	Show CO <sub>2</sub> history tendency from 0 to	
1.0000000000000000000000000000000000000	1400ppm.	2 min
-> <del>\</del>	Show alarm when CO <sub>2</sub> exceeds the threshold	2 11111
<u></u>	value.(1200 ppm by default)	

#### Note:

- AM100 series will do a full-screen refresh every 30 minutes in order to remove ghosting.
- Please refer section 4.3.3 for TVOC and CO<sub>2</sub> threshold settings.
- AM100 series shows current value on the screen and uplink the average value of the reporting interval to the gateway.

#### 2.3.2 Screen Mode Switch

Here are 3 methods to switch between the three modes:

- Power button: Quick press on the power button to switch the mode.
- Mobile APP: Go to APP menu "Device > Settings > Basic Settings" to select screen display mode.
- Software: Go to Toolbox menu "Device Settings > Basic > Basic Settings" to select screen display mode.

## 2.3 Power Button

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. Note: AM100 series will be automatically power on after reset.
Change Screen Mode	Quick press on the power button.

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

# 2.4 Dimensions(mm)



# 3. 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 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 battery.



# 4. Basic Configuration

AM100 series sensor can be monitored and configured through one of the following methods:

- Mobile APP (NFC);
- Windows software (NFC or Type-C port).

In order to protect the security of sensor, password validation is required when first configuration. Default password is **123456**.

# 4.1 Configuration via Smartphone APP

#### Preparation:

- Smartphone (NFC supported)
- Toolbox APP: APP can be download on Google Play or Apple Store.

## 4.1.1 Read/Write Configuration via NFC

- 1. Enable NFC on the smartphone and open "Toolbox" APP.
- 2. Attach the smartphone with NFC area to the device to read basic information.

**Note:** Ensure your smartphone NFC area and it is recommended to take off phone case before using NFC.



3. Click "Write" to change the configuration of AM sensor and attach the smartphone with NFC area to the device until the APP shows a successful prompt.

**Note:** If you use a new smartphone to configure the sensor at the first time, it's necessary to enter the password. (Default password: 123456)



4. Click "Read" to fetch the current data of sensor.

Status			
SN		5127A102	2508
Model		AM102	2-868
Device EUI	24e1	24127a10	2250
Firmware Vers	ion		V1.1
Hardware Vers	ion		V1.0
Device Status		ON	
Device Time	2020-03-18 13	:46:37	SYNC
Join Status		De-activ	/ated
RSSI/SNR			60/6
Temperature		2	5.6 ℃
Humidity		6	0.5%
Activity Level (	PIR)		796
	Read		
Device		Template	

#### 4.1.2 Template Settings

Template settings are used for easy and quick device configuration in bulk.

**Note:** Template function works only for sensors with the same model and LoRa frequency band.

1. Go to "Template" page of APP and save current settings as a template.

Template		Template
empty template		empty template
		New Template Please enter template name AM102-868_20200318
		Cancel OK
Save as a New Template		
Device Template	_	

- 2. Attach the smartphone with NFC area to another device.
- 3. Select the template file from Toolbox and click "Write".

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	9	LoRaWAN Settings	~
02-868_20200318 odlfied Time: 2020-03-18 16:20:23		Device EUI	
		24e124128a108592	
		* APP EUI	
		24e124c0002a0001	
		* Port	- 85 +
		Join Type	
		ΟΤΑΑ	
		Application Key	
		*************	*****
		* Support Frequency	
ave as a New Template		Ŵ	/rite



5. Slide the template item left to edit or delete the template.



# 4.2 Configuration via PC

#### Preparation:

- Dedicated NFC Reader or Type-C USB cable
- PC (Windows 10 is recommended)
- Toolbox: <u>https://www.milesight-iot.com/software-download/</u>

#### 4.2.1 Log in the Toolbox

Make sure "Toolbox" is downloaded on your computer. Select one of the following methods to log in Toolbox.

#### **USB** Connection

1. Connect the AM sensor to computer via type-C port.



2. Select type as "General" and click password to log in Toolbox. (Default password: 123456)

Туре	General	•
Serial port	COM4	-
Login password		
Baud rate	115200	•
Data bits	8	•
Parity bits	None	•
Stop bits	1	-

#### **NFC Connection**

1. Connect the NFC reader to computer, then attach the sensor to NFC area of the reader.



2. Select type as "NFC" and serial port as NFC reader port on Toolbox.

oolBox Settings		×
Туре	NFC	<u> </u>
Serial port	COM7	<b>-</b>
Save	Са	incel

## 4.2.2 Basic Configuration

1. Click "Read" to read current data of the sensor.

Status >		Read	Power Off
Device EUI:	24e16127A1040758		
Firmware Version:	01.02		
Hardware Version:	1.0		
Device Status:	On		
Join Status:	Activate		
RSSI/SNR:	-47/8		
Tempurature:	23.3°C		

2. When you perform one of the following operations, type the password and click "Enter", then wait a few seconds until toolbox shows a successful prompt. (Password is not needed if you connect it via type-C port)

- Turn on/off the sensor
- Reset the sensor
- Sync the time
- Click "Write" to change settings
- Upgrade

Channel		
Device EUI 24e	a124126a107457	
Verify Password	×	
Please put the NFC antenna close	to the NFC reader.	
Regular Report Confirmed		
ADR Mode		
	Channel Device EUI 24 Verify Password Password Password Please put the NFC antenna close Regular Report Confirmed CO ADR Mode Score	Channel         Device EUI       24e124126a107457         Verify Password       X         Password:       X         Please put the NFC antenna close to the NFC reader.         Regular Report Confirmed       ?         ADR Mode       ✓

#### 4.2.3 Upgrade

- 1. Download AM firmware to your computer.
- 2. Go to "Maintenance -> Upgrade" page of Toolbox.
- 3. Click "Browse" and select the firmware from computer.
- 4. Click "Upgrade" to upgrade the device.

**Note:** If NFC connection is selected, please keep the two devices close and don't move them in order to get the best connectivity as possible when upgrading.

Upgrade >

Upgrade	Backup and Reset	
Model:	AM102-470	
Firmware Version:	01.17	
Hardware Version:	1.4	
FOTA:	Up to date	
Update Locally	Browse	Upgrade
Update Locally	Browse	

#### 4.2.4 Template Settings

**Note:** Template function works only for sensors with the same model and LoRa frequency band.

- 1. Go to "Maintenance -> Template and Reset" page of Toolbox.
- 2. Click"Export" to save the current settings as a template.

	Upgrade >
Status	Upgrade Backup and Reset
<b>((0))</b> LoRaWAN Settings	Backup Export Config File Browse Import
ද්ටා Device Settings	Restore Factory Defaults Reset
습 Maintenance	

· 🕇 📘	« Too	olBox_v6 > ToolBox_v6.12	ٽ v		olBox_v6.12*
目织 ▼ 新建文	代共				
🔜 此电脑	^ 4	名称	修	改日期	类型
🧊 3D 对象		bearer	20	020/5/22 16:54	文件夹
- 视频		📙 iconengines	20	020/5/22 16:54	文件夹
1 图片		📙 imageformats	20	020/5/22 16:54	文件夹
		📙 platforms	20	020/5/22 16:54	文件夹
<ul> <li>↓ 下载</li> <li>↓ 音乐</li> </ul>	14	translations	20	020/5/22 16:54	文件夹
桌面					
🏪 本地磁盘 (C:	)				
🕳 新加卷 (D:)	v c				
文件名(N):	AM10	2-868_2020-06-09.dat			
保存类型(])	File (*.	dat)			

- 3. Click"Browse" to select the correct template from computer.
- 4. Click"Import"to import the template to the device.

Jpgrade >				
Upgrade	Backup and Reset			
Backup	Ex	port		
Config File	Box_v6.12/A	M102-868_2020-06-09.dat	Browse	Import
Restore Fac	tory Defaults	set		

## 4.3 Configuration Examples

#### 4.3.1 LoRa Channel Settings

The configuration of LoRaWAN<sup>®</sup> channel of AM104/AM107 must match the gateway's. Refer to <u>Appendix</u> to check default channel settings of AM104/AM107.

#### Mobile APP Configuration:

Open Toolbox APP and go to "Device ->Setting -> LoRaWAN Settings" to change the frequency and channels.

#### Software Configuration:

Log in Toolbox and go to "LoRaWAN Settings -> Channel" to change frequency and channels.

**Note:** 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

	Setting		e
port Frequ	ency		
IS915			-
nable Channel	Index (1)		
71			
ndex	Freque	ency/MHz	1
15	902.3 -	905.3	
- 31	905.5 -	908.5	
2 - 47	908.7 -	911 7	
	200.7	2110	
8 - 63	911.9 -	914.9	
4 - 71	903.9 -	914.2	

# 4.3.2 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 Toolbox and go to "Status" page to sync the time on the screen.

Status >		Read	Power Off
Device Status:	On		
Join Status:	De-Activate		
RSSI/SNR:	0/0		
Temperature:	Disabled		
Humidity:	61.5%		
Activity Level (PIR):	40		
Illumination:	85 lux		
CO2:	585 ppm		
TVOC:	210 ppb		
Barometric Pressure:	1006.1 hPa		
Battery:	92%		
Channel Mask:	000000000000000000000#		
Uplink Frame-counter:	0		
Downlink Frame-counter:	0		
Device Time:	2020-08-21 13:18:12		

#### 4.3.3 Alarm Settings

AM100 series will upload the current data instantly after the threshold is triggered. AM107 will also show alarms of  $CO_2$  and TVOC on the screen.

#### Mobile APP Configuration:

Open Toolbox APP and go to "Device -> Setting -> Threshold Settings" to enable the threshold settings and input the threshold.

#### Software Configuration:

Log in Toolbox and go to "Device Settings -> Basic -> Threshold Settings" to enable the calibration and input the calibration value.

Threshold Settings	$\wedge$		
When the value meets the threshold, the d report the value immediately.	evice will		
Temperature			
C02		Threshold Setting	s 🕐
Over / ppm			
1200		Temperature	
		CO2	
тиос		Over	1200
Over / ppb		TVOC	
400		Over	400

# 5. Installation

## **5.1 Installation Note**

In order to ensure the best detection and LoRaWAN<sup>®</sup> communication effect, it is recommended to install 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 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 1.5m high from floor.

## **5.2 Wall Mounting**

1. Attach the mounting sticker to the wall.

2. Mark the wall where the two mounting holes are according to the sticker's mark (around 88mm).

Note: The connecting line of two holes must be a horizontal line.

- 3. Drive two screws into wall at the marks using screw driver.
- 4. Mount the device on the wall.



# 6. Milesight IoT Cloud Management

AM100 series sensors can be managed by 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 following steps: cloud.milesight-iot.com.

# 6.1 Add a Milesight Gateway

1. Enable "Milesight" type network server and "Milesight IoT Cloud" mode in gateway web GUI.

Note: Ensure gateway has accessed the Internet.

Status	General Rad	ios Advanced	Custom	Traffic	
Packet Forwarder	General Setting				
Network Server	Gateway EUI 2	4E124FF			
Network	Frequency-Sync	Disabled ~			
System 🕨	Multi-Destination				
Maintenance	ID	Enable	Туре	Server Address	Operation
	0	Enabled	Milesight	localhost	
APP 🕨					
Status	General	Applications	Profiles	Device	Gateways
Packet Forwarder	General Setti	ng			
Network Server	Enable Milesight IoT C	loud 🔽			
Network	NetID	010203		]	
	Join Delay	5		sec	
System	RX1 Delay	1		sec	
Maintananco	Lease Time	8760-0-0		hh-mm-ss	
Waintenance	Log Level	info	~	]	

2.Go to "My Devices" page and click "+New Devices" to add gateway to Milesight IoT Cloud via SN. Gateway will be added under "Gateways" menu.

② Dashboard	Devices	Gateways	History +			
My Devices	Search	٩	⊘ Normal 1 🙇 Alarm 1 💐 Offline 1	⊗ Inactive 3		+ New Devices
🖄 Map	~ 首次	Add Device		×		
If O Triggers	613	5A39023			să.	(a) [v] (b)
Reports		×S X52-虚 1151109	N:	sociated with your		@ <u>w</u> @
Event Center 30	□ <del>3</del> 2 <sub>6</sub>	* Nam UC3X5 123A124	ne:		15 minutes ago	@ <u>M</u> @
Q Me	□ 凿 <sup>4</sup> 6	M102- 128A21755000 CO2	Cancel Confirm TVOC Barometric Pressure	<b>ux</b> ination	a few seconds ago	© <u>n</u> ©
≡		27°C Temperatur	re Humidity Activity Level (PIR)	<b>2lux</b> Illumination		

3. Check if gateway is online in Milesight IoT Cloud.

② Dashboard	Devices Gateway	History +		
My Devices	Search Q	⊘ Normal 1 🔊 Offline 0 ⊙ Inactive 1		+ New Devices
Map	Status Name	Associated Devices (Joined /Not Joined /Failed)	Last Updated	
Reports	UG85-915 621694470052	2/2/0 More	(5)	0 <u>v</u> @
Event Center 30	UG8555 6217A3163763	Device is not bound, please power on the device, after that, it will be associated with your account automatically	2020-08-18 16:42	© <u>M</u> ©
Sharing Center				

# 6.2 Add AM100 Series to Cloud

1. Go to "Device->My Devices" and click "Add Device". Fill in the SN of AM sensor and select associated gateway.

SN	6127
Name	
Associated Gateway	231 (6217******)
Device EUI	24e124127/
Application Key	5572404c696e6b4c6f526132303138

2.After sensor is connected to Milesight IoT Cloud, you could check the device information and data and create dashboard for it.

🕐 Dashboard	Devices	Gateways	Histor	- v	-			
My Devices	Search	٩	Ø No	rmal 1 🖄 Alarm	1 Offline 1	⊗ Inactive 3		+ New Devices
Kap Map			26.9°C †	50.5%	22	57lux		
Reports		AM102-915 6128A2175966	<b>797ppm</b> CO2	<b>209ррь</b> тvoc	1012.3hPa Barometric Pressure	namiatori	a minute ago	0 14 (2)
<ul> <li>Event Center 30</li> <li>Sharing Center</li> </ul>	o at	Am102-915 6128A2391618	27°C Temperature 632ppm	50.5% Humidity 103ppb	1 Activity Level (PIR) 1013hPa	<b>2lux</b> Illumination	a few seconds ago	@ <u>M</u> @
8 Me		Am100-915 6127A1782908	CO2	TVOC Devi	Barometric Pressure			@ <u>M</u> @
								< 1 >
≡								

# 7. Sensor Payload

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

All data are based on following format(HEX):

# 7.1 Basic Information

AM500 series sensors report basic information of sensor everytime joining the network.

Channel	Туре	Data Example	Description	
	01(Milesight Protocol Version)	01	V1	
	16 (Device SN)	61 27 a2 17 41 32	Device SN is 6127a2174132	
ff	ff 09 (Hardware Version) 0a(Software Version)	01 40	V1.4	
		01 14	V1.14	
	Of(Device Type)	00	Class A	
	19 (Concor Status)	00.7f	00=>all sensors	
	ro (Sensor Status)	0071	means all sensors are open	

# 7.2 Sensor Data

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

Channel	Туре	Data Example	Description
01		<u> </u>	64=>100
01	75(Battery Level)	64	Battery level =100%
		10.01	10 01 => 01 10 = 272
03	67 (Temperature)	1001	Temp=272*0.1=27.2°C
04		71	71=>113
	68(Humidity)		Hum=113*0.5=56.5%
		40.00	49 00 => 00 49 =73
05	ba(Activity Level)	49 00	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

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07	7d (CO <sub>2</sub> )	67 04	67 04 => 04 67 =1127 CO <sub>2</sub> = 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

# 7.3 Downlink Commands

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

Channel	Туре	Data Example	Description
	03(Set Reporting Interval)	b0 04	b0 04 => 04 b0 = 1200s
			Byte 1: Select Sensor
			01: Temperature
ff to (5, 14, (1), 1			02: Humidity
	10 (Enchle (dischle	01 01	03: PIR
		(Enable	04: Light
se	sensor)	Temperature)	05: CO <sub>2</sub>
			06: TVOC
			07: Barometric Pressure
			Byte 2: 00=disable, 01=enable

# Appendix

# **Default LoRaWAN Parameters**

	24E124 + 2 <sup>nd</sup> to 11 <sup>th</sup> digits of SN
DevEUI	e.g. SN = 61 26 A1 01 84 96
	Then Device EUI = 24E124126A101849
AppEUI	24E124C0002A0001
Appport	0x55
NetID	0x010203
	The 5 <sup>th</sup> to 12 <sup>th</sup> digits of SN
DevAddr	e.g. SN = 61 26 A1 01 84 96 00 41
	Then DevAddr = A1018496
АррКеу	5572404C696E6B4C6F52613230313823

www.milesight-iot.com

NwkSKey	5572404C696E6B4C6F52613230313823
AppSKey	5572404C696E6B4C6F52613230313823

# **Default Uplink Channels**

Model	Channel Plan	Channel Settings/MHz		
AM104-470M AM107-470M	CN470	470.3~489.3(All 95 channels)		
	EU868	868.1, 868.3, 868.5		
AM104-868M	RU864	868.9, 869.1		
AM107-868M	IN865	865.0625, 865.4025, 865.6025		
	AU915	915.2~927.1 (All 72 channels)		
AM104-915M	US915	902.3~914.2 (All 72 channels)		
AM107-915M	KR920	922.1, 922.3, 922.5		
	AS923	923.2, 923.4		
-END-				

