



Milesight WS203 Lorrawan Motion and TH Sensor User Guide

[Home](#) » [Milesight](#) » Milesight WS203 Lorrawan Motion and TH Sensor User Guide 

Milesight WS203 Lorrawan Motion and TH Sensor User Guide



Contents

- 1 Safety Precautions
- 2 Product Introduction
 - 2.1 Overview
 - 2.2 Key Features
- 3 Hardware Introduction
 - 3.1 Packing List
 - 3.2 Hardware Overview
 - 3.3 Power Button and LED Indicator
 - 3.4 Dimensions (mm)
- 4 Operation Guide
 - 4.1 NFC Configuration
 - 4.2 LoRaWAN® Settings
 - 4.3 General Settings
 - 4.4 Advanced Settings
 - 4.5 Maintenance
- 5 Installation
- 6 Device Payload
 - 6.1 Basic Information
 - 6.2 Sensor Data
 - 6.3 Downlink Commands
- 7 Documents / Resources
- 8 Related Posts

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 expose the PIR lens to direct sunlight.
- Do not paint or clean the PIR lens, or it will affect the detection of the device.
- Ensure that you install the battery properly. Choose the right model and make it connect to the positive and negative terminals rightly.
- Do not place the device where the temperature is below/above the operating range.
- Do not place the device close to objects with naked flames, heat source (such as oven), or exposure to sunlight, cold source, liquid, and extreme temperature changes.
- Remove the battery from the device if it is not to be used for an extended period. Otherwise, the battery might leak and damage the device.
- The device must never be subjected to shocks or impacts.

Declaration of Conformity

WS203 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
Aug. 3, 2023	V 1.0	Initial version

Product Introduction

Overview

WS203 is an environmental monitoring device that combines motion and temperature/humidity (TH) sensors. By detecting motion within a 6-meter range based on passive infrared (PIR) technology, the WS203 can trigger TH detection and periodically report environmental status over the LoRaWAN® network.

With easy configuration and wireless detection, the WS203 offers a reliable and convenient solution for space and TH optimization. Compatible with the Milesight LoRaWAN® gateway and Milesight IoT Cloud platform, it enables real-time monitoring of occupant status for effective remote management. The WS203 can find applications in various settings including smart offices, buildings, hospitals, and more.

Key Features

- Equipped with passive infrared and Fresnel Lens for motion or occupancy detection
- Built-in high-accurate TH sensor along with PIR sensor enabling communicative triggers
- Provide different types of PIR covers for adjustable and flexible field angles and different detecting ranges
- Store locally 1000 historical records and support retransmission to prevent data loss
- Equipped with NFC for one-touch configuration and support card emulation mode
- Function well with standard LoRaWAN® gateways and network servers
- Compatible with Milesight IoT Cloud
- Support Milesight D2D protocol to enable ultra-low latency and direct control without a gateway

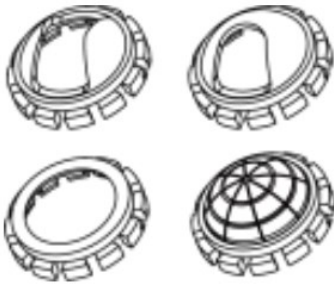
Hardware Introduction

Packing List

- 1 × WS203 Sensor



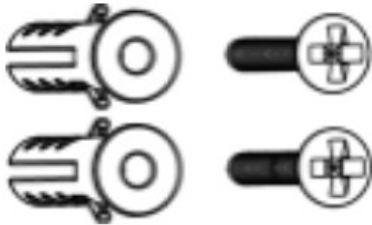
- 4 × PIR Covers



- 1 × 3M Tape



- 2 × Mounting Kits



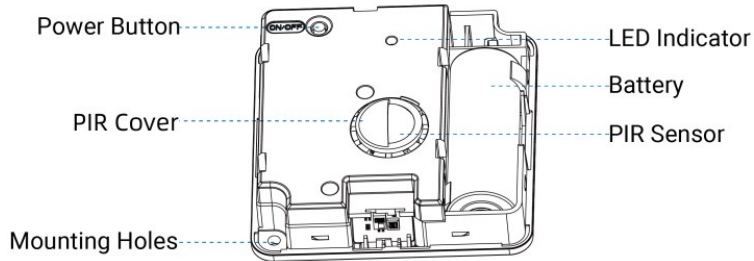
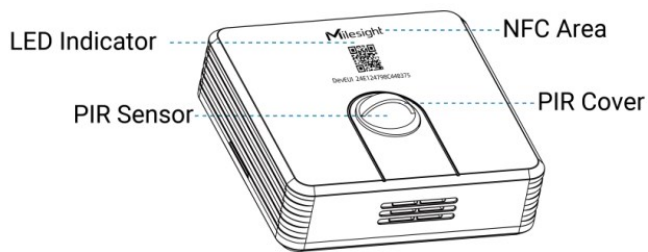
- 1 × Quick Start Guide



- 1 × Warranty Card



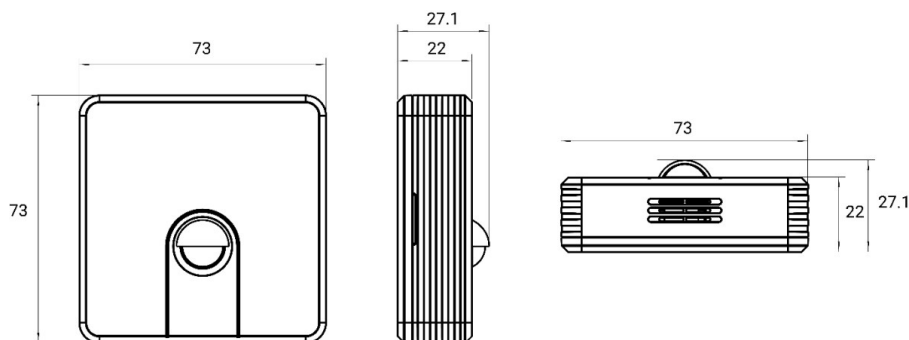
If any of the above items are missing or damaged, please contact your sales representative.



Power 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
Check On/Off Status	Quickly press the power button once.	Light On: Device is on
		Light Off: Device is off
Reset to Factory Default	Press and hold the power button for more than 10 seconds	Blink quickly
PIR Status	Vacant → Occupied	Blinks twice
	Occupied → Vacant	Blinks twice

Dimensions (mm)



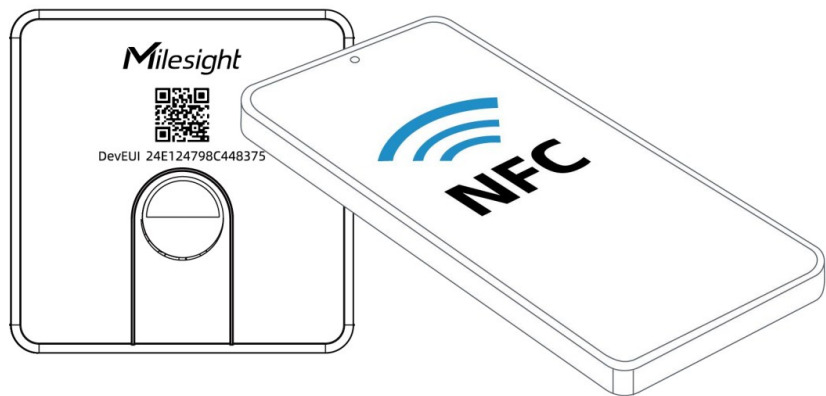
Operation Guide

NFC Configuration

WS203 sensor can be monitored and configured via NFC. Please refer to the following configuration steps

1. Download and install the Milesight ToolBox App from Google Play or Apple App Store.

- 2. Enable NFC on the smartphone and launch Milesight ToolBox.
- 3. Attach the NFC area of a smartphone to the device, and click NFC Read to read device information. The basic information and settings of the device will be shown on Tool Box 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 the password when first configuring. The default password is **123456**.



Note:

- 1. Ensure the location of NFC area of the smartphone and it's recommended to take off phone case.
- 2. If the smartphone fails to read/write configurations via NFC, remove the phone and try again.
- 3. WS203 sensor can also be configured by a dedicated NFC reader provided by Milesight IoT.

LoRaWAN® Settings

Go to **Device > Settings > LoRaWAN® Settings** of ToolBox App to configure AppEUI, Join Type, Application Key, and other information. You can also keep all settings by default.

Device EUI

24E124791D196040

* APP EUI

24e124c0002a0001

* Application Port

-

85

+

Join Type

ABP

* Network Session Key

* Application Session Key

Parameters	Description
------------	-------------

Device EUI	Unique ID of the device which can also be found on the label.												
App EUI	The 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, the default is 5572404C696E6B4C6F52613230313823.												
Network Session Key	Nwkskey for ABP mode, the default is 5572404C696E6B4C6F52613230313823.												
ApplicationSession Key	Appskey for ABP mode, the default is 5572404C696E6B4C6F52613230313823.												
Device Address	DevAddr for ABP mode, the default is the 5th to 12th digits of the SN.												
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 Mode	Select Standard-Channel mode or Single-Channel mode. When Single-Channel mode is enabled, only one channel can be selected to send uplinks. Please enable Single-Channel mode if connecting to the DS7610.												
Channel	<p>Enable or disable the frequency to send uplinks. Examples: 1, 40: Enabling Channel 1 and Channel 40; 1-40: Enabling Channel 1 to Channel 40; 60: Enabling Channel 1 to Channel 40 and Channel 60; All: Enabling all channels; Null: Indicate that all channels are disabled</p> <p>Channel Mode</p> <p>Standard-Channel ▼</p> <p>Enable Channel Index ⓘ</p> <p>0-71</p> <table> <thead> <tr> <th>Index</th><th>Frequency/MHz ⓘ</th></tr> </thead> <tbody> <tr> <td>0 - 15</td><td>902.3 - 905.3</td></tr> <tr> <td>16 - 31</td><td>905.5 - 908.5</td></tr> <tr> <td>32 - 47</td><td>908.7 - 911.7</td></tr> <tr> <td>48 - 63</td><td>911.9 - 914.9</td></tr> <tr> <td>64 - 71</td><td>903 - 914.2</td></tr> </tbody> </table>	Index	Frequency/MHz ⓘ	0 - 15	902.3 - 905.3	16 - 31	905.5 - 908.5	32 - 47	908.7 - 911.7	48 - 63	911.9 - 914.9	64 - 71	903 - 914.2
Index	Frequency/MHz ⓘ												
0 - 15	902.3 - 905.3												
16 - 31	905.5 - 908.5												
32 - 47	908.7 - 911.7												
48 - 63	911.9 - 914.9												
64 - 71	903 - 914.2												
Confirmed Mode	If the device does not receive an ACK packet from the network server, it will resend data once.												
Rejoin Mode	Reporting interval \leq 35 mins: the device will send a specific number of LinkCheckReq MAC packets to the network server every reporting interval or 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 the rejoin mode is enabled, set the number of LinkCheckReq packets to send. Note: the actual sending number is Set the number of packet sent + 1.
ADR Mode	Allow network server to adjust data rate of the device.
Spread Factor	If ADR is disabled, the device will send data via this spread factor.
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.

General Settings

Go to Device > **Setting** > **General Settings** of ToolBox App to set the reporting interval, etc.

Temperature Unit ⓘ

°C ▼

Reporting Interval - 30 + min

Time to Report Vacancy / min ⓘ

5

LED Indicator ⓘ ☐

Data Storage ⓘ ☒

Data Retransmission ⓘ ☐

Change Password ☐

Parameters	Description
Temperature Unit	Set the unit of temperature displayed on the status page.
Reporting Interval	The interval of reporting PIR status, temperature, humidity, and battery level to network server. Default: 30 min, Range: 1 – 1440 minNote: WS203 will report PIR “Occupied” status trigger packet immediatelywhen it detects motions and the reporting interval will be re-calculated.
Time to Report Vacancy / min	A “Vacant” status trigger packet will be reported if the device does notdetect motion with in a certain period of time and the reporting interval will be re-calculated. Default: 5 min, Range: 1 – 60 min
LED Indicator	Enable or disable the LED to indicate PIR status.
Data Storage	Disable or enable data storage locally. (see section 3.4.3)
Data Retransmission	Disable or enable data retransmission. (see section 3.4.4)
Change Password	Change the password for ToolBox App to write this device.

Advanced Settings

Calibration Settings

WS203 supports numerical calibration of the temperature and humidity value. Go to **Device > Settings > Calibration Settings** of ToolBox App to set the calibration value, the device will add calibration value to the current value and upload the final value.

Temperature

Numerical Calibration

Current Value: 26 °C

Calibration Value

°C

Final Value: 21 °C

Humidity

Threshold Settings

Go to Device > **Settings > Threshold Settings** of ToolBox App to enable the threshold settings and input the temperature threshold. If the temperature threshold is triggered, the device will upload the alarm packet once instantly and collect the temperature & humidity data as collect interval until the alarm releases.

Temperature



Over / °C

Below / °C

Collecting Interval



1



min

Data Storage

WS203 supports storing 1000 data records locally and exports data via ToolBox App. The device will record the data according to the reporting interval even not joining the network.

1. Go to **Device** > **Status** of ToolBox App to sync the device time.

Device Time

2023-08-08 19:22

Sync

2. Go to **Device** > **Setting** > **General Settings** to enable the data storage feature.

Data Storage



Data Retransmission



3. Go to **Device** > **Maintenance** of ToolBox App, click **Export**, then select the data time range and click Confirm to export data. The maximum export data period on ToolBox App is 14 days.

Cancel

Export Data Period

Confirm

2023-08-01 19:44 To 2023-08-08 19:44

2023	6	17	42
2022	7	18	43
2023	8	1	19
	2	20	45

4. Click **Export Record** to find the export file records.



24e124791d196040-Historical
Data-2023-08-04_10-31

124791d196040-Historical
Data-2023-08-04_11-09

Delete

Note: Slide the file record to the left to delete the record.

5. Click **Data Cleaning** to clear all stored data inside the device if necessary.

Export Historical Data

Export

Export Record

Data Cleaning

Data Retransmission

WS203 supports data retransmission to ensure the network server can get all data even if the network is down for some time. There are two ways to get the lost data:

- Network server sends downlink commands to enquire the historical data for specifying time range, refer to section 5.4;
- When network is down and no response from LinkCheckReq MAC packets for a period of time, the device will record the time of disconnection from the network and retransmit the lost data after the device is reconnected to the network.

Here are the steps of data retransmission:

1. Go to **Device > Setting > General** Settings to enable data storage feature and data retransmission feature.

Data Storage ⓘ



Data Retransmission ⓘ



2. Go to **Device > Setting > LoRaWAN Settings** to enable rejoin mode feature and set the number of packets sent. Take below as example, the device will send Link Check Req 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).

Rejoin Mode



Set the number of detection signals sent 

8

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 data re-transmission reporting interval.

Note:

1. If the device is rebooted or re-powered when data retransmission is not completed, the device will re-send interrupted retransmission data again after the device is reconnected back to the network.
2. If the network is disconnected again during data retransmission, the device will only send the latest disconnection data.
3. The retransmission data format is started with "20ce", please refer to section 5.4.
4. Data retransmission will increase the uplinks and shorten the battery life.

Milesight D2D Settings

Milesight D2D protocol is developed by Milesight and used for setting up transmission among Milesight devices without a gateway. When the Milesight D2D setting is enabled, WS203 can work as a Milesight D2D controller to send control commands to trigger Milesight D2D agent devices.

1. Configure RX2 data rate and RX2 frequency in LORaWAN® settings, it is suggested to change the default value if there are many LoRaWAN® devices around.
2. Go to **Device > Settings > D2D Settings** to enable D2D function and configure the D2D settings.

Enable



D2D Key

Occupied&Temperature threshold triggered



Control command

0

LoRa Uplink 



Control Time /min 



5

Occupied



Parameters	Description
Enable	Enable or disable Milesight D2D feature.
D2D Key	Define a unique D2D key which is the same as the setting in D2D agent devices. Default value: 5572404C696E6B4C6F52613230313823
Status Condition	When WS203 detects one or more of the below statuses, it will send the control command to the corresponding Milesight D2D agent devices: <ul style="list-style-type: none"> Occupied & Temperature threshold triggered Occupied (PIR) Vacant (PIR) Temperature threshold triggered Temperature threshold is lifted Note: for temperature threshold conditions, please enable and configure the temperature threshold feature under Threshold Settings.
Control command	Define a 2-byte hexadecimal control command (0x0000 to 0xffff).
LoRa Uplink	If enabled, a LoRaWAN® uplink packet that contains the PIR status or temperature alarm will be sent to gateway after the Milesight D2D control command is sent.
Control Time/min ¹	After receiving commands from WS203, Milesight D2D agent devices will take corresponding actions for this duration. Default: 5 mins, Range: 1 – 1440 mins

Maintenance

Backup

WS203 supports backup templates for easy and quick configuring devices in bulk. The backup feature is only for devices with the same model and LoRaWAN® frequency band.

1. Go to **Template** page on the App and save the current settings as a template. The saved templates are also editable.

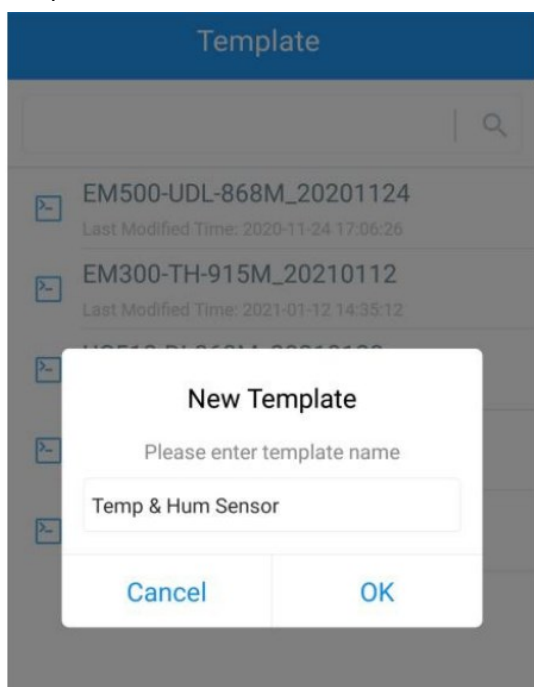


Device







Template

2. Select one saved template and click **Write**, then attach the smartphone to another device via NFC to reuse the template



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

This feature is under development on Milesight D2D agent devices.

Template	
<input type="text"/>	
	EM500-UDL-868M_20201124 Last Modified Time: 2020-11-24 17:06:26
	EM300-TH-915M_20210112 Last Modified Time: 2021-01-12 14:35:12
	UC512-DI-868M_20210128 Last Modified Time: 2021-01-28 16:57:20
	UC501-470M_20210201 Last Modified Time: 2021-02-01 11:29:43
V_20210208 1e: 2021-02-08 16:44:37	<div>EditDelete</div>

Upgrade

1. Download firmware from the Milesight website to your smartphone.
2. Go to **Device** > **Maintenance** of ToolBox App, tap **Browse** to import firmware and upgrade the device.

Note:

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

Status	Setting	Maintenance
SN	6791D19604050005	
Model	WS203-915M	
Firmware Version	V1.1	
Hardware Version	V1.0	
Manual Upgrade		
Browse		
Restore Factory Default		
Reset		

Reset to Factory Default

WS203 supports two methods to reset the device which are as following:

Via Hardware: Press and hold the power button for more than 10s until the LED indicator blinks quickly.

Via ToolBox App: Go to Device > Maintenance to tap Reset, then attach the smartphone to the device via NFC to complete the reset.

Status	Setting	Maintenance
SN	6791D19604050005	
Model	WS203-915M	
Firmware Version	V1.1	
Hardware Version	V1.0	
Manual Upgrade		
<button>Browse</button>		
Restore Factory Default		
<button>Reset</button>		

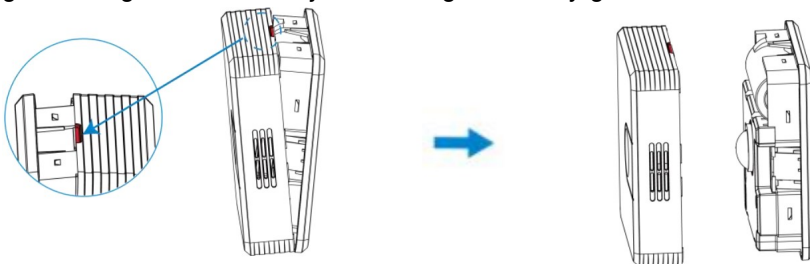
Installation

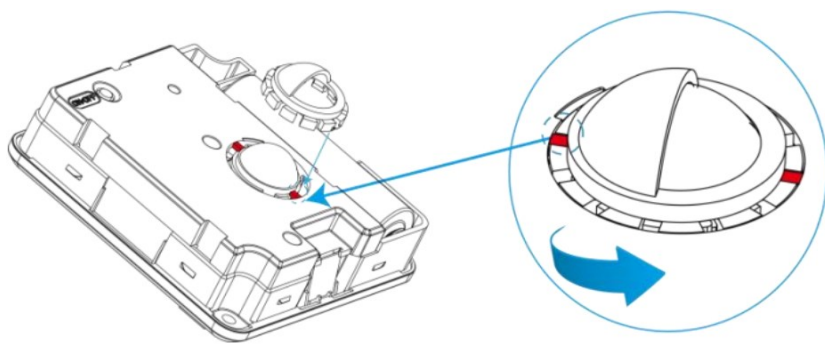
Installation Note:

1. Adjust the installation direction according to the detection area requirement.
2. Ensure the detection area does not have moving objects like waving trees and fans.
3. Ensure the detection area is not blocked by curtains or barriers.
4. Do not expose the device to direct infrared (including sunlight, light, etc.), or the PIR detection will be affected.
5. The recommended installation location is 2 m in height on the wall with the half PIR cover to avoid room light inference.
6. Avoid the device to face a transparent plate (like glass) within 5m since the PIR will detect through it.






PIR Cover Installation:

Take off the front cover of the device, then select the PIR cover as required and put it on the PIR sensor with groove alignment. The adjustable angle of every groove is 30°.





PIR cover reference guidance(wall mount and installation height=2m):

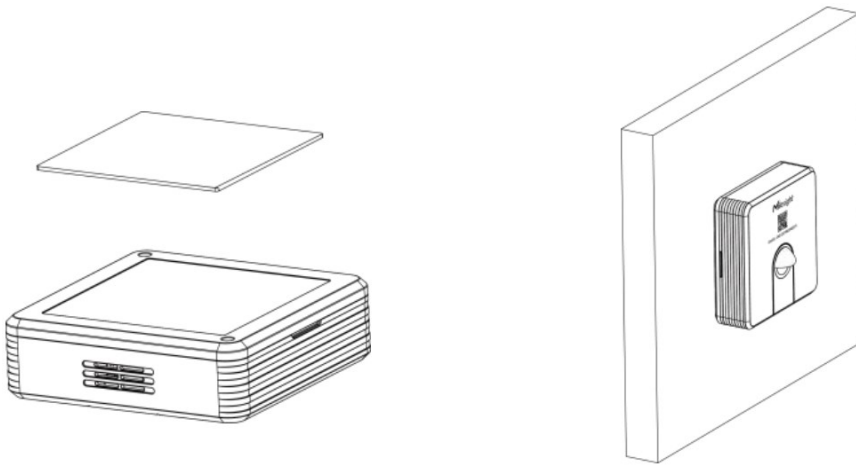
PIR Cover	Detection Area
	Maximum: 120 ° Horizontal, 50 ° Vertical, 6 m Recommend: 98 ° Horizontal, 44.4° Vertical, 5 m
	Maximum: 38 ° Horizontal, 50 ° Vertical, 6 m Recommend: 38 ° Horizontal, 44.4° Vertical, 5 m
	Maximum: 38 ° Horizontal, 100 ° Vertical, 6 m Recommend: 38 ° Horizontal, 88.8° Vertical, 5 m
	Maximum: 120 ° Horizontal, 100 ° Vertical, 6 m Recommend: 98 ° Horizontal, 88.8 ° Vertical, 5 m
	Support to be tailored as required

Fixed by 3M Tape:

Attach 3M tape to the back of the sensor, then tear the other side and place it on a flat surface. Please adjust the installation direction according to the detection area.

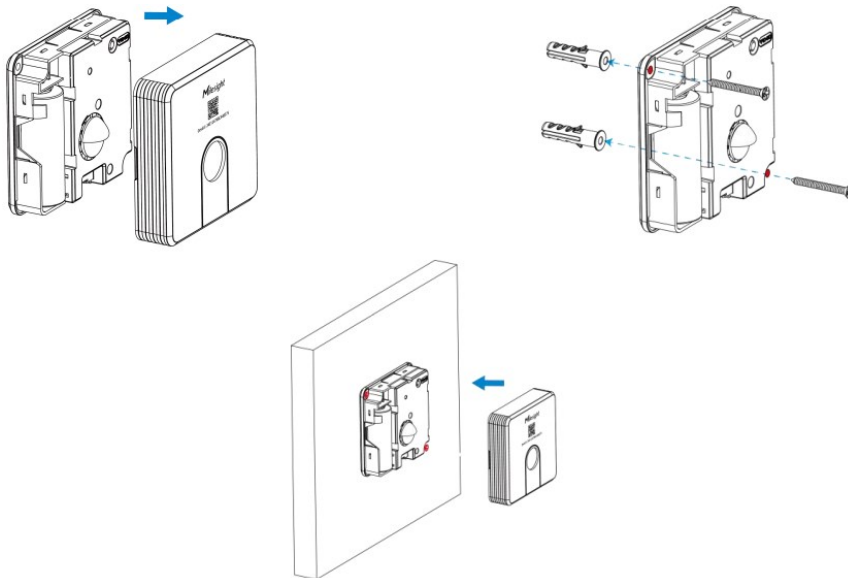
Note:

1. Since the default 3M tape has a high viscosity, please tear the device down via a screwdriver.
2. If it is necessary to tear the device down easily, please divide the 3M tape into several parts and only tear one part to the device.



Fixed by Mounting Kits

1. Take off the front cover of the device, then fix the wall plugs to a flat surface according to the device mounting holes. Finally, secure the device to the wall plugs using screws. Please adjust the installation direction according to the detection area.
2. Restore the front cover back to the device.



Device Payload

All the data is based on the following format (HEX), the Data field should follow the 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 the files on <https://qgithub.com/Milesight-IoT/SensorDecoders>.

Basic Information

WS203 sensor reports basic information whenever joining the network.

Channel	Type	Description
ff	0b (Power On)	Device is on
	01(Protocol Version)	01=>V1
	16 (Device SN)	16 digits
	09 (Hardware Version)	01 40 => V1.4
	0a (Software Version)	01 14 => V1.14
	0f (Device Type)	00: Class A, 01: Class B, 02: Class C

Example:

ff0bff ff0101 ff166791d19604050005 ff090100 ff0a0101 ff0f00					
Channel	Type	Value	Channel	Type	Value
ff	0b(Power On)	ff(Reserved)	ff	01(Protocol Version)	01(V1)
Channel	Type	Value	Channel	Type	Value
ff	16(Device SN)	6791d19604050005	ff	09(Hardware Version)	0100(V1.0)
Channel	Type	Value	Channel	Type	Value
ff	0a (Software Version)	0101 (V1.1)	ff	0f (Device Type)	00(Class A)

Sensor Data

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 %RH
PIR Status	05	00	00: Vacant; 01: Occupied
Temperature Alarm	83	67	Temperature (2 Bytes) + Alarm Status(1Byte)Temperature: unit — °CAlarm Status:00 -Alarm release01 -Alarm

Examples:

1. **Periodic packet:** report as reporting interval (30 minutes by default).

017562 0367d500 04687f 050001					
Channel	Type	Value	Channel	Type	Value
01	75(Battery Level)	62=>98%	03	67(Temperature)	d5 00=>00 d5=213 Temp=213*0.1=21.3°C
Channel	Type	Value	Channel	Type	Value
04	68(Humidity)	7f=>127Hum=127*	05	00(PIR Status)	01=>Occupied

2. **PIR trigger packet:** report when PIR status changes.

0367d500 04687f 050001					
Channel	Type	Value	Channel	Type	Value
03	67(Temperature)	d5 00=>00 d5=213Temp=213*0.1=21.3°C	04	68(Humidity)	7f=>127 Hum=127*0.5= 63.5%
Channel	Type	Value			
05	00(PIR Status)	01=>Occupied			

3. Temperature alarm packet: report when the temperature reaches the threshold or returns back to normal value.

83670e0101 04687a					
Channel	Type	Value	Channel	Type	Value
83	67(Temperature)	Temperature: 0e 01 = >01 0e = 270* 0.1 = 27 °C01= Alarm	04	68(Humidity)	7a=>122 Hum=122*0.5= 61%

Downlink Commands



WS203 supports downlink commands to configure the device. The application port is 85 by default.

Example:

20ce 7ac1cc64 04 01 0e01 7b			
Channel	Type	Time Stamp	Value
20	ce (Historical Data)	7ac1cc64 => 64ccc17a => 1691140474s= 2023-08-04 17:14:34	04=>Periodic report PIR: 01=>Occupied;Temperature: 0e01=>010e = 27°CHumidity: 7b => 123 = 61.5%



Documents / Resources

 Motion & TH Sensor Featuring LORRAWAN® WS203 User Guide 	<p>Milesight WS203 Lorrawan Motion and TH Sensor [pdf] User Guide</p> <p>WS203 Lorrawan Motion and TH Sensor, WS203, Lorrawan Motion and TH Sensor, Motion and TH Sensor, Motion and TH Sensor, TH Sensor, Sensor</p>
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Manuals+