

# Radar Human Presence Sensor Featuring LoRaWAN® VS370



#### **Safety Precautions**

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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.
- The device is not intended to be used as a reference sensor, and Milesight will not hold responsibility for any damage which may result from inaccurate readings.
- Do not place the device in places where the temperature is below/above the operating range.
- Do not place the device near naked flames, heat source (such as oven), or expose it to sunlight, cold source, liquid, and with 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**

VS370 is in conformity with the essential requirements and other relevant provisions of the CE, FCC, and RoHS.



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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 Phase III, Xiamen 361024, China

#### **Revision History**

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# 1. Product Introduction

## 1.1 Overview

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VS370 is a LoRaWAN<sup>®</sup> Radar Human Presence Sensor that adopts Millimeter Wave Radar and PIR technology. The sensor can detect human presence or slight movement and provide accurate human mobility statistics. Without any violation of privacy, VS370 has high detection accuracy with remarkable sensitivity, excellent algorithm performance, and exceptional precision.

As a Milesight D2D controller, the VS370 seamlessly communicates with other Milesight D2D devices, establishing more possible connections and paving the way for smoother operations. It can also be linked with lighting control and HVAC system to achieve an automated scene deployment where the lights, HVAC system and other associated devices turn on when someone enters the room.

With easy configuration and wireless detection, VS370 can be integrated with Milesight LoRaWAN<sup>®</sup> gateway and Milesight Development Platform, enabling remote and visual management of all sensor data.

VS370 can be used in various meeting rooms, conference rooms, and other spaces requiring monitoring of human presence.

## 1.2 Key Features

- Equipped with Millimeter Wave Radar and PIR technology, it can identify human slight-movement and moving object
- Detachable and movable magnetic bracket with an additional 30 ° deflection angle to achieve full area coverage
- 100% privacy protection, no specific images will be captured
- Working well even in low-light or completely dark environments with great lighting adaptability
- Support the sensitivity configuration of PIR and radar sensors, allowing for the selection of different sensitivity levels based on actual scenarios
- Support Milesight D2D protocol to enable ultra-low latency and direct control without gateways
- Support customized hibernation periods to achieve flexible control and save battery power
- Easy configuration via NFC and Bluetooth
- Support management and OTA upgrade via Milesight Development Platform

# 2. Hardware Introduction

## 2.1 Packing List

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

## 2.2 Hardware Overview



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# 2.3 Button Descriptions

Function	Action
	Install the batteries
Power Un/Uff	Remove the batteries
Reboot	Press and hold reset button for over 3s
Reset to Factory Default	Press and hold reset button for over 10s

# 2.4 Dimensions (mm)



# 3. Power Supply

Hold the back cover and rotate counterclockwise.



Install the two batteries according to the markings.





Align the mark with the unlock logo, then rotate to the left to secure the back cover.

#### Note:

1) The device can only be powered by ER14505 Li-SOCl<sub>2</sub> batteries and does not support the use of alkaline batteries.

2) If the device is not used for a long period of time, please remove the batteries, otherwise it may cause battery leakage and damage to the internal components.

3) When replacing batteries, ensure all batteries are newest; otherwise, it may shorten battery life or cause inaccurate power calculations.

## 4. Operation Guide

## 4.1 NFC & Bluetooth Configuration

After the device is powered on, it can be configured via Bluetooth or NFC. Bluetooth is recommended for the first time installation.

#### **NFC Configuration:**

1. Download and install "Milesight ToolBox App" on an NFC-supported smartphone.

2. Enable NFC on the smartphone and open "Milesight ToolBox" App.

3. Open "Milesight ToolBox" App, attach the smartphone with NFC area to read/write the device until App shows a successful prompt. It's suggested to configure a device password for security. (Default password: 123456)



4. Basic information and settings of devices will be shown on ToolBox if it's recognized successfully.

#### Note:

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

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

#### **Bluetooth Configuration:**

1. Download and install "Milesight ToolBox" App on an Bluetooth-supported smartphone.

2. Enable Bluetooth and location function on the smartphone.

3. Open "Milesight ToolBox" App, select Bluetooth method, search for the target device, and connect entering the Bluetooth password. Read/write operations can be performed once the app shows a success message. It's suggested to configure a device password for security. (Default password: 123456)



#### Note:

1) The Bluetooth connection will be terminated if there's no data interaction within 3 minutes. It will request to connect again.

2) The device can connect to only one smartphone via Bluetooth at a time. For example, if the device is connected to Smart phone A via Bluetooth, the connection will be terminated after it is connected to Smartphone B.

## 4.2 Time Synchronization

Go to **Device > Basic Information**, click  $\subset$  to sync the time from smartphone.



## 4.3 LoRaWAN® Settings

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

LoRaWAN D2D
Device EUI
24E124773E335233
APP EUI
24e124c0002a0001
* Application Port
85
LoRaWAN Version
V1.0.3

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.
LoRaWAN® Version	V1.0.2 and V1.0.3 are available.
Work Mode	It's fixed as Class A.
Confirmed Mode	If the device does not receive an ACK packet from the network server, it will resend data once.
Join Type	OTAA and ABP modes are available.
Application Key	Appkey for OTAA mode, the default is 5572404C696E6B4C6F52613230313823.
Network Session	Nwkskey for ABP mode, the default is
Key	5572404C696E6B4C6F52613230313823.
Application	Appskey for ABP mode, the default is
Session Key	5572404C696E6B4C6F52613230313823.
Device Address	DevAddr for ABP mode, the default is the 5th to 12th digits of the SN.
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 > 3	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.		
	Note: Only OTAA mod	e supports rejoin mode.	
	When the rejoin mode is enabled, set the number of LinkCheckReq packets to		
Set the number of	send.		
packets sent	Note: the actual sending number is Set the number of packet sent + 1.		
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.		
	Enable or disable the f	requency to send uplinks.	
	* Support Frequency		
	EU868	•	
	Frequency/MHz		
	868,1		
	868.3	•	
	868.5	••	
Supported	867.1		
riequency	867.3		
	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. <b>Examples:</b> 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		
ADR Mode	Allow network server to adjust the data rate of the device.		
Spread Factor	If ADR is disabled, the	If ADR is disabled, the device will send data via this spread factor.	
Tx Power	Transmit power of the device.		
RX2 Data Rate	RX2 data rate to receive downlinks.		
RX2 Frequency	RX2 frequency to receive downlinks. Unit: Hz		

#### Note:

- 1) Please contact sales personnel for device EUI list if there are many units.
- 2) Please contact sales personnel if you need random App keys before purchase.
- 3) Select OTAA mode if you are using Milesight Development Platform to manage devices.

# 4.4 General Settings

	General
	Reporting Interval(min)
	10
	Occupancy Trigger Sensitivity (1)
	High -
	Occupancy Maintaining Sensitivity (1)
	Middle
	Hibernate Period (1)
	00:00 — 00:01 (S)
	00:00 — 00:01 (S)
	Time Zone
	UTC+8 (CT/CST: China St
	Daylight Saving Time
	Time to Report Vacancy(min) ①
	1
	Illuminance Collection
	Change Password
Parameters	Description
Reporting Interval	The interval of reporting current occupancy status, illuminance status

and battery level to network server. Default: 1440 min, Range: 1 ~ 1440

	min
Occupancy Trigger Sensitivity	Adjust the responsiveness of the device to occupancy events. Higher sensitivity leads to quicker triggers but increases the probability of false triggers.
Occupancy Maintaining Sensitivity	Control the time and accuracy for maintaining the operational state after detecting presence. Higher sensitivity makes it easier to detect slight movements and maintain the occupied state.
Hibernate Period	Disable or enable Hibernate mode and configure the Hibernate Period. It will stop detecting and reporting when hibernating.
Time Zone	Set the time zone of the current location. When you click <b>Sync</b> button of ToolBox App to sync time, the device will also sync the time zone from smartphone automatically.
Daylight Saving Time	<ul> <li>Enable or disable Daylight Saving Time (DST).</li> <li>Start Time: the start time of DST time range.</li> <li>End Time: the end time of DST time range.</li> <li>DST Bias: the DST time will be faster according to this bias setting.</li> </ul>
Time to Report Vacancy(min)	After being released from the occupied state, it needs to wait for the idle time. If no occupancy is detected again during the idle time, the space will be considered as vacancy and the device will report a Vacant report. Default: 3min, Range: 1~60min.
Illuminance Collection	Enable or disable light intensity collection. Default: Bright status ≥ 700 lux; Dim status ≤ 300 lux. When the value is higher than 700 lux, the device will report status as Bright; when the value is lower than 300 lux, the device will report status as Dim.

#### 4.5 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, VS370 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<sup>®</sup> settings, it is suggested to change the default value if there are many LoRaWAN<sup>®</sup> devices around.

2. Go to Device > Settings > Network > D2D to enable D2D function and configure the D2D



settings.

LoRaWAN	D2D	
Enable		
D2D Key		
*******	******	*****
Occupied		
Control comma	nd	
0		
LoRa Uplink 🛈		
Control Time(m	in) (j	
Vacant		
Bright		
Dim		
Occupied/Brigh	t	
Occupied/Dim		

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	<ul> <li>When device detects one or more of the below statuses, it will send the control command to the corresponding Milesight D2D agent devices:</li> <li>Occupied</li> <li>Vacant</li> <li>Bright</li> <li>Dim</li> <li>Occupied/Bright</li> </ul>		

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	Occupied/Dim	
Control command	Define a 2-byte hexadecimal control command (0x0000 to 0xffff).	
LoRa Uplink	If enabled, a LoRaWAN <sup>®</sup> uplink packet that contains the information of button status will be sent to gateway after the Milesight D2D control command is sent.	
Control Time /min	After receiving commands from VS370, Milesight D2D agent devices will take corresponding actions within this duration. Default: 5 mins, Range: 1~1440 mins	

## 4.6 Maintenance

#### 4.6.1 Backup

VS370 supports backup templates for easy and quick device configurations in bulk. The backup feature is only for devices with the same model and LoRaWAN<sup>®</sup> frequency band.

1. Click **I** to go to **Template** page in the App, click **Add Template** to save the current settings as a template. The saved templates are also editable.





Modify the configuration and click Save, then attach the smartphone to another device, click
 Write to reuse the template.

< VS370-86 VS370-86 Save
Device Network
General
Template Name 'S370-868M_20241126
Da Tir Cancel Con 5
Illuminance Collection
Change Password
Write

Note: Check the box to export or delete the template. Click the template to edit the

#### configurations.





#### 4.6.2 Upgrade

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

2. Go to **Maintenance** page of ToolBox App, and tap **Upgrade** to import firmware and upgrade the device.

靣

Delete

Upgrade 👩	Restart	2
Reset 🧿		
-	N))	6
_	7	5

## 4.6.3 Reset

Go to **Maintenance** page and tap **Reset**, then attach the smartphone to the device via NFC or connect Bluetooth to complete the reset.

Device Maintenance	
Upgrade 👩	Restart 🔁
Reset 🕘	]
Device	Naintenance

# 5. Installation Instruction

## 5.1 Detection Range

VS370 will use PIR to detect the movement first and then trigger the radar to turn on to detect the occupancy status.

Condition: Installation Height=2.7m, Angle=75°.

**PIR Detection Range:** 

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Radar Slight Movement Detection Range:



Radar Movement Detection Range:



## 5.2 Installation

**Location:** On a wall at a height of 2.5 to 3 meters. Ceiling installation is not supported. **Tilt angle:** 60° or 75° is recommended.



#### **Recommended Installation Location:**



the device on the glass side (Position 4). It is not recommended to
install it on the opposite side (Position 2).



For large meeting rooms (area  $\geq$  6m\*6m): for any requirements, please contact a pre-sales or sales representative to arrange a solution evaluation.

#### Installation Steps:

Step 1: Take out the bracket adhesive, peel off the protective film on one side, and affix it to the magnetic bracket.



**Step 2:** After determining the installation position, peel off the protective film on the other side of the bracket adhesive and secure the magnetic bracket to the wall.



Step 3: Attach the sensor unit to the magnetic bracket.



Note: Ensure the sensor logo faces upward during installation.

Step 4: Installation complete.

#### **Installation Note:**

• Ensure the installation surface is flat and stable to prevent the device from tilting or being

unstable.

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- Avoid prolonged direct sunlight exposure on the device.
- Ensure that the lens of the device is facing the detection area directly, and avoid any obstructions around it.
- Interference sources such as fans, curtains, and plants can affect the radar's performance. Please try to avoid having these interference sources within the detection range.

## 5.3 Factors Affecting Accuracy

- Interference sources such as fans, curtains, and plants within the detection range can cause false alarms.
- Continuous presence of people outside the glass surfaces can cause false alarms.
- The device has blind spots; targets within these blind spots cannot be detected.
- Because radar can penetrate objects and has a wide FOV, it is recommended to keep the conference room's door closed after use.
- Because of the radar's wide field of view (FOV), the device is unsuitable for application in small areas like bathrooms.
- This product cannot detect a relatively stationary human body that shows only respiration and heartbeat without any noticeable limb movements.

# 6. Communication Protocol

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 files on <u>https://github.com/Milesight-IoT/SensorDecoders</u>.

#### 6.1 Basic Information

VS370 sensor reports basic information whenever it joins the network.

Channel	Туре	Byte	Description
	0b (Power On)	1	ff
	01(Protocol Version)	1	01=>V1
	ff (TSL Version)	2	0100
ff	16 (Device SN)	8	16 digits
	09 (Hardware Version)	2	01 00 => V1.0
	0a (Firmware Version)	2	01 14 => V1.14
	Of (Device Type)	1	00: Class A

	fe (Reset Report)	1	ff, only report after reset to factory default

#### Example:

ff0bff ff0101 ffff0100 ff166773e33523300001 ff090100 ff0a0101 ff0f00 fffeff						
Channel	Туре	Value	Channel	Туре	Value	
ff	0b (Power On)	ff (Reserved)	ff	01 (Protocol Version)	01 (V1)	
Channel	Туре	Value	Channel	Туре	Value	
ff	ff (TSL Version)	0100 (V1.0)	ff	16 (Device SN)	6773e33 5233000 01	
Channel	Type	Value	Channel	Тура	Valua	
onumer	iype	value	Channel	iype	value	
ff	09 (Hardware Version)	0100 (V1.0)	ff	0a (Firmware Version)	0101 (V1.1)	
ff	09 (Hardware Version) Type	0100 (V1.0) Value	ff	0a (Firmware Version) Type	0101 (V1.1) Value	

# 6.2 Sensor Data

Channel	Туре	Byte	Description
01	75(Battery Level)	1	UINT8, Unit: %, [1-100]
03	00(Occupied status)	1	01: Occupied; 00: Vacant
04	00(Illumination Status)	1	01: Bright; 00: Dim; fe: Disabled

## Examples:

1. Periodic packet:

	017564 030001 040000					
Channel	Туре	Value	Channel	Туре	Value	
01	75	64->100%	02	00(Occupied	01 =>	
01	(Battery Level)	04->100%	03	status)	Occupied	
Channel	Туре	Value				
04	00(Illumination					
04	Status)	00=> DIIII				

2. Occupancy Status Alarm packet:

030001 040000					
Channel	Туре	Value	Channel	Туре	Value
02	00(Occupied	01 =>	04	00(Illumination	00-> Dim
03	status)	Occupied	04	Status)	

# 6.3 Downlink Commands

VS370 supports downlink commands to configure the device. The application port is 85 by default.

Channel	Туре	Byte	Description
	10(Reboot)	1	ff
ff	8e(Reporting Interval)	3	<ul> <li>Byte 1: 01</li> <li>Byte 2-3: Reporting Interval, INT16, Unit: min</li> </ul>
f9	3e(Occupancy Trigger Sensitivity)	1	00: Low 01: Middle 02: High
	3f(Occupancy Maintaining Sensitivity)	1	00: Low 01: Middle 02: High
	44(Hibernate Period)	1	<ul> <li>Byte 1: 01-Period 1, 00-Period 2</li> <li>Byte 2: 01: enable; 00: disable</li> <li>Byte 3-4: Start Time, unit: min</li> <li>Byte 5-6 End Time, unit: min</li> </ul>
	bd(UTC Time Zone)	2	INT16/60
ff	ba(Daylight Saving Time)	10	<ul> <li>Byte1: 01-Enable; 00-Disable</li> <li>Byte2: DST Bias, INT8, Unit:min</li> <li>Byte3: Start Month</li> <li>Byte4:</li> <li>Bit 7-4: Start Week</li> <li>Bit 3-0: Start Day</li> <li>Byte5-6: Start Time, UINT 16, Unit:min</li> <li>Byte7: End Month</li> <li>Byte8:</li> <li>Bit 7-4:End Week</li> </ul>

			➢ Bit 3-0: End Day
			• Byte9-10: End Time, UINT 16, Unit:min
	40(Report Vacancy Time)	1	UINT8, Unit: min
		5	• Byte 1: 01-enable, 00-disable
f9	41(Illuminance)		<ul> <li>Byte 2-3: Bright Status Illuminance, UINT 16, unit: lux, Default: 700</li> </ul>
			<ul> <li>Byte 4-5: Dim Status Illuminance, UINT 16, unit: lux, Default: 300</li> </ul>
	84(Milesight D2D Feature)	1	01-enable, 00-disable
	35(Milesight D2D Key)	8	First 16 digits, last 16 digits are fixed as 0
ff	96(Milesight D2D Settings)	8	<ul> <li>Byte 1: 00-Occupied 01-Vacant</li> <li>02-Bright</li> <li>03-Dim</li> <li>04-Occupied/Bright</li> <li>05-Occupied/Dim</li> <li>Byte 2: 01-enable, 00-disable</li> <li>Byte 3: 01-enable LoRa Uplink, 00-disable</li> <li>LoRa Uplink</li> <li>Byte 4-5: D2D control command</li> <li>Byte 6-7: control time, Unit: min</li> <li>Byte 8: 01-enable control time, 00-disable</li> </ul>
	4a(Time Synchronization)	1	ff
	8f(Bluetooth)	1	01: enable; 00: disable

## Examples:

1. Reboot the device.

ff10ff		
Channel	Туре	Value
ff	10 (Reboot)	ff

## 2. Set reporting interval as 2 minutes.

ff8e 00 0200			
Channel	Туре	Value	

#### 3. Set up Hibernate Mode.

f944 00 01 fe01 ec04			
Channel	Туре	Value	
		00: Period 1	
f9	44 (Hibernate Mode)	01: Enable Hibernate mode	
		fe 01 => 01 fe = 510 minutes = 8 hours +30mins	
		= 8:30	
		ec 04 => 04 ec = 1260minutes =21 hours = 21:00	

#### 4. Set time zone as UTC-4.

ffbd 10ff		
Channel	Туре	Value
ff	bd(UTC Time Zone)	10 ff => ff10 = -240/60 = -4

5. Set Daylight Saving Time from Mar. /2nd /Sun. 14:00 to Nov. /1st /Mon 14:00 and Bias as 60min.

ffba 01 3c 03 27 4803 0b 11 4803			
Channel	Туре	Value	
		01=enable	
		Bias: 3c=60min	
		Start Month: 03=March	
		27=>0010 0111	
		Start Week: 0010=2= 2 <sup>nd</sup>	
<i>ff</i>	ba(Daylight	Start Day: 0111=7=Sunday	
11	Saving Time)	Start Time: 48 03=> 03 48=>840min=14:00	
		End Month: 0b=11=Nov.	
		11=>0001 0001	
		End Week: 0001=1=1 <sup>st</sup>	
		End Day: 0001=1=Monday	
		End Time: 48 03=> 03 48=>840min=14:00	

## 6. Set D2D Key as 5572404C696E6B4C0000000000000000.

ff35 5572404C696E6B4C		
Channel	Туре	Value
ff	35 (Set D2D Key)	5572404C696E6B4C

#### 7. Set D2D settings.

ff96 04 01 01 04e0 0500 01		
Channel	Туре	Value

ff 96 (D2D Settings)	96 (D2D Settings)	04=> Occupied/Bright;
		01=>Enable;
		01=>Enable LoRa Uplink;
		04 e0=>e0 04, Control Command is e0 04;
		05 00=>00 05, Control time is 5 mins;
	01=>Enable Control Time	

8. Enable Illuminance collection and set bright/dim status threshold values.

f941 01 2003 9001		
Channel	Туре	Value
f9	41 (Illuminance)	01=>Enable;
		Max Illuminance: 20 03=>03 20=>800 lux
		Min Illuminance: 90 01=>01 90=>400 lux

-END-

