

Specification

Product Name: 24GHz Large-space presence sensor (RS485 version)

Product Model: MSA237D 99 485 (Order NO:3022370007001)

Product Version: V1.1

Versions	Release Date	Record	Publishing
V1.0	2025.6.12	Initial release	Jacky
V1.1	2025.7.14	RS485 protocol update	Jacky

【Product Description】

MSA237D 99 485 is a 24GHz radar sensor based on Merrytek patented orthogonal antenna. Its antenna has high gain and wide detection range. Combined with Merrytek's unique 4th generation human presence detection software algorithm and FMCW modulation, it can accurately detect micro movements brought by human in almost

all indoor spaces and provide fast and accurate front-end sensing input for smart home, smart hotel, smart office and other scenes.

【Product Feature】

- Exclusive Merrytek Lifebeing Presence Detection
- FMCW modulation technology applied to detect micro movement brought by breathing
- Merrytek plug-play AI self-learning function to recognize room size itself
- Germany RF technology applied for 5-year guarantee assurance
- Accurate Presence/Absence Output
- Daylight Sensor Available
- Daylight threshold mode and daylight report mode available
- Support RS485 communication
- 24Ghz ISM Band Millimeter Wave Radar technology
- Major/Minor/Micro Motion detection diameter: 7-9m Max
- Major/Minor/Micro Motion detection range are highly coincide
- Round radiation. Effectively managing a whole space by a single sensor
- Flush mounting and Surface mounting installation available
- Sensor parameter adjustable by Merrytek wechat mini program or RS485 protocol
- Sensing function based on millimeter wave radar technology
- Low RF power output. No harm to human health
- Not affected by temperature, humidity, noise, airflow, dust, light and other environments



【Product dimension】

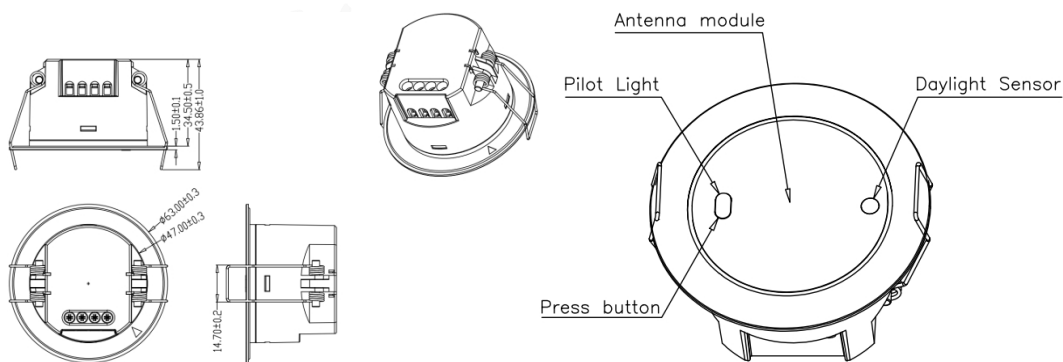
- Dimension: $\phi 47 \times 36$ mm
- Connection: 4-pin terminal

【Parameter】

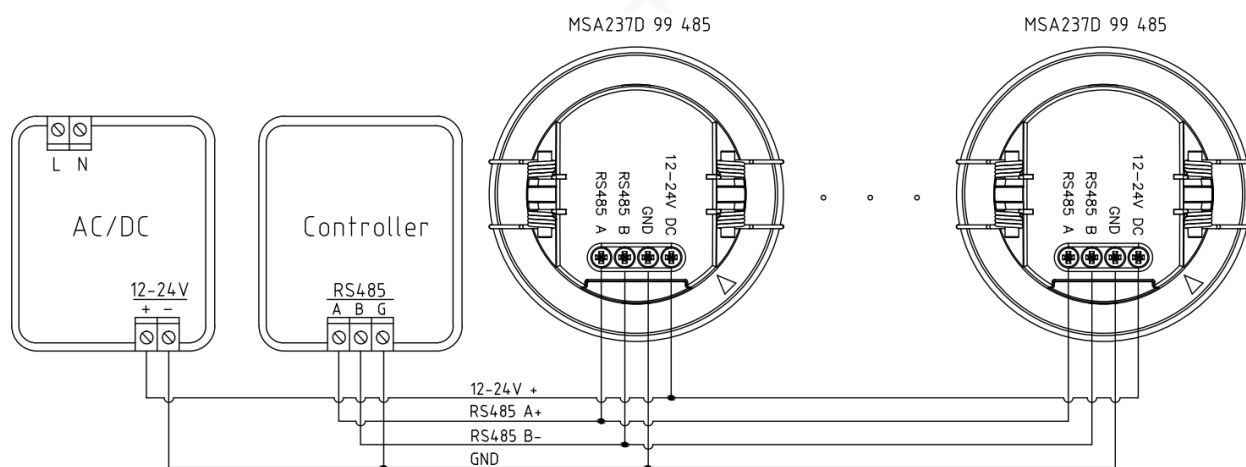
Input/Output	Input voltage	12-24V DC
	Rated voltage	24V DC
	Working Current	@12Vdc: 80±3mA @24Vdc: 42±3mA
	Working Power	≤1.2W @24V DC
	Output signal	RS485 (factory setting is data report mode, and you can switch to data inquiry mode by merrytek wechat mini program)
	Load type	Data report/data inquiry
Sensor Parameter	Radar frequency	24GHz -24.25GHz, ISM band
	Transmitting Power	5mW Max.
	Detection Area	0-4m(setting by merrytek mini program)
	Hold Time	3-7200s (setting by merrytek mini program)Remark: For better presence detection,hold time shall set >30S
	Daylight threshold	5-2000Lux(setting by merrytek mini program,when value set as 2000lux,daylight sensor is disabled)
	Daylight sensor range	0-2000Lux
	Radius detection range (based on 4m gear and medium sensitivity)	major/minor/micro movement (3m height installation) : 4±0.5m (based on 41m ² open area test and might change due to different space)
	Sensitivity	high/medium/low
	Remote control	Unavailable
	Merrytek mini program	Available
	Mounting height	2.5-4.0m typical value:3m
Application Environment	Detecting Angle	120°
	Drill hole	Φ50-55mm
	Working Temperature	0℃...+50℃
Certificate Standard	Storage Temperature	-25℃~+80℃ Humidity:≤85% (non-condensation)
	Certificate	FCC/RED
	Environmental Requirement	Compliant to RoHS
	IP Rating	IP20
Guarantee	Guarantee	5 year (only for product quality problem)

Note: "N/A" means not available

【Dimension and Function diagram】



【Wiring instruction】



Wiring layout suggestion:

1. Hand-in-hand wiring is highly recommended, yet star-topology or tree-topology is strongly deprecated
2. RS485 layout wire length shall not longer than 300m and 12pc sensor is the max quantity layout in one circuit
3. 4-pin shield wire or class 6 network wire is highly recommended for layout
4. Our sensor don't have terminal resistance, if there's impedance matching problem in RS485 bus, we recommend connect 2pc 120Ω resistance in the terminal

【Initialization】

When powered on, sensor indicator will turn off after flashing for 10S and will enter a 20S detection cycle, if there's presence detected, then sensor will report presence and enter hold time calculating, if absence detected, then sensor will report absence. During initialization, sensor will not detect moving signal and you can use merrytek wechat mini program to adjust detection area、hold time and daylight sensor etc parameter.

【Factory setting】

Detection Area: 4m

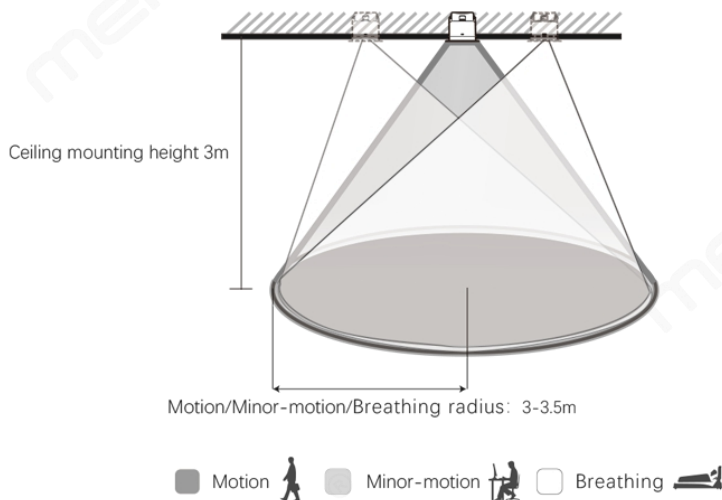
Hold Time: 30s

Indicator light:open

Sensitivity: Medium sensitivity

【Detection radiation】

MSA237D 99 485 is highly recommended ceiling flush mounting and its detection radiation is as below shows:



【Detection Signal】

The product detects human moving, minor moving, and presence signals, and realizes the detection of human-existing/no-human in non-sleep state. The following is a description of the moving, minor moving and presence signals:

- **Major movement:** detect the human significant moving (walking) in the detection area.
- **Minor movement:** detect the human slight moving in the detection area, such as leaning forward, leaning forwarder and back, swinging limbs, shaking head, typing, playing with mobile phones and so on.
- **Micro movement:** detect human abdominal and thoracic expansion behaviors caused by breathing, but not detect moving signal and minor moving signal.



Major movement



Minor movement



Micro movement

【RS485 protocol】

Baud rate	9600
Data bit	8
Stop bit	1
DATA0	Frame header
DATA1	ID high bit
DATA2	ID low bit
DATA3	Data length
DATA4	Function
DATA5/DATA6/DATA7	Value
DATA8	Check code
Communication data type	HEX TX/RX
Data communication requirement	Each data command interval shall>100ms

Example	Header	ID high bit	ID low bit	length	function	value	Check code
	DATA0	DATA1	DATA2	DATA3	DATA4	DATA5	DATA6
	51	FF	FF	06	05	64	BE

Check code: $51+FF+FF+06+05+64=2BE$ take last 2 bit:BE

Example	Header	ID high bit	ID low bit	length	function	value			Check code
	DATA0	DATA1	DATA2	DATA3	DATA4	DATA5	DATA6	DATA7	DATA8
	51	FF	FF	08	07	09	27	C0	4E

Check code: $51+FF+FF+08+07+09+27+C0=34E$ take last 2 bit: 4E

Merrytek radar presence sensor protocol introduction:

Command	Function	Description	Data range	w/r	Default value
0x00	Read command value	Read Function data		w	
0x03	Presence/absence report	Work state	1-2	w/r	00
0x05	Detection area setting	Detection area	0x00-0xFF	w/r	FF
0x06	Sensitivity setting	Set the sensor high or low	0-2	w/r	2
0x07	Blocking time	Blocking time	0-FFFFFF（单位 s）	w	000000
0x08	Indicator activation	LED Indicator	0-1	w/r	01
0x09	Daylight value report	Light sensor	0-2000lux	r	
0x0A	Daylight difference value setting	Difference Value	10-100	w/r	30Lux
0x0D	Hold time setting	Hold Time	3-7200	w/r	30s
0x17	Update firmware version	Firmware version	0.0.0-100.0.0	r	当前版本号
0x18	Setting device ID	Device ID	0x0000-0x0063	w/r	0000
0x21	Edit device ID	Edit ID	0-1	w	00
0x22	Report or Reading mode	Submit a report/Enquire about	0-1	w/r	01
0x23	Status flip	Status flip	1	w	
0x25	Daylight threshold function	Daylight sensor	5-2000lux	w/r	2000Lux（不受控）
0x28	Presence detection activation	Presence detection on/off	0-1	w/r	1

0x29	Environment adapting	Environmental learning	1-7	w	
0x30	Recover factory setting	Reset	1	w	
0x31	Single mode	Single mode	0-1	w/r	0
0x32	Daylight sensor mode	Light sensing mode	0-1	w/r	1
0x33	Forbidden area setting	Near zone shielding range	0-3	w/r	3

Command value introduction

Command	When you're using reading data mode,you shall take below data format as reference					
Example Function	HEAD (DATA0)	ID (DATA1-DATA2)	LEN (DATA3)	Format (DATA4)	Function (DATA5)	CRC (DATA6)
Inquire presence/absence status	0x51	0x0000	0x06	0x00	0x03	data0+...+data5
Inquire detection area	0x51	0x0000	0x06	0x00	0x05	data0+...+data5
Inquire sensitivity	0x51	0x0000	0x06	0x00	0x06	data0+...+data5
Inquire indicator status	0x51	0x0000	0x06	0x00	0x08	data0+...+data5
Inquire daylight value	0x51	0x0000	0x06	0x00	0x09	data0+...+data5
Inquire daylight difference value	0x51	0x0000	0x06	0x00	0x0A	data0+...+data5
Inquire hold time	0x51	0x0000	0x06	0x00	0x0D	data0+...+data5
Inquire firmware version	0x51	0x0000	0x06	0x00	0x17	data0+...+data5
Inquire device ID	0x51	0x0000	0x06	0x00	0x18	data0+...+data5
Inquire data report or reading mode	0x51	0x0000	0x06	0x00	0x22	data0+...+data5
Inquire daylight threshold value	0x51	0x0000	0x06	0x00	0x25	data0+...+data5
Inquire presence detection activation status	0x51	0x0000	0x06	0x00	0x28	data0+...+data5

Inquire single mode activation status	0x51	0x0000	0x06	0x00	0x31	data0+...+data5
Inquire daylight sensor mode	0x51	0x0000	0x06	0x00	0x32	data0+...+data5
Inquire forbidden area	0x51	0x0000	0x06	0x00	0x33	data0+...+data5

1.	Presence/absence report: our radar will report if it's presence or absence within detection area					
Data Example Function	HEAD (DATA0)	ID (DATA1-DATA2)	LEN (DATA3)	Function (DATA4)	Value (DATA5)	CRC (DATA6)
Absence	0x51	0x0000	0x06	0x03	0x01	data0+...+data5
Presence	0x51	0x0000	0x06	0x03	0x02	data0+...+data5

Presence/absence report:

Our radar will report presence/absence data ONLY when radar sees presence switch to absence or absence switch to presence, if current status doesn't change, our radar will not report same presence/absence information

2.	Detection area setting: 0x00-0xFF means detection range is set from 0~4m Factory setting is 0xFF, means detection					
Data Example Function	HEAD (DATA0)	ID (DATA1-DATA2)	LEN (DATA3)	Function (DATA4)	Value (DATA5)	CRC (DATA6)
Min:0m	0x51	0x0000	0x06	0x05	0x00	data0+...+data5
Max:4m	0x51	0x0000	0x06	0x05	0xFF	data0+...+data5

Example

0m: 0x00 0.5m: 0x01 1m: 0x03 1.5m: 0x07 2m: 0x0F 2.5m: 0x1F 3m: 0x3F 3.5m: 0x0x7F 4m: 0xFF

3.	Sensitivity setting: there's high/medium/low sensitivity to choose					
Data example Function	HEAD (DATA0)	ID (DATA1-DATA2)	LEN (DATA3)	Function (DATA4)	Value (DATA5)	CRC (DATA6)
High sensitivity	0x51	0x0000	0x06	0x06	0x01	data0+...+data5

Low sensitivity	0x51	0x0000	0x06	0x06	0x00	data0+...+data5
Medium sensitivity	0x51	0x0000	0x06	0x06	0x02	data0+...+data5

4.	Blocking time: it's used to block sensor detection function within certain time					
Data example Data value	HEAD (DATA0)	ID (DATA1-DAT A2)	LEN (DATA3)	Function (DATA4)	Value (DATA5-DAT A7)	CRC (DATA8)
0ms	0x51	0x0000	0x08	0x07	0x000001	data0+...+data7
1h	0x51	0x0000	0x08	0x07	0x000E10	data0+...+data7

5.	Indicator activation: it's used to turn on/off indicator					
Data example Function	HEAD (DATA0)	ID (DATA1-DAT A2)	LEN (DATA3)	Function (DATA4)	Value (DATA5)	CRC (DATA6)
Disable	0x51	0x0000	0x06	0x08	0x00	data0+...+data5
Enable	0x51	0x0000	0x06	0x08	0x01	data0+...+data5

6.	Daylight value report: current daylight value will update only when daylight difference value is meet					
Data example Data value	HEAD (DATA0)	ID (DATA1-D ATA2)	LEN (DATA3)	Function (DATA4)	Value (DATA5-DATA6)	CRC (DATA7)
Min: 0Lux	0x51	0x0000	0x07	0x09	0x0000	data0+...+data6
Max: 2000Lux	0x51	0x0000	0x07	0x09	0x07D0	data0+...+data6

7.	Daylight difference: it means how much daylight changed from last second to current					
Data example Data value	HEAD (DATA0)	ID (DATA1-DAT A2)	LEN (DATA3)	Function (DATA4)	Value (DATA5)	CRC (DATA6)
Min: 10Lux	0x51	0x0000	0x06	0x0A	0x0A	data0+...+data5
Max: 100Lux	0x51	0x0000	0x06	0x0A	0x64	data0+...+data5

8.	Hold time: it refers to the time period radar switch from presence to absence after people leaves detection area					
Data example Data value	HEAD (DATA0)	ID (DATA1-DATA2)	LEN (DATA3)	Function (DATA4)	Value (DATA5-DATA6)	CRC (DATA7)
Min: 3s	0x51	0x0000	0x07	0x0D	0x0003	data0+...+data6
Max: 7200s	0x51	0x0000	0x07	0x0D	0x1C20	data0+...+data6

9.	Setting device ID: it can set device ID to distinguish from others					
Data example Data value	HEAD (DATA0)	ID (DATA1-DATA2)	LEN (DATA3)	Function (DATA4)	Value (DATA5-DATA6)	CRC (DATA7)
Min:0x0000	0x51	0x0000	0x07	0x18	0x0000	data0+...+data6
Max:0x0063	0x51	0x0000	0x07	0x18	0x0063	data0+...+data6

1) When our sensor is powered and self-inspection finished (ie 20s after sensor powered), you can short press the pairing button, there'll be 51 FF FF 06 21 01 77 displayed and our indicator flashing, it means you can start set the sensor's ID, when succeed, the indicator will stop flashing (if you want finish ID setting soon after the indicator flashing, you can repeat short press the pairing button)

2) Each sensor's default ID is 0x0000

3) You can long press the pairing button > 3s to recover factory setting fastly

4) Important tips: there can only be one sensor under ID setting in an RS485 bus, or there might be communication error

10.	ID edit activation: it refers if the device can edit, if read 0, then device can't be edited ID, if read 1, then device can be edited ID					
Data example Data value	HEAD (DATA0)	ID (DATA1-DATA2)	LEN (DATA3)	Function (DATA4)	Value (DATA5)	CRC (DATA6)
Disable	0x51	0x0000	0x06	0x21	0x00	data0+...+data5
Enable	0x51	0x0000	0x06	0x21	0x01	data0+...+data5

11.	Report or Reading mode switch. 00 is reading mode 01 is report mode					
Data example Data value	HEAD (DATA0)	ID (DATA1-DAT A2)	LEN (DATA3)	Function (DATA4)	Value (DATA5)	CRC (DATA6)
Disable	0x51	0x0000	0x06	0x22	0x00	data0+...+data5
Enable	0x51	0x0000	0x06	0x22	0x01	data0+...+data5

12.	Status flip: it's used to fastly switch presence to absence or from absence to presence					
Data example Data value	HEAD (DATA0)	ID (DATA1-DAT A2)	LEN (DATA3)	Function (DATA4)	Value (DATA5)	CRC (DATA6)
Enable	0x51	0x0000	0x06	0x23	0x01	data0+...+data5

13.	Daylight threshold value : when you set a certain value as daylight threshold,if environment daylight is higher than this value and sensor is absence status,then sensor will not report presence when people enter detection area.If you set 2000LUX,then daylight threshold will disable,and daylight will report its actual lux value					
Data example Data value	HEAD (DATA0)	ID (DATA1-D ATA2)	LEN (DATA3)	Function (DATA4)	Value (DATA5-DATA6)	CRC (DATA7)
Min: 5Lux	0x51	0x0000	0x07	0x25	0x0005	data0+...+data6
Max: 2000Lux	0x51	0x0000	0x07	0x25	0x07D0	data0+...+data6

2000Lux: 光感为不受控状态，无论光感为多少都不影响有人无人上报。

14.	If you enable sensor's presence detection function,then it can detect all movement signal,if disable,it can only detect major movement signal and ignore minor and micro signal					
Data example Data value	HEAD (DATA0)	ID (DATA1-DAT A2)	LEN (DATA3)	Function (DATA4)	Value (DATA5)	CRC (DATA6)
Enable	0x51	0x0000	0x06	0x28	0x01	data0+...+data5
Disable	0x51	0x0000	0x06	0x28	0x00	data0+...+data5

15.	AI environment-learning function:if you enable this function,our sensor will learn environment background interference and adjust its own software to improve its presence/absence report accuracy,and this will last 1min since start					
Data example Data value	HEAD (DATA0)	ID (DATA1-DAT A2)	LEN (DATA3)	Function (DATA4)	Value (DATA5)	CRC (DATA6)
Start AI learning	0x51	0x0000	0x06	0x29	0x01	data0+...+data5
AI learning finished	0x51	0x0000	0x06	0x29	0x02	data0+...+data5
Cancel AI learning	0x51	0x0000	0x06	0x29	0x03	data0+...+data5
AI learning failure	0x51	0x0000	0x06	0x29	0x04	data0+...+data5
Ignore interference	0x51	0x0000	0x06	0x29	0x05	data0+...+data5
Locate interference	0x51	0x0000	0x06	0x29	0x06	data0+...+data5
Interference location report	0x51	0x0000	0x06	0x29	0x07	data0+...+data5

16.	Factory setting:Once activate this function,all sensor parameter will back to factory setting					
Data example Data value	HEAD (DATA0)	ID (DATA1-DAT A2)	LEN (DATA3)	Function (DATA4)	Value (DATA5)	CRC (DATA6)
Reset factory setting	0x51	0x0000	0x06	0x30	0x01	data0+...+data5

17.	Single mode: If you enable this mode,sensor will report absence after 15s when people leave detection area regardless of the hole time you preset,but this mode is only available when there's single person within detection area					
Data example Data value	HEAD (DATA0)	ID (DATA1-DAT A2)	LEN (DATA3)	Function (DATA4)	Value (DATA5)	CRC (DATA6)
Enable	0x51	0x0000	0x06	0x31	0x01	data0+...+data5
Disable	0x51	0x0000	0x06	0x31	0x00	data0+...+data5

18.	Daylight sensor mode: 0x00: daylight report mode 0x01: daylight threshold mode Factory setting is 0x01					
Data example Data value	HEAD (DATA0)	ID (DATA1-DAT A2)	LEN (DATA3)	Function (DATA4)	Value (DATA5)	CRC (DATA6)
Daylight report mode	0x51	0x0000	0x06	0x32	0x00	data0+...+data5
Daylight threshold mode	0x51	0x0000	0x06	0x32	0x01	data0+...+data5

19.	Forbidden area setting: Sensor will not detect any single within your setting area					
Data example Data value	HEAD (DATA0)	ID (DATA1-DAT A2)	LEN (DATA3)	Function (DATA4)	Value (DATA5)	CRC (DATA6)
0m	0x51	0x0000	0x06	0x33	0x00	data0+...+data5
0.6m	0x51	0x0000	0x06	0x33	0x01	data0+...+data5
1.2m	0x51	0x0000	0x06	0x33	0x02	data0+...+data5
1.6m	0x51	0x0000	0x06	0x33	0x03	data0+...+data5

Factory setting parameter:

Detection area	4m
Hold time	30s
Sensitivity	Medium
Forbidden area	1.6m
Indicator	ON
Presence detection	Enabled
Working mode	Data reporting
Device ID	0000
Single mode	Off
Daylight mode	Daylight threshold (2000Lux, Disable)

Remark:

- 一、When factory setting enabled,all parameter will not report to bus
- 二、When daylight mode set threshold,its default value is 2000Lux
- 三、When daylight mode set report,its default daylight report difference value is 30lux
- 四、If you set value beyond range,then sensor will feedback:51XXXX06FF02XX
- 五、If you send wrong value,sensor will not react

【Disclaimer】

Due to the complexity of product technology and differences in application environment, it is difficult to guarantee a completely accurate or complete description, so this specification is only for user reference.

We will reserve the right to make changes to the product specifications without notifying the user, and do not make any commitments and guarantees in the legal sense. At the same time, our company encourages users to supplement or modify the contents of our specifications after using our products.