MR5G21

Micro-motion presence detection module

Product Manual V1.2

LeapMMW
阶跃时进

Released by Chengdu Step Shijin Technology Co., Ltd.

2021-09-15

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1.product description

MR5G21The micro-motion presence detection module transmits 5.8GHz FMCW and CW radio waves to the detection area, and receives the radio waves reflected by all moving and weakly moving targets in the area. The principle of FM continuous wave target modulation is processed by high-performance digital signal recognition algorithm to analyze whether there are micro-moving targets and moving targets in the area.

Standing still, squatting, sitting, etc. static human body, due to breathing will cause weak ups and downs in the chest cavity and other parts of the body, MR5G21Such weak movements can be reliably detected with extremely high sensitivity, thus sensing the presence or absence of people in the area.

at the same time,MR5G21Introduced multi-target distance measurement technology for the first time in the industry to solve the industry problems of microwave penetration through walls and blurred distance boundaries. than distance control schemes that set energy thresholds or distance percentages,MR5G21The distance and area control are more reliable, stable and consistent.

1.1Product Features

-Micro-motion detection

Can detect head tilt, wave hand, raise hand, move slightly, swipe the phone, flip Books and other small movements.

-presence detection

It can detect stationary states such as standing still, squatting still, sitting still, etc. human body in state.

-motion detection

It can detect movements such as walking, trotting, running, circling, and jumping.

-distance measurement

The multi-target distance measurement function can accurately filter the targets outside the area.

Note: If you have special requirements for 5.8G detection of sleep stillness and deep sleep, please contact us to customize the version. Deep sleep can also be detected with our HS series products.

1.2Product Features

-distance filtering

With multi-target distance measurement, targets outside the area are filtered. batch The application consistency is better, the performance is more stable, and the detection is effectively solved. Distance control and false positives through walls.

-Large induction radius

The beam angle is wide and the detection distance is long. During typical top loading, fretting storage within the detection radius5-7Meter. When wall-mounted, the detection distance of micro-motion presence can reach11Meter.

-Flexible configuration of parameters

Through the serial port configuration "detection distance, detection sensitivity, delay time between,PWMOutput, light perception" and other parameters, which are convenient for development, testing and adaptation to different application scenarios.

-Support IAP upgrade program

Support local serial port upgrade program. Can be customized by upgrading Collecting on-site raw data is conducive to analyzing and solving various on-site Complex interference, faults and other issues.

-Strong anti-interference ability

Can avoid co-channel interference and support intensive use; a variety of digital signals Processing Algorithms, SuppressionWiFiInterference, power frequency clutter, high-order harmonics and sudden interference to avoid false alarms.

-Induction is stable and reliable

andCWContinuous wave breath detection or enhanced Doppler techniques Compare,MR5G21The detection of fretting targets has higher sensitivity, higher reliability and lower false alarm rate.

-Strong penetration

Can penetrate glass, plastic, clothing, ceramics, veneer and other materials.

-Not affected by the environment

Not affected by snow and haze, temperature and humidity, dust, light, noise, etc.

2.Application field

The MR5G21 module can be widely used in lighting, security, home, home appliances, hotels, garages, buildings, transportation, IoT and other industries that need to detect human fretting, motion and control the detection distance.

3.technical parameter

1. The main parameters

surface3.1 MR5G21Main technical parameters of the module

parameter item			minimum	Typical value	maximum value	unit	illustrate
System parameters	transmit power			3	5	dBm	Pt
	beam angle			120×120		°	@-3dB
	working frequency			5800		MHz	
Function parameter	Wall Mount: Micro-Motion Sensing Distance				11	m	Wall Mount: vs Distance/Sensitivity configuration related
	Top mount: micro-motion induction radius			5	7	m	Top-mounted: with the installation height, Distance/Sensitivity configuration related
	delay time		2	15	1500	s	Configurable
	photosensitive threshold			10	50	Lux	Configurable, detection range can be custom made
working conditions	Operating Voltage		4.5	5	5.5	V	optional7~18V
	Working current			twenty two		mA	25°C
	Operating temperature		- 20		85	°C	
	storage temperature		- 30		100	°C	
	Working humidity		5		95	%RH	
control interface (OUT pin)	output level	V_{OH}		5		V	high level
		V_{OL}		0			low level
Communication Interface (serial port pin)	input level	V_{IH}		3.3		V	high level
		V_{IL}		0			low level
	output level	V_{OH}		3.3		V	high level
		V_{OL}		0			low level
	Serial port baud rate			115200		bps	

Note:

(1)The parameters described in the current document are the standard version module parameters. For applications that require short-distance micro-motion presence detection, such as desk lamps, please contact us to obtain the short-distance version module.

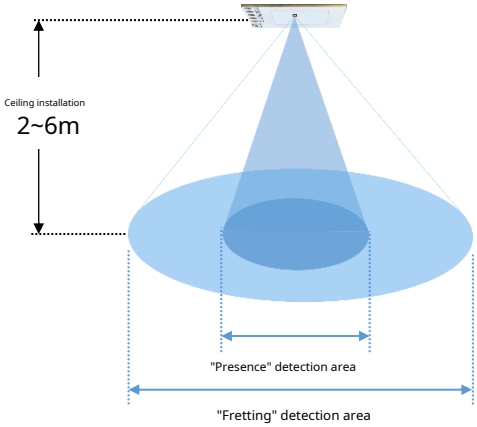
(2) It is easier to detect "standing still, squatting still" , for sitting still, the detection effect is slightly inferior to wall mounting; but by setting greater sensitivity and longer delay than wall mounting Time and time can also achieve more accurate detection. The wall mount can detect sitting still, standing still, and squatting still.

2．Detection range: top mounted

The following figure3.1When "top mounted", the human body facesMR5G21Schematic diagram of the detectable area of the module.

(1) "Fretting" detection area: can detect micro-motion (Head tilting, waving, raising hand, moving lightly, flipping through books, slightly tilting left and right back and forth, etc.), sports(Walking, trotting, running, circling, jumping and other sports),exist(standing still, squatting still);

(2) "Presence" detection area: It can detect the human body in still states such as standing still, squatting still, sitting still, etc.



Detection area(Related to installation height and sensitivity parameters):

-Presence detection radius:1~3m

-Inching detection radius:5~7m

Note: Detectable radius and installation environment, human body size, relative angle, and fretting /motion range and many other factors, the above parameters are used by our testers Test results of pure modules, descriptions such as tiny movements and movements are qualitative descriptions, not Quantitative description, for reference only. Under different test conditions, please refer to the actual measurement.

picture3.1Top Load:MR5G21Schematic diagram of module detection area

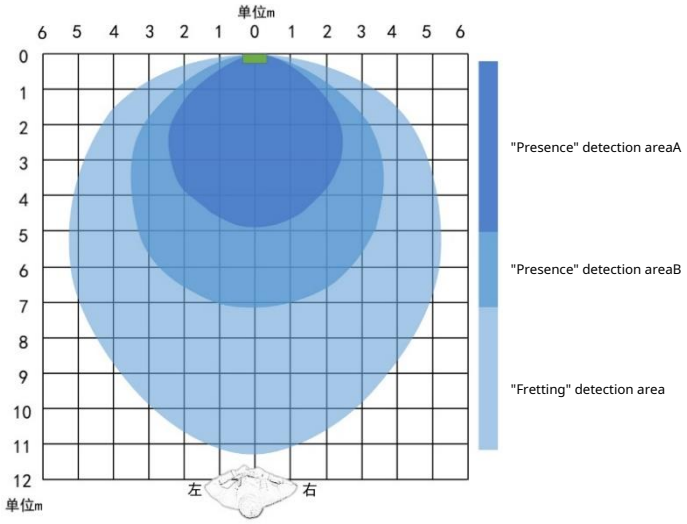
3．Detection range: wall mounted

The following figure3.2When "wall mounted", the human body facesMR5G21Schematic diagram of the detectable area of the module.

(1) "Presence" detection area A: It can detect the presence of human beings who are sitting still, standing still, and squatting still;

(2) "Presence" detection area B: It can detect the existence of human body standing still or squatting still;

(3) "Fretting" detection area: can detect micro-motion (Head tilting, waving, raising hand, moving lightly, slightly tilting left and right back and forth, etc.),sports (Walking, trotting, running, circling, jumping and other sports).

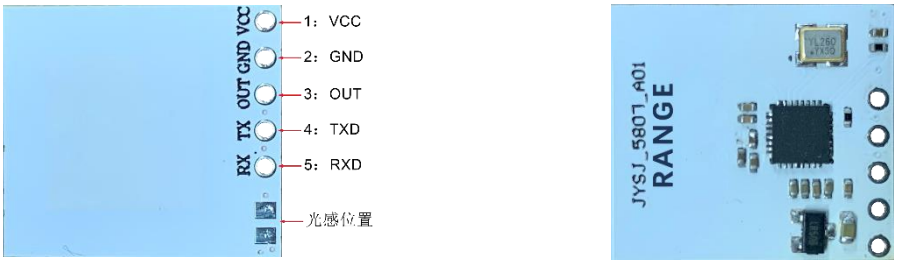


picture3.2Wall Mount:MR5G21Schematic diagram of the detection area of the module (the human body faces the module (green rectangle))

Note: The detectable distance is related to many factors such as the installation environment, the size of the person, the relative angle, and the fretting/movement amplitude. The above parameters are the test results of our company using pure modules.

The descriptions of small movements and sports are qualitative descriptions, not quantitative descriptions, and are for reference only. Under different test conditions, please refer to the actual measurement.

4.Connection size



a)front b)back

picture4.1 MR5G21Module physical map

Tip: Due to different production batches, the color and cover oil of the module may be different, but it does not affect the function and performance of the module

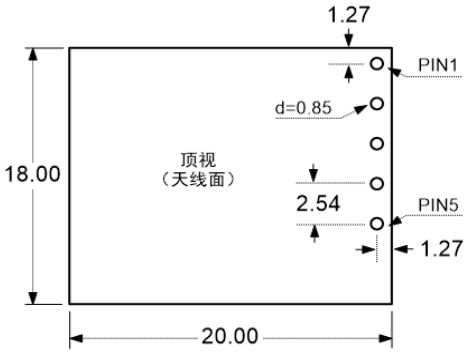
4.1interface

MR5G21common to modulesVCC,GND,OUT,TXDandRXDFive signal interfaces, the solderable spacing is2.54mmpin header; Module parameters through the serial portTXDandRXDconfigure;OUTPin output detection control signal.

surface4.1 MR5G21Module Interface Definition Table

pin number	definition	illustrate
1	VCC	Module power supply; power supply range4.5~5.5V;Optional with high pressureLDOVersion(7~18V)
2	GND	Module power ground
3	OUT	output signal; outputI/Oswitch orPWMcontrol signal
4	TXD	Module serial port sending; used to configure module working parameters
5	RXD	Module serial port reception; used to configure module working parameters

4.2size

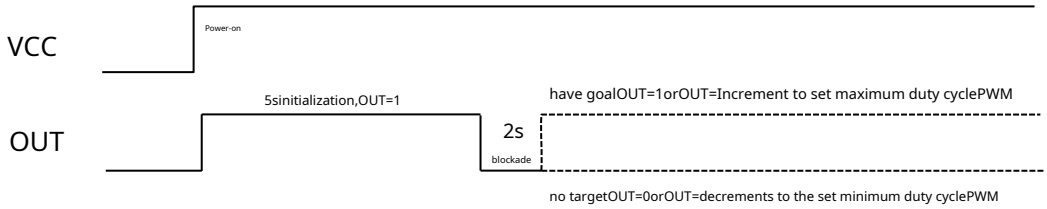


picture4.2 MR5G21Module dimension drawing (unit:mm)

5.Instructions for use

5.1Output signal timing diagram

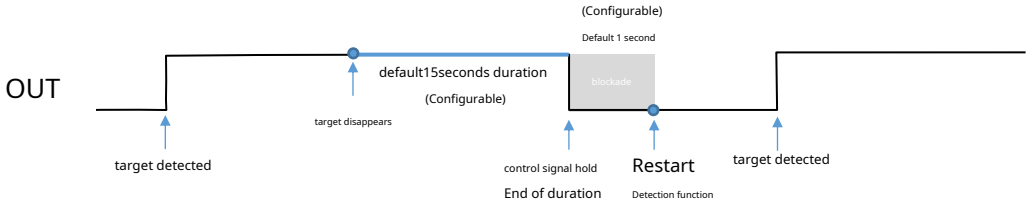
- **Power-on:**MR5G21Module power-up requires an initialization process. After power-on, the OUT pin first outputs a high level for 5 seconds, and then outputs a low level for 2 seconds (configurable), and then enters the normal detection mode. The power-on sequence is shown in Figure 5.1:



picture5.1Power-on:OUTPin Out Signal Timing Diagram

Note: The high and low level state and time length of "5 seconds high level, 2 seconds low level" can be customized according to user needs

- **blockade:**MR5G21After the module detects the target, the detection function is blocked for 1 second (default value, adjustable), and the OUT pin outputs a control signal. When the duration of the control signal ends, the detection function is blocked for 1 second (default value, adjustable), and then the target can be detected again. The relevant timing is shown in Figure 5.2:



picture5.2Detection target:OUTPin Out Signal Timing Diagram

Note: During the user test, it can be understood that the target will not be detected within 1 second after the light is turned off. Special attention should be paid to this point.

- **Trigger/Maintain:**The MR5G21 module adopts the default configuration parameters of "low sensitivity trigger, high sensitivity maintenance" by default; that is, when detecting someone in an unmanned state, a relatively large action is required, such as shrugging, turning around, or even walking to make the module detect someone; when After the module detects someone, it only needs a smaller weak movement, even breathing and body movement, to enable the module to continuously detect the presence of someone.

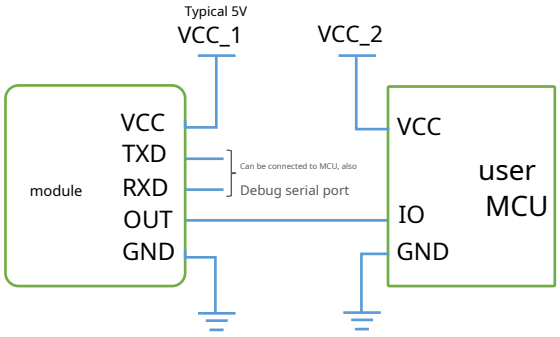
Note: Large action trigger mode will make the trigger distance or trigger radius smaller when the module detects "no one to someone". Please pay special attention to this point, users can

environment, configure the relevant trigger mode parameters to make the trigger distance or trigger radius appropriate.

If you need "weak action trigger", such as fretting, deep breathing, tilting your head and other actions can also detect someone with a highly sensitive trigger module, please contact our company to modify the default parameters.

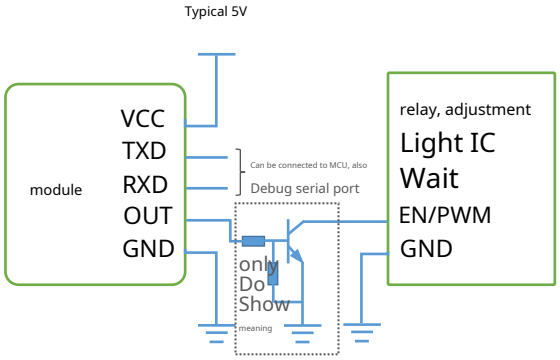
5.2hardware connection

5.2.1 MCUDirectly read "module output signal"



- userMCUofI/Oport, configured as a floating input, connected to the moduleOUTpin. Read module test results directly;
- The serial port of the module can be connected to the userMCU, to achieve remote, Real-time, flexible parameter modification. You can also just use the serial port to The pin is led out, and it is only used to configure parameters during development and testing;

5.2.2""module output signal" directly controls peripherals



- module outputI/Oswitch orPWMThe control signal passes through the triode,MOSIsolation, drive, signal conversion circuits such as tubes, magnetic couples, optocouplers, etc., and then control relays, lights, Motors and other load equipment work;
- The serial port of the module can be connected to the userMCU, to achieve remote, Real-time, flexible parameter modification. You can also just use the serial port to The pin is led out, and it is only used to configure parameters during development and testing;

Note: Since the power load is easy to cause interference, the module blocking time should not be too short.

6.Module special instructions

Due to the characteristics of microwave technology, ideal detection results will not appear in some application scenarios, or only under suitable conditions can ideal detection results be obtained.

MR5G21The module is a module with high detection performance and can detect micro-motion changes that are invisible to the human eye. If you encounter different performances than expected in the test, please contact us to provide detailed technical support, so as not to affect the use due to incorrect parameter settings, the module cannot play the best detection performance.

MR5G21The default configuration parameters of the module may not be suitable for the actual scenarios of all users. Be sure to use the serial port tool to reconfigure the module parameters so that the working parameters of the module are suitable for the usage scenarios and achieve better test results and performance.

1. Detection technology: Weak motion detection technology at breathing level:

(1) This versionMR5G21Can detect fluctuations as low as1mmor at speeds as low as3mm/sThe target of change, and most of the human breathing movement, body micro-movement, the fluctuation range is much greater than1mmor faster than3mm/s, so it can be highly sensitive to identify whether there is a human body;

(2) From the point of view of use, it can be understood as motion detection with higher sensitivity but lower false alarm rate, and can detect weak fluctuations such as breathing stably and reliably.

2. Limitations of "Weak Motion Detection Technology":

(1) Shaking air conditioners, fans, washing machines; shaking curtains, green plants; shaking large pieces of metal equipment, ventilation pipes, fire pipes, drainage pipes; motion frequencies or harmonic frequencies of objects such as vibrations that are invisible to the human eye. If it falls within the range of human breathing frequency, it may be observed by the sensor and mistaken for "the presence of a human body";

(2) To exclude the interference of shaking or shaking objects, you can set the farthest detection distance to exclude the interference from the detection area; you can also adjust the installation position so that the beam cannot be directly or indirectly irradiated with interference after multiple reflections thing. Or when there is a fixed source of interference, when the general version module cannot be solved, you can customize the interference algorithm to filter the interference (such as electric fans, air conditioners, Yuba, etc.).

3. Relative motion is required:

(1) Since the module has the highest detection sensitivity to the target of radial motion (relative motion), the detection distance is the farthest, and it is easier to detect the target. Therefore, the best installation method is: horizontal installation > oblique downward installation > top installation; however, when using the presence detection function, top installation is recommended, because horizontal installation and oblique downward installation will have certain detection blind spots.

(2) When top-mounted, the best relative motion is up and down motion; the second is motion with a motion component in the up and down direction;

(3) When top-mounted, the human body at a certain distance from the module will be irradiated obliquely to the body by the beam, and the horizontal movement of the body will have a partial motion component in the up and down direction, so the presence of someone can be detected;

(4) When top-mounted, sit and stand directly under the module and the body does not shake, only breathing movement. Since the breathing movement is a horizontal movement, there is no movement component in the up and down direction, the module will not be able to detect the presence of someone. In this case, the delay time of the module is generally increased, so that in a longer observation time, the probability that the human body has no physical movement directly under the module becomes smaller, and the probability of detecting the existence of the human body will increase, and the false alarm will be missed. rate decrease;

(5) When installed horizontally: only the feet are irradiated, and the presence of people will not be detected.

4. Module angle

(1) Electromagnetic waves are like a flashlight, and there is energy beyond the edge. Although there is light near the edge, it is relatively weak. like

120×120° modules,120° represents the antenna radiation angle, which is the relative front of the signal energy.0°attenuation3dB(0.5times), it is not the detection angle at which the target can be detected, and the cross-section of the center of the detection area is not like an opening.120° Triangular detection surface.

(2) The size and distance of the detection area are related to the volume, relative angle and movement speed of the detected target. For horizontal installation: The larger the target volume, the easier it is to be detected; the smaller the relative angle (such as relative movement in front), the easier it is to be detected.

5. Signal enhancement:

Due to the propagation effect of signal multipath, in a closed environment with many obstacles, the reflected signal will be enhanced, so that the detection performance of the module will be better. For example, a small bathroom will have a better detection effect than a large conference room; a small room will have a better detection effect than a hall, and so on.

6. Antenna radiation:

There should be no metal objects (including the case) on the front of the module antenna, and there can be penetrating obstacles such as plastic, glass, wood, etc., but the shield should not be close to the antenna, so as not to affect the resonance, radiation ability or shield the signal. In addition, the larger the ground plane provided to the module by the backplane, the less the backward radiation, and more energy will be radiated from the front of the antenna, which can also make the detection performance better.

7. Multi-module installation:

When installing multiple modules, try to ensure that the antennas of each module are parallel to each other, irradiated in the same direction or in the opposite direction, avoid each module being directly irradiated with each other, and keep the modules between the modules.0.5mabove spacing.

8. Power frequency and harmonic interference:

The module has done a variety of power frequency interference and multiple harmonic suppression algorithms, but it is still recommended to keep away from high-voltage AC power supply, rectifier bridge, high-power electrical drive and other circuits as much as possible, and to do a good job in the design of voltage regulation, shielding, power integrity, etc. In order to avoid super power frequency interference, exceeding the suppression capability of the module, resulting in abnormal operation of the module.

9. Power fluctuations:

Modules without LDOs have higher requirements on power supply stability, and unstable power supply may lead to false alarms. Therefore, it is necessary to ensure that the power supply is stable and the ripple is less than50mV, and has greater than60mAcurrent output capability. It is recommended not to allow modules and circuits with sudden current demand (such as relays,WiFi,4GModules, etc.) share a set of power supplies to avoid power supply fluctuations caused by pulse currents, resulting in false alarms of the modules.

10. OUT pin drive capability:

moduleOUTThe drive capability of the pin is relatively weak, and the driven load (ledLights, driver ICs, relays, etc.) If a large current is required, it is recommended to use an indirect driving method such as isolation to drive the load (the method of driving a large current circuit with a small current drives the load).

11. Luminous interference:

The luminous change of the light-emitting components may cause the light intensity detected by the light-sensing device to change too much, causing the module to continuously switch between the off-detection and on-detection functions, and the control signal is abnormal. It is suggested that during the installation process, the light-sensing device on the module should avoid being directly or indirectly irradiated by the light emitted by the light-emitting device. This version of the module uses a single photosensitive device to detect ambient light, and can use a combination of natural light detection sensors and multiple photosensitive sensors to avoid this problem.

12. Pay attention to ESD protection:

Do not touch the antenna and circuit with your hands to avoid human contact discharge and damage to the module.

Reminder: For more unfinished matters, common problems and solutions, please refer to the "Instruction Manual" , "FAQ Frequently Asked Questions" and other documents

7.statement

Please read this statement carefully before using the product described in this document. Once used, it is deemed to be an acknowledgement and acceptance of the contents of this statement.

user in applicationMR5G21When the module is installed, according to the product features, performance and functions described in this document, it must be re-tested according to its own application to confirm that it meets the user's application requirements. In case of damage or damage caused by improper use, Chengdu Step Shijin Technology Co., Ltd. will not be responsible for the corresponding loss and compensation.

Due to the continuous update and iteration of this product, the documentation may be changed without notice. Please confirm the update of the data and the errata information through appropriate channels during application. Please understand, and the final interpretation right belongs to Chengdu. Owned by Step Time Advance Technology Co., Ltd.

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