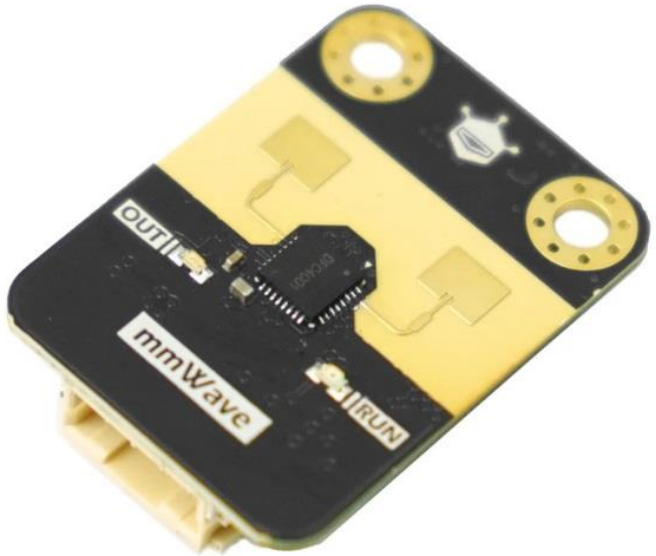
C4001 mmWave 24GHz Presence Sensor 12m Gravity

Overview

C4001 (12m) millimeter wave presence sensor uses a wavelength signal of 24GHz, with a detection range of 100° horizontally, presence detection range of 8 meters, and motion detection and ranging range of 12 meters.



Order Code

Order Code	Brand	Description
E33002-001	DFRobot	C4001 mmWave 24GHz Presence Sensor 12m Gravity

Human detection

Compared to other types of human presence sensors, such as infrared sensors, the C4001 (12m) millimeter wave presence sensor has the advantage of detecting both static and moving objects. It also has a relatively strong anti-interference ability, making it less susceptible to factors such as temperature changes, variations in ambient light, and environmental noise. Whether a person is sitting, sleeping, or moving, the sensor can quickly and sensitively detect their presence.

Millimeter-wave Presence Sensor	**Infrared Sensor**	
Sensing Principle	TOF radar principle + Doppler radar sensing principle (active detection)	Pyroelectric infrared sensing principle (passive radiation)
Motion Sensitivity	Can detect presence, slight movement, and motion of human body	Can only detect motion and close-range slight movement of human body
Sensing Range	Can be adjusted to different sensing distances	Sensing range cannot be adjusted
Environmental Temperature Impact	Not affected by environmental temperature	Sensitivity decreases when temperature is close to human body temperature
Application Environment	Not affected by heat sources, light sources, air flow	Susceptible to heat sources and air flow
Penetration Ability	Can penetrate fabrics, plastics, glass, and other insulating materials	Can only penetrate some transparent plastics
Distance Measurement Support	Yes	No

Distance and velocity detection

The C4001 (12m) millimeter wave presence sensor utilizes FMCW modulation for distance and speed measurement. It has a maximum detection range of 12 meters and a speed measurement range of 0.1 to 10 meters per second.

FMCW (Frequency Modulated Continuous Wave) is a type of radar system based on frequency modulation of continuous wave signals. Unlike traditional pulse radar, FMCW radar continuously emits a series of continuous wave signals with gradually changing frequencies while simultaneously receiving the reflected signals. By analyzing the received signals, measurements of parameters such as distance, speed, and angle can be achieved.

Compared to traditional pulse radar technology, FMCW radar can continuously measure the distance of an object. By utilizing the Doppler effect, it can also obtain information about the velocity of the target object. This makes FMCW radar suitable for applications that require tracking the movement of objects. Additionally, FMCW radar can achieve continuous frequency scanning, providing higher measurement resolution. Since it does not require waiting for the return of echo signals, FMCW radar is suitable for applications that require real-time monitoring and tracking of target objects.

What is a millimeter-wave radar sensor?

Millimeter-wave radar technology is a non-contact sensing technology used to detect objects and provide information about their distance, velocity, and angle (in the case of humans, for example). The signals emitted by millimeter-wave sensors fall within the high-frequency spectrum with wavelengths between 24GHz and 300GHz, also known as the millimeter (mm) range.

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Characteristics

- Communication Methods: It supports two communication methods, I2C and UART.
- Interface: It uses the Gravity interface (PH2.0).
- Human Detection: It can detect the presence of humans up to 8 meters and detect human motion up to 12 meters.
- Distance Detection: It can measure distances from 1.2m to 12m.
- Speed Detection: It can detect speeds from 0.1m/s to 10m/s.
- Strong anti-interference capability: It is not affected by factors such as snow, haze, temperature, humidity, dust, light, and noise.
- Compact size and easy integration.

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Technical Specifications

- Operating Voltage: 3.3V/5V
- Maximum Detection Range: 12m
- Beam Angle: 100*80°
- Modulation Mode: FMCW
- Operating Frequency: 24GHz
- Operating Temperature: -40~85℃
- Baud Rate: 9600
- I2C Address: 0x2A/0x2B
- Size: 22*30mm

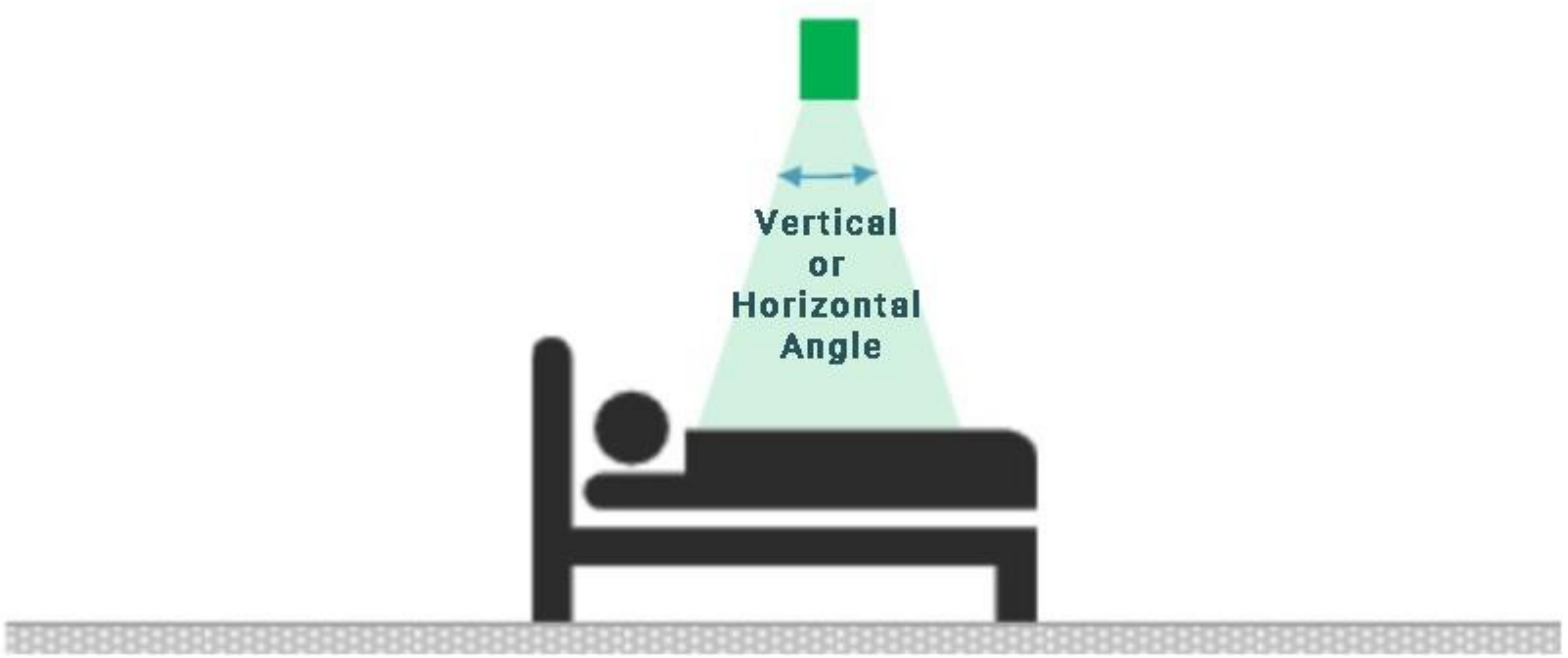
Interface Definitions

Definition	Explanation
+	Power
-	Ground
C/R	I2C Clock Line / RX
D/T	I2C Data Line / TX

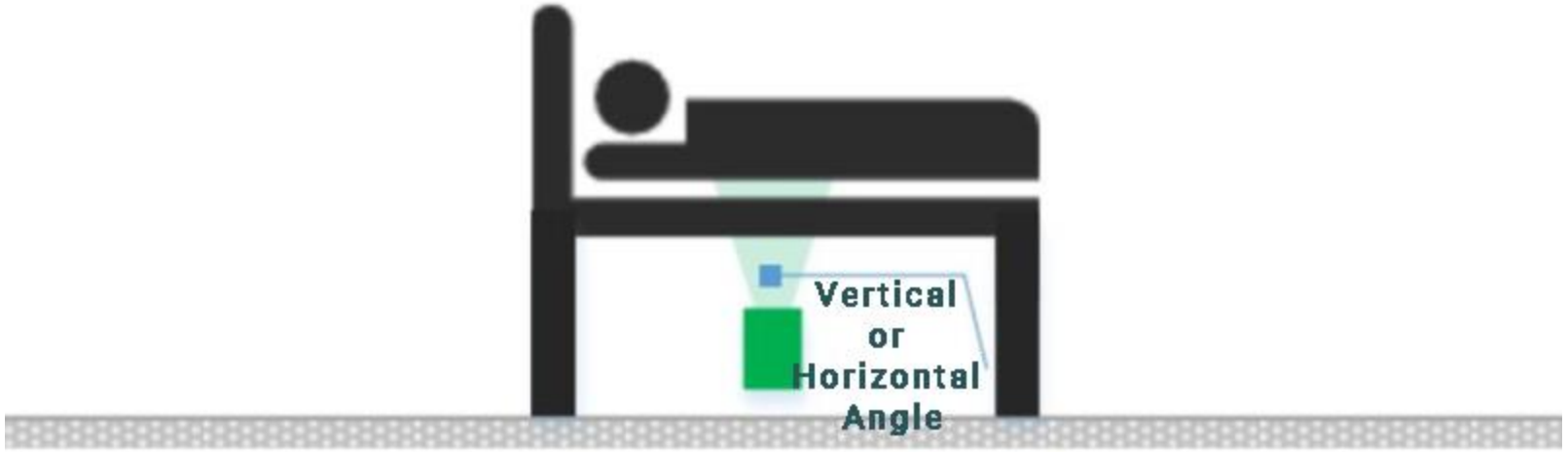
Installation Method

The millimeter-wave human body sensor is sensitive to the installation method, and improper installation can affect the performance and functionality of the sensor. The commonly used installation methods for this module include top installation, bottom installation, horizontal installation, and downward tilted installation.

Top Installation



Bottom Installation



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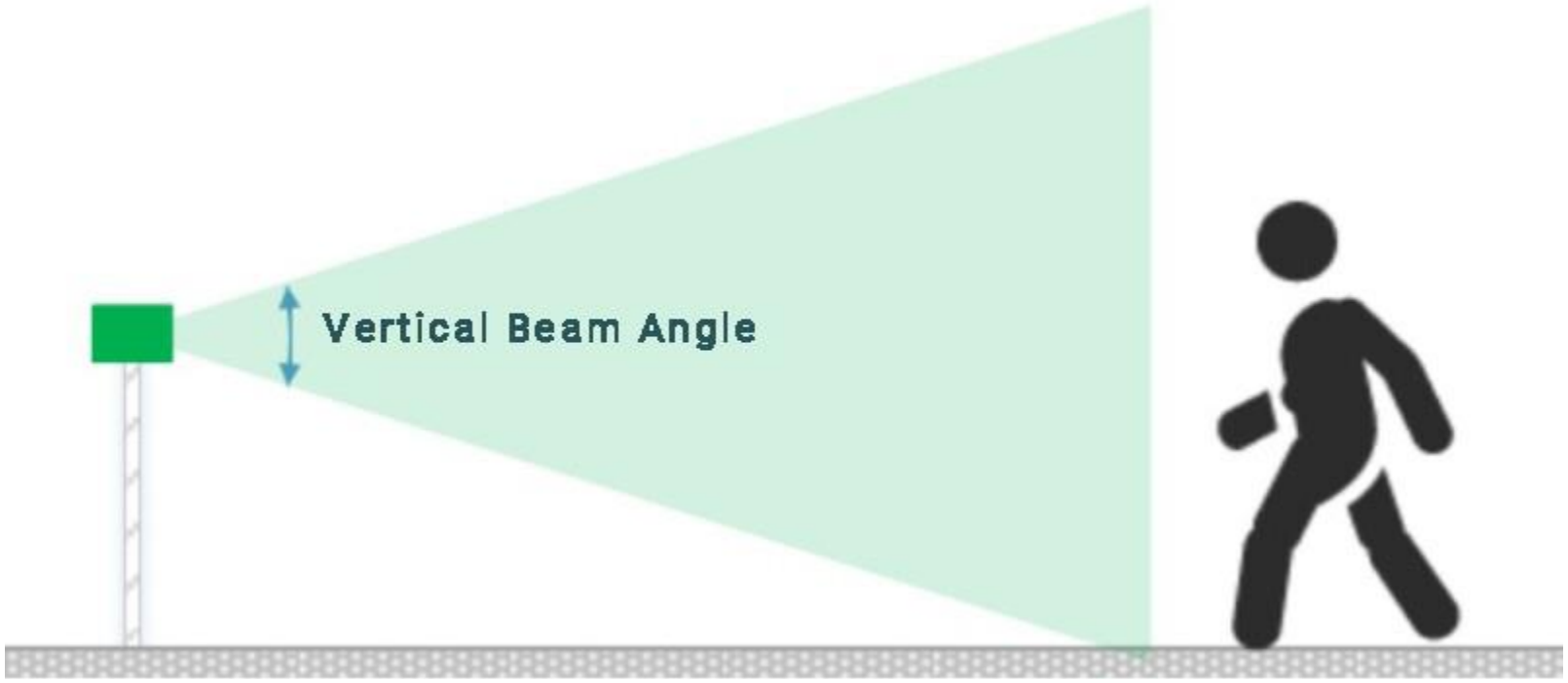
Horizontal Installation



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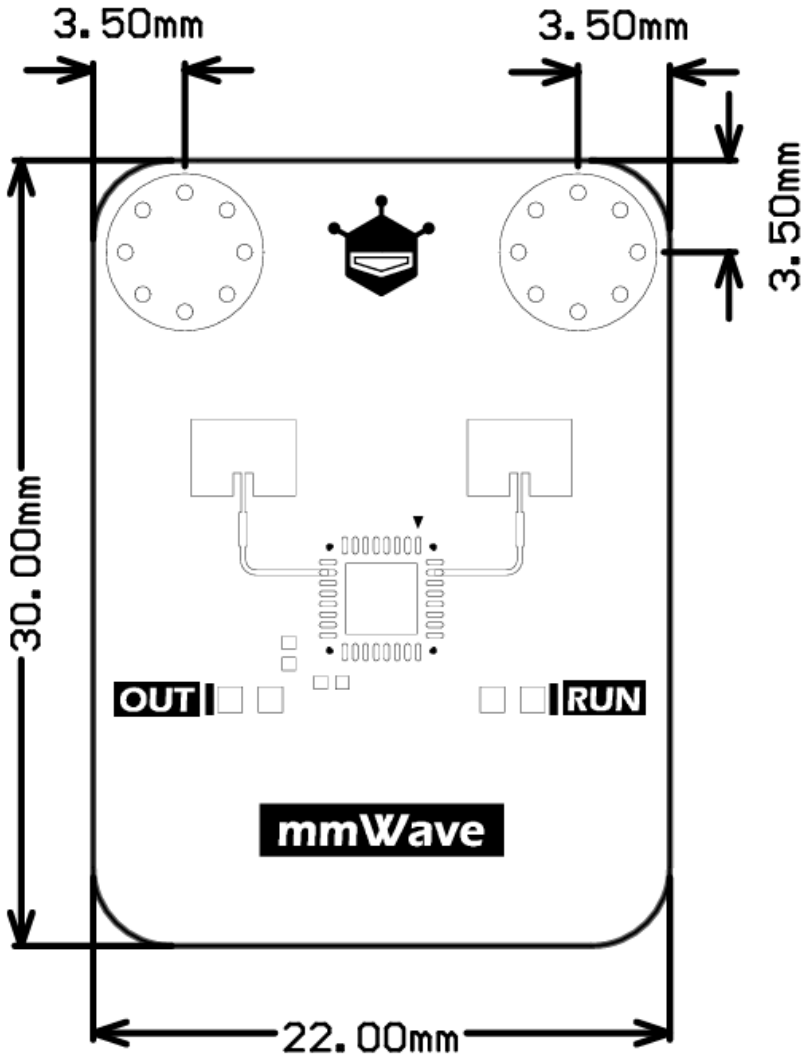

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Revision History

Date	Revision	Change description
30/10/2025	1.0	Initial release