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# Principles of human body micro motion detection

The human body micro motion detection sensor emits 5.8GHz FMCW and CW radio waves into the detection area, and receives the radio waves reflected by all moving and weakly moving targets in the area. The microwave circuit of the sensor converts them into differential frequency electrical signals. Then, based on the principle of linear frequency modulation continuous wave target modulation, high-performance digital signal recognition algorithms are processed to analyze whether there are micro motion targets and moving targets in the area.

Standing still, squatting still, sitting still, and other stationary human bodies can cause weak undulating movements in the chest and other parts of the body due to breathing. The JY220-CC-RS485 sensor can reliably detect such weak movements with extremely high sensitivity, thereby sensing the presence or absence of people in the area. The principle and steps of the sensor 'detecting human presence' are as follows:

1. Detect changes in micro motion distance: continuously emit and receive reflected electromagnetic waves, and calculate the micro motion distance of human targets based on the time difference between receiving and transmitting electromagnetic waves multiplied by the speed of light;
2. Micro motion distance law: Based on the micro motion distance of the human body, calculate the "time micro motion distance" law of the human body (the fluctuation law of the body caused by breathing);
3. Personnel detection: Analyze whether there is human body micro movement or breathing based on the "time micro movement distance" pattern.

# Description of detection area

The area where the JY220-CC-RS485 sensor emits energy signals is mainly determined by the angle of the transmitting beam. The 3D schematic diagram of the beam angle is shown in the following figure.



Special note: For example, if the beam angle is 120 °, it does not mean that there is no energy signal outside of 120 ° and the target cannot be detected; 120 ° only represents that when measured at a fixed distance (such as 2 meters, 4 meters, or other suitable distance), the measured radiation energy is 3dB (0.5 times) lower than the energy at the 0 ° position directly ahead. So there are actually radiation signals at positions such as 130 ° and 140 °, but the energy is lower than that at 120 °. If there is a large volume or object with strong reflected energy at a close range, larger angle position, such as 130 °, it may still be detected.

# Installation Instructions - Top Mount

The perception sensor of human body micro motion is sensitive to installation. Improper installation will prevent or unreasonably irradiate the electromagnetic waves emitted by the sensor onto the target to be detected, directly affecting performance and function, and even leading to abnormal operation (missed or false alarms). Therefore, a reasonable installation method plays a crucial role in the normal use of sensors.

According to the scope and shape of the area to be tested, select a suitable installation location on the ceiling to ensure that the testing area can be effectively covered.

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For ceiling installation, it is important to note that the sensor directly detects "air conditioning," "curtains," "fans," or "green plants," as if their oscillation frequency is within the respiratory frequency range, it may cause the sensor to malfunction.

At the same time, it is necessary to pay attention to the occurrence of multipath reflection similar to mirror reflection when the beam illuminates the ground, walls, or doors, indirectly detecting the aforementioned interferences. Appropriate parameter configurations such as sensitivity and distance can reduce some interference.

# Installation instructions

## Product size

JY220-CC-RS485 adopts embedded ceiling installation method, and the outer edge of the sensor is 93mm; The size of the embedded ceiling part is: long × wide × High=65 × sixty-five × 32 mm.

## connection

Clip the power cord onto the device (gently clip the cord, otherwise it may be easily cut) and introduce it into the ceiling opening.

Connect the A and B signal lines of the sensor's RS485 to the RS485 bus of the user system. Sensor A and B terminals are not connected to terminal resistors by default, and users need to decide whether to install terminal resistors on the bus based on the actual situation.

Reminder: 9-36V DC power supply can be centralized using a switching power supply or powered by a power adapter

## install

1. Opening on the ceiling with a recommended edge length of 70 × A 70 mm square hole or a circular hole with a diameter of 77-80 mm.
2. Fold the spring clip of the sensor backwards, and pay attention to the spring clip rebound grip; Then clip the sensor into the ceiling hole to complete the installation.

# Sensor Characteristics - Supplementary

1. Do not detect targets within 5 seconds of initialization

After the sensor is powered on or restarted, there will be a 5-second self calibration and initialization process, during which no target detection will be performed.

1. After someone becomes unmanned, there is a default protection time of 1 second (blocking time)

After the sensor changes its detection status from manned to unmanned, it will activate a default self-protection time of 1 second. During this time, the detection sensitivity will automatically be adjusted to a lower level and the triggering conditions will be higher. The purpose is to prevent the high-power actuator actions of linkage control from interfering with the sensor when the sensor status changes.

1. Micro movements and respiratory movements can maintain the presence of a person, but there is a certain probability that the sensor cannot be triggered

When the output of the micro motion sensor is unmanned, a larger action than pure breathing motion or micro motion is required to trigger the sensor. When the sensor output is in a manned state, only breathing movements and micro movements are required to maintain the state of sensing the presence of a person.

1. Description of sensor LED and buzzer

There is one indicator light on the sensor, and the blue color represents the device status indicator light:

* The blue indicator light indicates the working status of the device as follows:
1. Off: Normal working state;
2. Flashing once: The remote control is configured with parameters. When the button is active, the light flashes once and the buzzer beeps once for each press of the button (which can be turned off).
3. When configuring parameters, the sensor will stop

When configuring the parameters of the sensor, the microwave module will first stop working, then save the parameters, and then restart the microwave module. Therefore, when configuring sensor parameters, if the original output state of the sensor is manned, it will first change to unmanned state and then to manned state.

# matters needing attention

1. Suitable installation location
2. It should be noted that the sensor directly illuminates "air conditioning", "curtains", "fans" or "green plants", as if the oscillation frequency of these objects falls within the respiratory frequency range, it may cause the sensor to malfunction;
3. At the same time, it is necessary to pay attention to the multiple reflections similar to mirror reflection when the sensor beam illuminates the ground, wall, or door, indirectly detecting the aforementioned interference;
4. The appropriate configuration of the farthest detection distance, sensitivity, and delay time parameters can eliminate interference from some objects.
5. Multi sensor installation:

When multiple sensors are installed in a centralized manner, a distance of at least 1m should be maintained between them, and they should be illuminated in the same or opposite direction to avoid mutual illumination of each sensor.

1. Reasonable detection distance parameters
2. The farthest detection distance of the sensor can reach 11 meters, with a factory default of 6 meters. Excessive detection distance can lead to unnecessary target interference (secondary and multiple reflections, L-shaped right-angle reflections, and other effects that result in the detection of targets that do not need to be detected, affecting normal operation) in low installation height and narrow scenes.
3. In low and narrow installation scenarios, such as bathrooms, toilets, and kitchens, it is recommended to set the detection distance smaller than the installation height and lower the sensitivity.
4. Reasonable sensitivity parameters

Sensors can be set to 10 levels of sensitivity from 0 to 9, with 9 being the highest sensitivity and 0 being the lowest sensitivity. The factory default sensitivity is 7. The lower the sensitivity, the greater the target's micro movement or breathing amplitude, and the closer the distance to be detected. The higher the sensitivity, the weaker and larger the angle range of interference in complex scenarios, and the higher the false alarm rate. In low installation height and narrow scenes, sensitivity can be reduced.

1. Reasonable delay time parameters

The delay time has two parameters:

1. The first parameter is the confirmation delay. Configuring the optimal parameter values can greatly reduce the false alarm rate. Although the higher the value, the more reliable it is, when a true target appears, the sensor needs to take a longer time to report the detected target, which is prone to triggering situations where people walk below the sensor. For scenarios where real-time triggering is not required and there is no movement, this value can be increased to reduce the false alarm rate.
2. The second parameter is the disappearance delay (commonly understood delay time: how long to delay after the target disappears). The larger the configured parameter value, the easier it is to reduce the false alarm rate caused by accidental disappearance of targets and natural drop of environmental electromagnetic waves. Although the higher the value, the more reliable it is, when the target truly disappears, the sensor needs to take a longer time to report that the target has disappeared. It is recommended that the confirmation time (delay time) for target disappearance should not be too small, with a default of 15 seconds. If the time is smaller, there may be a certain probability of target disappearance due to occasional breathing pauses, resulting in false alarms.

**Reminder: The** actual delay time after the target disappears may fluctuate based on the set time (it is not possible to accurately delay the set time after there is no target)

# RS485 communication protocol

## Protocol Basis

#### data type

The various data types used in data frames are shown in the table below:

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| data type  | Description and requirements  |
| SBYTE  | Byte, 8-bit signed single byte integer  |
| BYTE  | Byte, 8-bit unsigned single byte integer  |
| WORD | Word, 16 bit unsigned double byte integer; Unsigned short data in C language  |
| SWORD  | Word, 16 bit signed double byte integer; Short data in C language  |
| DWORD | Double word, 32-bit unsigned four byte integer; Unsigned long data in C language  |
| SDWORD  | Double word, 32-bit signed four byte integer; Long data in C language  |

#### RS485 communication related parameter description:

1. Communication parameters: 4800bps (modifiable), 1-bit stop bit, 8-bit data bit, no parity bit, no flow control;
2. Device ID: The factory default device ID is 0, which should be a unique number on the RS485 bus;
3. Checksum: Perform a single byte sum operation on a frame of data from the first byte to the checksum field (excluding the checksum field);
4. Small end format: The protocol uses small end format byte order to pass words and doublewords:
5. Word transmission: First transmit the low 8 bits, then transmit the high 8 bits;
6. Double word (DWORD) transmission: first transmit the low 8 bits, then transmit the low 9-16 bits, then transmit the low 17-24 bits, and finally transmit the high 8 bits;
7. Parameter setting command: After receiving the parameter setting command, the device responds with a universal response, indicating that the communication data frame is correct or incorrect;
8. Read parameter command: After receiving the parameter read command, the device immediately outputs the parameters that need to be read (without replying to a universal response).

#### RS485 data frame format:

Each frame of data consists of a synchronization header, command or response code, device ID, data length, data body, and checksum.

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| --- | --- | --- | --- | --- | --- |
| Synchronization head  | Command code/response code  | Device ID  | Data length  | Data body  | Checksum |
| BYTE [3]  | BYTE  | WORD  | WORD  | BYTE [n]  | WORD  |
| 3 bytes  | 1 byte  | 2 bytes  | 2 bytes  | Determined by specific command or response codes  | 2 bytes |

1. **Synchronization head:**

3 bytes in length, 3 BYTE type data, represented in hexadecimal as 0x5A 0x41 0x3C

1. **Command code/response code:**

1 byte in length, BYTE type, used to indicate the purpose of the frame data, whether it is a set parameter or a query result. Please refer to the description in the following chapters for details.

1. **Device ID:**

2 bytes in length, WORD type, used as a unique number for each device on the RS485 bus.

1. **Data length:**

2 bytes in length, WORD type, used to indicate the byte length of a frame of data ("synchronization header" length+"command code/response code" length+"device ID" length+"data length" byte length+"data body" length+"checksum" length).

1. **Data** **body:**

The length is a variable data length, which is determined by the corresponding command code or response code.

1. **Verification:**

2 bytes in length, WORD type. The verification method is 1-byte cumulative sum verification, whose value is equal to starting from the first byte of the synchronization header, the first byte+the second byte+the third byte+...+the last byte of the data body (verifying the previous byte).

## Protocol Command

### Universal response

After receiving the parameter setting command, the device responds with a universal response, indicating that the received data frame format is correct or incorrect.

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| The data frame format received by the device is correct:  |
| Synchronization head  | Command code  | Device ID  | Data length  | Data body (BYTE type) | Checksum  |
| 0x5A 0x41 0x3C  | **0x00**  | 0x00 0x00  | 0x0B 0x00  | **0x01**  | 0xE3 0x00 |
| Data flow: 5A 41 3C 00 00 00 00B 00 01 E3 00  |

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| The format of the data frame received by the device is incorrect (if there is a verification error, the device will not reply to any information):  |
| Synchronization head  | Command code  | Device ID  | Data length  | Data body (BYTE type)  | Checksum |
| 0x5A 0x41 0x3C  | **0x00**  | 0x00 0x00  | 0x0B 0x00  | **0x00**  | 0xE2 0x00 |
| Data flow: 5A 41 3C 00 00 00 00B 00 00 E2 00  |

### Detection distance

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| **Description:**  |
| * The farthest detection distance of the sensor supports up to 11m;
* The sensor has a distance transition area of 1m, which means that if the farthest detection distance is set to 3 meters, it is possible to detect targets between 3 and 4 meters. When approaching 4 meters, a significant amount of movement is required to be detected, and it is also possible that the target cannot be detected at a distance of 4 meters (related to its characteristics). However, no targets will be detected beyond 4 meters, 4.5 meters, and beyond. Therefore, when configuring the farthest distance parameter, users need to pay special attention to this feature in order to accurately divide the detection area;
* The distance parameter value is in centimeters (cm).

Note: This sensor is not specifically designed for distance measurement. Currently, the distance has not been calibrated, so the distance can only be used as a reference and may have some offsets or errors.  |
| **Configuration parameter command:**  |
| Command code for nearest detection distance: 0x81 Maximum detection distance command code: 0x82  |
| **Read configuration parameter commands and data bodies:** | **Read configuration parameter response:**  |
| Command code for nearest detection distance: 0x80; Data body: 0x01 Command code for farthest detection distance: 0x80; Data body: 0x02  | Nearest detection distance response code: 0x01 Longest detection distance response code: 0x02 |

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| **Example** **1:** **Configure the closest detection distance to 0cm**  |
| Synchronization head  | Command code  | Device ID  | Data length  | Data body (WORD type)  | Checksum  |
| 0x5A 0x41 0x3C  | **0x81** | 0x00 0x00  | 0x0C 0x00  | **0x00 0x00**  | 0x64 0x01  |
| Data flow: 5A 41 3C 81 00 00 0C 00 00 00 64 01 |

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| **Example** **2:** **Configure the farthest detection distance to be** **600cm=0x0258**  |
| Synchronization head  | Command code  | Device ID  | Data length  | Data body (WORD type)  | Checksum |
| 0x5A 0x41 0x3C  | **0x82**  | 0x00 0x00  | 0x0C 0x00  | **0x58 0x02**  | 0xBF 0x01 |
| Data flow: 5A 41 3C 82 00 00 0C 00 58 02 BF 01  |

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| **Example** **3: Reading the closest detection distance**  |
| Synchronization head  | Command code  | Device ID  | Data length  | Data body (BYTE type)  | Checksum  |
| 0x5A 0x41 0x3C | **0x80**  | 0x00 0x00  | 0x0B 0x00  | **0x01**  | 0x63 0x01  |
| Data flow: 5A 41 3C 80 00 00 0B 00 01 63 01 |
|  |
| **Device response reads the nearest detection distance (0x0258** **is a hexadecimal representation of 600cm)**  |
| Synchronization head  | Command code  | Device ID  | Data length  | Data body (WORD type)  | Checksum  |
| 0x5A 0x41 0x3C | **0x01**  | 0x00 0x00  | 0x0C 0x00  | **0x58 0x02**  | 0x3E 0x01  |
| Data flow: 5A 41 3C 01 00 00 0C 00 58 02 3E 01 |

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| **Example** **4: Reading the farthest** **detection distance**  |
| Synchronization head  | Command code  | Device ID  | Data length  | Data body (WORD type)  | Checksum  |
| 0x5A 0x41 0x3C  | **0x80** | 0x00 0x00  | 0x0B 0x00  | **0x02**  | 0x64 0x01  |
| Data flow: 5A 41 3C 80 00 00 0B 00 02 64 01 |
|  |
| **The device responds by reading the farthest** **detection distance** **(0x0258** **is a hexadecimal representation of 600cm)**  |
| Synchronization head  | Command code  | Device ID  | Data length  | Data body (WORD type)  | Checksum |
| 0x5A 0x41 0x3C  | **0x02**  | 0x00 0x00  | 0x0C 0x00  | **0x58 0x02** | 0x3F 0x01  |
| Data flow: 5A 41 3C 02 00 00 0C 00 58 02 3F 01  |

### sensitivity

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| **Description:**  |
| * There are 10 levels of sensitivity, and the larger the number, the higher the sensitivity; The smaller the number, the lower the sensitivity; 9 is the most sensitive; The default sensitivity value of the sensor is 7.

Note: Please configure sensitivity based on actual usage environment and requirements; The lower the sensitivity, the greater the range of motion and the closer the distance of the target are needed to be detected. The higher the sensitivity, the higher the requirement for environmental interferences. If there are interferences, they are more likely to be misreported.  |
| **Configuration parameter command:**  |
| Command code: 0x83  |
| **Read configuration parameter commands and data bodies:**  | **Read configuration parameter response:**  |
| Command code: 0x80; Data body: 0x03  | Response code: 0x03 |

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| **Example** **1: Configure detection sensitivity to 6**  |
| Synchronization head  | Command code  | Device ID  | Data length  | Data body (BYTE type)  | Checksum  |
| 0x5A 0x41 0x3C  | **0x83** | 0x00 0x00  | 0x0B 0x00  | **0x06**  | 0x6B 0x01  |
| Data flow: 5A 41 3C 83 00 00 0B 00 06 6B 01  |

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| **Example 2: Reading Sensitivity**  |
| Synchronization head  | Command code | Device ID  | Data length  | Data body (BYTE type)  | Checksum  |
| 0x5A 0x41 0x3C  | **0x80**  | 0x00 0x00  | 0x0B 0x00 | **0x03**  | 0x65 0x01  |
| Data flow: 5A 41 3C 80 00 00 0B 00 03 65 01  |
|  |
| **Device response reading sensitivity**  |
| Synchronization head  | Command code  | Device ID  | Data length  | Data body (BYTE type)  | Checksum |
| 0x5A 0x41 0x3C  | **0x03**  | 0x00 0x00  | 0x0B 0x00  | **0x07**  | 0xEC 0x00 |
| Data flow: 5A 41 3C 03 00 00 0B 00 07 EC 00  |

### Delay Time

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| **Description:**  |
| * Output delay time configuration, used to configure the confirmation time after "target detection" and the confirmation time after "target disappearance"
* Confirmation time after detecting the target: Value range: 0-10s, default to 0.1 seconds
* Confirmation time after "target disappears": Value range: 0.5~1500s, default to 15 seconds
* Delay time parameter value in milliseconds (ms)

**Note:****(1) The confirmation time after detecting the target** **and** **configuring the optimal** **parameter values** **can greatly reduce the false alarm rate.** **Although the larger the value, the more reliable it is, when a true target appears, the sensor** **needs to take a longer time to report that the target has been detected;****(2) The confirmation time after the "target disappears", the larger the configured** **parameter value,** **the easier it is to reduce missed alarms caused by the accidental disappearance of the target.** **Although the higher the value, the more reliable it is, when the target truly disappears, the sensor** **needs to take a longer time to report that the target has disappeared.** **For scenarios where the response speed requirement is not high after the target disappears, it is recommended to exceed** **15** **seconds to greatly reduce the false alarm rate. It can also be set longer, such as** **30** **seconds,** **60** **seconds,** **90** **seconds, etc.** |
| **Configuration parameter command:**  |
| Confirmation time command code for 'detection target': 0x84 Confirmation time command code for 'target disappearance': 0x85  |
| **Read configuration parameter commands and data bodies:**  | **Read configuration parameter response:**  |
| Confirmation time command code for "detection target": 0x80; Data body: 0x04Confirmation time command code for 'target disappearance': 0x80; Data body: 0x05  | Confirmation time response code for 'detection target': 0x04 Confirmation time response code for 'target disappearance': 0x05 |

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| **Example** **1:** **Configure the "detection target" confirmation time to be** **0.1s** **(100ms=0x64)**  |
| Synchronization head  | Command code  | Device ID  | Data length  | Data body (DWORD type)  | Checksum |
| 0x5A 0x41 0x3C  | **0x84**  | 0x00 0x00  | 0x0E 0x00  | **0x64** **0x00** **0x00 0x00 0x00** | 0xCD 0x01  |
| Data flow: 5A 41 3C 84 00 00 0E 00 64 00 00 00 CD 01  |

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| **Example** **2:** **Configure the confirmation time for 'target disappearance' to be** **15** **seconds** **(15000ms=0x3A98)**  |
| Synchronization head | Command code  | Device ID  | Data length  | Data body (DWORD type)  | Checksum  |
| 0x5A 0x41 0x3C  | **0x85**  | 0x00 0x00 | 0x0E 0x00  | **0x98 0x3A 0x00 0x00**  | 0x3C 0x02  |
| Data flow: 5A 41 3C 85 00 00 00E 00 98 3A 00 00 3C 02 |

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| **Example** **3: Reading the "Detection Target" Confirmation Time**  |
| Synchronization head  | Command code  | Device ID  | Data length  | Data body (BYTE type)  | Checksum  |
| 0x5A 0x41 0x3C  | **0x80**  | 0x00 0x00 | 0x0B 0x00  | **0x04**  | 0x66 0x01  |
| Data flow: 5A 41 3C 80 00 00 0B 00 04 66 01  |
|  |
| **Device response reading** **"detection target" confirmation time** **(0x64** **is a hexadecimal representation of** **100ms)** |
| Synchronization head  | Command code  | Device ID  | Data length  | Data body (BYTE type)  | Checksum  |
| 0x5A 0x41 0x3C  | **0x04**  | 0x00 0x00 | 0x0E 0x00  | **0x64 0x00 0x00 0x00 0x00**  | 0x4D 0x01  |
| Data flow: 5A 41 3C 04 00 00 0E 00 64 00 00 00 4D 01  |

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| **Example** **4: Reading the "Target Disappearance" Confirmation Time** |
| Synchronization head  | Command code  | Device ID  | Data length  | Data body (BYTE type)  | Checksum  |
| 0x5A 0x41 0x3C  | **0x80**  | 0x00 0x00  | 0x0B 0x00 | **0x05**  | 0x67 0x01  |
| Data flow: 5A 41 3C 80 00 00 0B 00 05 67 01  |
|  |
| **Device response reading** **"target disappearance" confirmation time** **(0x3A98** **is a hexadecimal representation of** **15000ms)** |
| Synchronization head  | Command code  | Device ID  | Data length  | Data body (DWORD type)  | Checksum  |
| 0x5A 0x41 0x3C  | **0x05**  | 0x00 0x00 | 0x0E 0x00  | **0x98 0x3A 0x00 0x00**  | 0xBC 0x01  |
| Data flow: 5A 41 3C 05 00 00 00E 00 98 3A 00 00 BC 01  |

### Cancel induction

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| **Description:** |
| * The sensor sensing function has three working states: (1) Normal operation (parameter value=0); (2) Turn off the sensing function and continuously output with a target present (parameter value=1); (3) Turn off sensing function and continuously output without target present (parameter value=2)
 |
| **Configuration parameter command:**  |
| Command code: 0x86  |
| **Read configuration parameter commands and data bodies:**  | **Read configuration parameter response:**  |
| Command code: 0x80; Data body: 0x06  | Response code: 0x06 |

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| **Example** **1:** **Cancel the sensing function** **and continuously output** **without a target** **present** **(parameter value=2)**  |
| Synchronization head  | Command code  | Device ID  | Data length  | Data body (BYTE type)  | Checksum  |
| 0x5A 0x41 0x3C | **0x86**  | 0x00 0x00  | 0x0B 0x00  | **0x02**  | 0x6A 0x01  |
| Data flow: 5A 41 3C 86 00 00 00B 00 02 6A 01 |

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| **Example** **2:** **Query sensing function**  |
| Synchronization head  | Command code  | Device ID  | Data length  | Data body (BYTE type)  | Checksum  |
| 0x5A 0x41 0x3C  | **0x80**  | 0x00 0x00 | 0x0B 0x00  | **0x06**  | 0x68 0x01  |
| Data flow: 5A 41 3C 80 00 00 0B 00 06 68 01  |
|  |
| **Device response reading** **sensing function** **(parameter value=2, indicating that the sensing function is turned off and** **there is no** **target** **present** **output)** |
| Synchronization head  | Command code  | Device ID  | Data length  | Data body (BYTE type)  | Checksum  |
| 0x5A 0x41 0x3C  | **0x06**  | 0x00 0x00 | 0x0B 0x00  | **0x02**  | 0xEA 0x00  |
| Data flow: 5A 41 3C 06 00 00 00B 00 02 EA 00  |

### LED working mode

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| **Description:** |
| * The LED working modes include: (1) light on/flashing during faults, and light off during normal operation (parameter value=0); (2) The light turns off during normal operation and malfunction (except for remote control, it still flashes) (parameter value=1).
 |
| **Configuration parameter command:** |
| Command code: 0x87  |
| **Read configuration parameter commands and data bodies:**  | **Read configuration parameter response:**  |
| Command code: 0x80; Data body: 0x07  | Response code: 0x07  |

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| **Example** **1:** **Lights on/flashing during faults, lights off during normal operation**  |
| Synchronization head  | Command code  | Device ID | Data length  | Data body (BYTE type)  | Checksum  |
| 0x5A 0x41 0x3C  | **0x87**  | 0x00 0x00  | 0x0B 0x00  | **0x00** | 0x69 0x01  |
| Data flow: 5A 41 3C 87 00 00 0B 00 00 69 01  |

|  |
| --- |
| **Example** **2:** **Querying the working** **mode of LED lights**  |
| Synchronization head  | Command code  | Device ID  | Data length  | Data body (BYTE type)  | Checksum |
| 0x5A 0x41 0x3C  | **0x80**  | 0x00 0x00  | 0x0B 0x00  | **0x07**  | 0x69 0x01 |
| Data flow: 5A 41 3C 80 00 00 0B 00 07 69 01  |
|  |
| **Device response** **query** **LED light working mode** **(parameter value=0, indicating** **light on/flashing during fault, light off during normal operation)**  |
| Synchronization head  | Command code  | Device ID  | Data length  | Data body (BYTE type)  | Checksum |
| 0x5A 0x41 0x3C  | **0x07**  | 0x00 0x00  | 0x0B 0x00  | **0x00**  | 0xE9 0x00 |
| Data flow: 5A 41 3C 07 00 00 00B 00 00 E9 00  |

### Buzzer working mode

|  |
| --- |
| **Description:**  |
| * Configure the buzzer sound to turn on (parameter value=0) or off (parameter value=1); The current version does not support
 |
| **Configuration parameter command:** |
| Command code: 0x88  |
| **Read configuration parameter commands and data bodies:**  | **Read configuration parameter response:**  |
| Command code: 0x80; Data body: 0x08  | Response code: 0x08  |

### Master slave working mode

|  |
| --- |
| **Description:** |
| * Configure the sensor in slave mode and wait for host commands; Or it can be in active mode, actively reporting data
* (1) Slave mode, parameter value=0; (2) In active mode, if the parameter value is ≥ 1 but<65535, the parameter value is the cycle time of active reporting, in seconds; (3) Active mode, with a parameter value of 65535, is an active reporting mode controlled by light perception, which only reports the presence of detection results (with no one present) when the ambient light intensity is less than the set light value; (4) Active mode, parameter value=65535, and the parameter value of master-slave working mode (command code 0x8B) is greater than 0, then it is an active reporting mode that is not controlled by light perception
* There are three types of actively reported frame data: presence of detection results, presence of the closest distance to the target, and presence of light intensity; The active reporting mode controlled by or not controlled by light perception only reports the presence of a detection result message
 |
| **Configuration parameter command:**  |
| Command code: 0x89  |
| **Read configuration parameter commands and data bodies:**  | **Read configuration parameter response:** |
| Command code: 0x80; Data body: 0x09  | Response code: 0x09  |

|  |
| --- |
| **Example** **1:** **Configuring to slave** **mode**  |
| Synchronization head  | Command code  | Device ID  | Data length  | Data body (WORD type)  | Checksum |
| 0x5A 0x41 0x3C  | **0x89**  | 0x00 0x00  | 0x0C 0x00  | **0x00 0x00** | 0x6C 0x01  |
| Data flow: 5A 41 3C 89 00 00 0C 00 00 00 6C 01  |

|  |
| --- |
| **Example** **2:** **Configured as active reporting mode, with a reporting cycle of 5** **seconds**  |
| Synchronization head  | Command code  | Device ID  | Data length | Data body (WORD type)  | Checksum  |
| 0x5A 0x41 0x3C  | **0x89**  | 0x00 0x00  | 0x0C 0x00 | **0x05 0x00**  | 0x71 0x01  |
| Data flow: 5A 41 3C 89 00 00 0C 00 05 00 71 01  |

|  |
| --- |
| **Example** **3:** **Configured as active reporting mode, only reported when the ambient light intensity is lower than the set light value**  |
| Synchronization head  | Command code  | Device ID | Data length  | Data body (WORD type)  | Checksum  |
| 0x5A 0x41 0x3C  | **0x89**  | 0x00 0x00  | 0x0C 0x00 | **0xFF 0xFF**  | 0x6A 0x03  |
| Data flow: 5A 41 3C 89 00 00 0C 00 FF 6A 03  |

### Timed active reporting mode

|  |
| --- |
| **Description:** |
| * When configuring the sensor in active mode (active data reporting), it is not controlled by light perception, but reports the presence of unmanned status at regular intervals
* The timed active reporting mode is a supplement to the "master slave working mode" and is only effective when the sensor working mode is "active mode" and the parameter value is 65535
* When there is a change in unmanned status, immediately report the status data and reset the timer of the sensor (restart timing) until the next timing cycle expires before reporting again
* The parameter value needs to be greater than 0 in order to activate the timed reporting mode that is not controlled by light perception; The parameter value is equal to 0, and the scheduled reporting mode set by this command is invalid
 |
| **Configuration parameter command:**  |
| Command code: 0x8B  |
| **Read configuration parameter commands and data bodies:**  | **Read configuration parameter response:** |
| Command code: 0x80; Data body: 0x0B  | Response code: 0x0B  |

|  |
| --- |
| **Example** **1:** **Configured as active reporting mode (timed reporting mode not controlled by light perception), with a reporting cycle of 5 seconds**  |
| Step 1: Use the master-slave working mode command 0x89 to configure the sensor to be in the active reporting mode controlled by light sensing, with parameter value=65535  |
| Synchronization head | Command code  | Device ID  | Data length  | Data body (WORD type)  | Checksum  |
| 0x5A 0x41 0x3C  | **0x89**  | 0x00 0x00 | 0x0C 0x00  | **0xFF 0xFF**  | 0x6A 0x03  |
| Data flow: 5A 41 3C 89 00 00 0C 00 FF 6A 03 |
| Step 2: Use the timed active reporting mode command 0x8B, and configure the reporting cycle time to 5 seconds (if the parameter value is greater than 0, the light sensing control reporting will be automatically turned off, and the timed active reporting method will be used)  |
| Synchronization head  | Command code  | Device ID  | Data length  | Data body (WORD type)  | Checksum  |
| 0x5A 0x41 0x3C | **0x8B**  | 0x00 0x00  | 0x0C 0x00  | **0x05 0x00**  | 0x73 0x01  |
| Data flow: 5A 41 3C 8B 00 00 0C 00 05 00 73 01 |

### Light sensing configuration

|  |
| --- |
| **Description:**  |
| * Configure light sensitivity threshold; When the light intensity of the environment is lower than the configured light sensitivity value and there is a change in unmanned status, the detection results are actively reported
* This function is only effective when the sensor is in active mode controlled by light sensing (parameter value=65535)
 |
| **Configuration parameter command:**  |
| Command code: 0x8A  |
| **Read configuration parameter commands and data bodies:**  | **Read configuration parameter response:** |
| Command code: 0x80; Data body: 0x0A  | Response code: 0x0A  |

|  |
| --- |
| **Example** **1:** **Configure the light sensitivity threshold to 100** **Lux (100** **Lux=0x64)**  |
| Synchronization head  | Command code  | Device ID  | Data length | Data body (DWORD type)  | Checksum  |
| 0x5A 0x41 0x3C  | **0x8A**  | 0x00 0x00  | 0x0C 0x00  | **0x64 0x00** | 0xD1 0x01  |
| Data flow: 5A 41 3C 8A 00 00 0C 00 64 00 D1 01  |

|  |
| --- |
| **Example** **2: Reading the Light Sensitivity Threshold**  |
| Synchronization head  | Command code  | Device ID  | Data length  | Data body (BYTE type)  | Checksum |
| 0x5A 0x41 0x3C  | **0x80**  | 0x00 0x00  | 0x0B 0x00  | **0x0A**  | 0x6C 0x01 |
| Data flow: 5A 41 3C 80 00 00 00B 00 0A 6C 01  |
|  |
| **Device response reading** **light sensitivity threshold**  |
| Synchronization head  | Command code  | Device ID  | Data length  | Data body (BYTE type)  | Checksum  |
| 0x5A 0x41 0x3C  | **0x0A** | 0x00 0x00  | 0x0C 0x00  | **0x64 0x00**  | 0x51 0x01  |
| Data flow: 5A 41 3C 0A 00 00 0C 00 64 00 51 01  |

### Light intensity

|  |
| --- |
| **Description:** |
| * The current light intensity value detected by the device
 |
| **Read configuration parameter commands and data bodies:**  | **Read configuration parameter response:**  |
| Command code: 0x80; Data body: 0x10  | Response code: 0x10  |

|  |
| --- |
| **Example** **1:** **Reading** **Light Intensity**  |
| Synchronization head  | Command code  | Device ID  | Data length | Data body (BYTE type)  | Checksum  |
| 0x5A 0x41 0x3C  | **0x80**  | 0x00 0x00  | 0x0B 0x00  | **0x10** | 0x72 0x01  |
| Data flow: 5A 41 3C 80 00 00 0B 00 10 72 01  |
|  |
| **Device response reading** **light intensity** **(0x07D0=2000lux)**  |
| Synchronization head  | Command code  | Device ID  | Data length  | Data body (WORD type)  | Checksum |
| 0x5A 0x41 0x3C  | **0x10**  | 0x00 0x00  | 0x0C 0x00  | **0xD0 0x07**  | 0xCA 0x01 |
| Data flow: 5A 41 3C 10 00 00 0C 00 D0 07 CA 01  |

### The closest distance to the target exists

|  |
| --- |
| **Description:**  |
| * The distance in centimeters between all targets closest to the device
 |
| **Read configuration parameter commands and data bodies:**  | **Read configuration parameter response:**  |
| Command code: 0x80; Data body: 0x11 | Response code: 0x11  |

|  |
| --- |
| **Example** **1:** **Query the distance** **of the nearest target**  |
| Synchronization head  | Command code  | Device ID  | Data length  | Data body (BYTE type)  | Checksum  |
| 0x5A 0x41 0x3C  | **0x80** | 0x00 0x00  | 0x0B 0x00  | **0x11**  | 0x73 0x01  |
| Data flow: 5A 41 3C 80 00 00 0B 00 11 73 01 |
|  |
| **The device responds by reading the distance to the nearest target** **(0x3C=60cm)**  |
| Synchronization head  | Command code  | Device ID  | Data length  | Data body (WORD type)  | Checksum  |
| 0x5A 0x41 0x3C | **0x11**  | 0x00 0x00  | 0x0C 0x00  | **0x3C 0x00**  | 0x30 0x01  |
| Data flow: 5A 41 3C 11 00 00 0C 00 3C 00 30 01 |

### Presence of detection results

|  |
| --- |
| **Description:**  |
| * Does the device detect the presence of a target
 |
| **Read configuration parameter commands and data bodies:**  | **Read configuration parameter response:**  |
| Command code: 0x80; Data body: 0x12  | Response code: 0x12 |

|  |
| --- |
| **Example** **1:** **Query** **detection results**  |
| Synchronization head  | Command code  | Device ID  | Data length  | Data body (BYTE type)  | Checksum  |
| 0x5A 0x41 0x3C  | **0x80**  | 0x00 0x00 | 0x0B 0x00  | **0x12**  | 0x74 0x01  |
| Data flow: 5A 41 3C 80 00 00 0B 00 12 74 01  |
|  |
| **Device response query** **detection result** **(0x01** **indicates that a target has been detected)** |
| Synchronization head  | Command code  | Device ID  | Data length  | Data body (BYTE type)  | Checksum  |
| 0x5A 0x41 0x3C  | **0x12**  | 0x00 0x00 | 0x0B 0x00  | **0x01**  | 0xF5 0x00  |
| Data flow: 5A 41 3C 12 00 00 0B 00 01 F5 00  |

### Hardware version

|  |
| --- |
| **Description:**  |
| * Device hardware version number (string)
 |
| **Read configuration parameter commands and data bodies:** | **Read configuration parameter response:**  |
| Command code: 0x80; Data body: 0x13  | Response code: 0x13  |

|  |
| --- |
| **Example** **1:** **Querying** **Hardware Version**  |
| Synchronization head  | Command code  | Device ID  | Data length  | Data body (BYTE type)  | Checksum |
| 0x5A 0x41 0x3C  | **0x80**  | 0x00 0x00  | 0x0B 0x00  | **0x13**  | 0x75 0x01 |
| Data flow: 5A 41 3C 80 00 00 0B 00 13 75 01  |
|  |
| **Device response** **query** **hardware version** **(**4A 59 5F 31 30 38 5F 44 30 31 00 00 in hexadecimal for JY\_108-D01**)**  |
| Synchronization head  | Command code  | Device ID  | Data length  | Data body (BYTE [12] type) | Checksum  |
| 0x5A 0x41 0x3C  | **0x13**  | 0x00 0x00  | 0x16 0x00 | 0x4A 0x59 0x5F 0x31 0x30 0x38 0x5F 0x44 0x30 0x31 0x00 0x00 | 0x9F 0x03  |
| Data flow: 5A 41 3C 13 00 00 16 00 4A 59 5F 31 30 38 5F 44 30 31 00 00 9F 03  |

### Software version

|  |
| --- |
| **Description:**  |
| * Device software version number (string)
 |
| **Read configuration parameter commands and data bodies:**  | **Read configuration parameter response:** |
| Command code: 0x80; Data body: 0x14  | Response code: 0x14  |

|  |
| --- |
| **Example** **1:** **Querying** **Software Version**  |
| Synchronization head  | Command code  | Device ID  | Data length  | Data body (BYTE type)  | Checksum |
| 0x5A 0x41 0x3C  | **0x80**  | 0x00 0x00  | 0x0B 0x00  | **0x14**  | 0x76 0x01 |
| Data flow: 5A 41 3C 80 00 00 0B 00 14 76 01  |
|  |
| **Device response** **query** **software version** **(**34 38 35 5F 56 31 2E 30 00 00 00 in hexadecimal for 485\_V1.0**)**  |
| Synchronization head  | Command code  | Device ID  | Data length  | Data body (BYTE [12] type) | Checksum  |
| 0x5A 0x41 0x3C  | **0x14**  | 0x00 0x00  | 0x16 0x00 | 0x34 0x38 0x35 0x5F 0x56 0x31 0x2E 0x30 0x00 0x00 0x00 0x00 | 0xE6 0x02  |
| Data flow: 5A 41 3C 14 00 00 16 00 34 38 35 5F 56 31 2E 30 00 00 00 00 00 E6 02  |

### Baud rate

|  |
| --- |
| **Description:**  |
| * Configure the RS485 communication baud rate of the device
 |
| **Configuration parameter command:**  |
| Command code: 0x95  |
| **Read configuration parameter commands and data bodies:**  | **Read configuration parameter response:** |
| Command code: 0x80; Data body: 0x15  | Response code: 0x15  |

|  |
| --- |
| **Example** **1:** **Configure a baud rate of** **9600bps=0x2580**  |
| Synchronization head  | Command code  | Device ID  | Data length | Data body (DWORD type)  | Checksum  |
| 0x5A 0x41 0x3C  | **0x95**  | 0x00 0x00  | 0x0E 0x00 | **0x80 0x25 0x00 0x00**  | 0x1F 0x02  |
| Data flow: 5A 41 3C 95 00 00 0E 00 80 25 00 00 1F 02  |

### Device ID

|  |
| --- |
| **Description:** |
| * Configure the RS485 communication ID number of the device, which should be unique on the bus
 |
| **Configuration parameter command:**  |
| Command code: 0x96  |
| **Read configuration parameter commands and data bodies:**  | **Read configuration parameter response:**  |
| Command code: 0x80; Data body: 0x16 | Response code: 0x16  |

|  |
| --- |
| **Example** **1:** **Configure** **device ID to 0**  |
| Synchronization head  | Command code  | Device ID  | Data length  | Data body (WORD type)  | Checksum  |
| 0x5A 0x41 0x3C | **0x96**  | 0x00 0x00  | 0x0C 0x00  | **0x00 0x00**  | 0x79 0x01  |
| Data flow: 5A 41 3C 96 00 00 0C 00 00 00 79 01 |

### Restore factory configuration

|  |
| --- |
| **Description:**  |
| * Restore all parameters of the device to the factory default values: detection distance of 6 meters, sensitivity of 7, target detection confirmation time of 0.1 seconds, target disappearance confirmation time of 15 seconds, baud rate of 4800bps, device ID=0
 |
| **Configuration parameter command:** |
| Command code: 0x97  |

|  |
| --- |
| **Example** **1:** **Restoring Factory** **Configuration**  |
| Synchronization head  | Command code  | Device ID  | Data length  | Data body (DWORD type)  | Checksum  |
| 0x5A 0x41 0x3C | **0x84**  | 0x00 0x00  | 0x0E 0x00  | **0xF1 0xFB 0x09 0x00** | 0x71 0x03  |
| Data flow: 5A 41 3C 97 00 00 00E 00 F1 FB 09 00 71 03  |

### Reset and restart the device

|  |
| --- |
| **Description:**  |
| * Reset and restart the device
 |
| **Configuration parameter command:**  |
| Command code: 0x98 |

|  |
| --- |
| **Example** **1:** **Reset and restart**  |
| Synchronization head  | Command code  | Device ID  | Data length  | Data body (DWORD type)  | Checksum  |
| 0x5A 0x41 0x3C  | **0x98** | 0x00 0x00  | 0x0E 0x00  | **0x40 0xE2** **0x01 0x00**  | 0xA0 0x02 |
| Data flow: 5A 41 3C 98 00 00 00E 00 40 E2 01 00 A0 02  |

# Remote control settings parameters

The RS485 version sensor can be configured with parameters using a remote control, facilitating on-site installation, debugging, and maintenance management

#### Remote Control Panel Description



#### Additional instructions for function keys

1. [ON/OFF] key:

Users can use this button to make the output signal normally open or normally closed.

1. [ID/Lock] key:

Short press button: Configure the ID value of the sensor, ranging from 0 to 65535; The factory default ID is 0.

Long press button: Unlock and lock the remote control; The sensor is in the "unlocked" state by default at the factory, and users can directly operate it using the remote control. During normal use of the sensor, if encountering interference from the remote control of other electrical appliances, the sensor can be locked by long pressing to prohibit remote control operation.

1. 【 Reset/Restore Factory 】 key:

When the sensor is in the manual remote control output or closed output state, press the reset button to restore the sensor to the induction output state; Long press this button to restore the sensor parameters to the default state: sensitivity 7, detection distance 6 meters, and delay time 15 seconds.

1. Baud rate key:

The configurable range of baud rate values is unlimited, and it is recommended to be less than 9600bps; The factory default baud rate is 4800bps.

1. 【 Light sensitivity 】 key:

The configurable light sensitivity range is 0-2000; If the light sensing function is not required, configure the light sensing value to 9999 to turn off the light sensing function.

1. Sensitivity key:

The configurable sensitivity value range is 0-9, and the larger the value, the higher the sensitivity.

1. [Confirm Delay] key:
2. The configurable value range is 0-10s, with one decimal place remaining valid. Excess decimal points and decimal values will be ignored by the sensor.
3. The confirmation time after detecting the target and configuring the optimal parameter values can greatly reduce the false alarm rate. Although the larger the value, the more reliable it is, when a true target appears, the sensor needs to take a longer time to report that the target has been detected;
4. 【 Disappearance Delay 】 key:
5. The configurable value range is 0.5~1500s, with one decimal place remaining valid. Excess decimal points and decimal values will be ignored by the sensor.
6. The delay time after "target disappearance", the larger the configured parameter value, the easier it is to reduce missed alarms caused by accidental target disappearance. Although the higher the value, the more reliable it is, when the target truly disappears, the sensor needs to take a longer time to report that the target has disappeared. For scenarios where the response speed requirement is not high after the target disappears, it is recommended to set it to more than 15 seconds or longer, such as 30 seconds, 60 seconds, 90 seconds, etc.
7. 【 farthest distance 】 key:
8. The configurable value range is 0.5~11m, with two decimal places remaining valid. Excess decimal points and decimal values will be ignored by the sensor.
9. Sensors will only detect targets located between the closest and farthest distances. For example, if the nearest distance is 1 meter and the farthest distance is 3 meters, the sensor will not detect targets within 1 meter or greater than 3 meters.
10. [OK] key:

After pressing the [Light Sensitivity], [Sensitivity], [Delay], or [Maximum Distance] keys on the remote control, input the parameter values. Finally, press the [Confirm] key before the sensor will store and use the new parameter values, otherwise they will not be used.

1. [•/Buzzer] key:

The default buzzer is on, and a sound will sound when the remote control button is pressed. If the buzzer needs to be turned off, long press and hold the button to turn off the buzzer; Press and hold again to turn on the buzzer.

1. 【 0/LED switch 】 key:

The default LED indicator light turns off when working normally, and flashes or lights up when abnormal. Long press and hold this button to turn off the indicator light (it will still flash when the remote control is in use), and it will no longer flash or light up in case of abnormalities. Press and hold again to turn on the indicator light.

1. Quick parameter configuration: Users can quickly configure typical parameters by long pressing these buttons.
* [Configuration 1] key, with the following parameters, suitable for scenarios such as bathrooms and kitchens:

Sensitivity: 6; The nearest detection distance is 0.9m; The farthest detection distance is 2.4m; Target confirmation time is 0.2 seconds; Delay time of 20 seconds;

* 【 Configuration 2 】 key, with the following parameters, suitable for scenarios such as study and bedroom:

Sensitivity: 8, nearest detection distance 0.9m, farthest detection distance 3m, target confirmation time 0.5s, delay time 120s;

* 【 Configuration 3 】 Key: The parameters are as follows, suitable for living rooms, halls, conference rooms, and other spaces:

Sensitivity: 7; The nearest detection distance is 0.6m; The farthest detection distance is 6m; Target confirmation time 0.1; Delay time of 60 seconds;

1. [Battery Protection Sheet]:

Before using the remote control, please remove the plastic sheet that isolates the battery to ensure that the remote control is powered on and working properly. It is recommended to keep the plastic sheet and insert it back when the remote control is not frequently used to protect it.

**Reminder:**

1. After pressing the [Light Sensitivity], [Sensitivity], [Delay], or [Maximum Distance] buttons, if there is no operation within 5 seconds, the sensor will timeout and exit the configuration state;
2. 【 • 】, 【 0 】, 【 1 】, 【 2 】, 【 3 】, 【 4 】, 【 5 】, 【 6 】, 【 7 】, 【 8 】, 【 9 】 are numerical combination keys used for parameter value input.

#### Example

1. Set sensitivity to 8:

Operation steps: In the remote control unlocking state, first press the [Sensitivity] key to enter the configuration state, then press the number key [8], and finally press the [Confirm] key to take effect.

1. If the maximum detection distance is set to 6.5 meters:

Operation steps: In the remote control unlocking state, first press the [farthest distance] button to enter the configuration state, then press the number key [6], decimal point key [•], number key [5], and finally press the [confirm] button to take effect.

1. To quickly configure the parameters of parameter group 2:

Operation steps: In the remote control unlocking state, press the [8/Configuration 2] button for more than 3 seconds.

1. Restore factory configuration:

Press the 'Restore Factory' button for more than 3 seconds while the remote control is unlocked.

# statement

Please read this statement carefully before using the product described in this document. Once used, it is considered as recognition and acceptance of the content of this statement.

When users apply microwave human body micro motion sensing sensors, based on the product characteristics, performance, and functions described in this document, they must retest according to their own application to confirm that they meet the user's application needs. Chengdu Jieyue Shijin Technology Co., Ltd. shall not be liable for any corresponding losses or damages caused by improper use.

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