# Infrared CO2 Sensor

## (Model：MH-Z1911A)

# User's Manual

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Zhengzhou Winsen Electronic Technology Co., Ltd

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**Zhengzhou Winsen Electronics Technology CO., LTD**

# MH-Z1911A Infrared CO2 Sensor

## Profile

MH-Z1911A infrared CO2 sensor is intelligent sensor as shown in Figure 1,common type, small size, using non-dispersive infrared (NDIR) principle to detect the existence of CO2 in the air, with good selectivity, non-oxygen dependent and long life. Built-in temperature compensation, and it has UART output IIC and PWM output. It is developed by the tight integration of mature infrared absorbing gas detection technology, precision optical circuit design and superior circuit design.
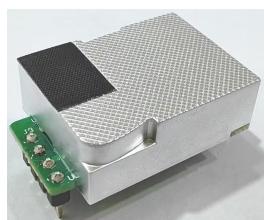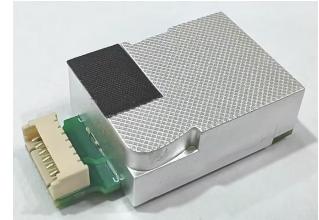
Pin type          Terminal

Figure 1

## Features:

*High sensitivity, low power consumption

*Good stability and consistency

*Temperature compensation, excellent linear output

*Multiple output modes: UART, IIC, PWM

*Long lifespan

*Anti-water vapor interference, anti-poisoning

## Applications：

*HVAC system                          *Air purifier

*Indoor air quality monitor           *Smart home device

*Consumer CO2 meter

## Main parameters:

| Model No. | MH-Z1911A | Preheat time | 1 min |
|---|---|---|---|
| Detection Gas | CO2 | Response Time | $T_{90} < 120$ s |
| Working voltage | DC 5.0±0.1V | Working temperature | -10 ~ 50 ℃ |
| Average current | < 30mA (@5V power supply) | Working humidity | 0~95%RH(No condensation) |
| Peak current | 125mA (@5V power supply) | Storage temperature | -20~60 ℃ |
| Interface level | 3.3 V (Compatible with 5V) | Weight | 5 g |
| Output signal | Serial Port (UART) (TTL level 3.3V);IIC | Detection Range | 400~10000ppm (optional,see table 2) |
|  | PWM | Lifespan | > 10 years |

**Table1**

| Detection Gas | Formula | Detection Range | Resolution | Accuracy |
|---|---|---|---|---|
| Carbon Dioxide | $CO_2$ | 400~2000ppm | 1ppm | ± (50ppm+5% reading value) |
| | | 400~5000ppm | | |
| | | 400-10000ppm | | |

**Table2** Detection range and accuracy

## Appearance and structure:

### Pin type
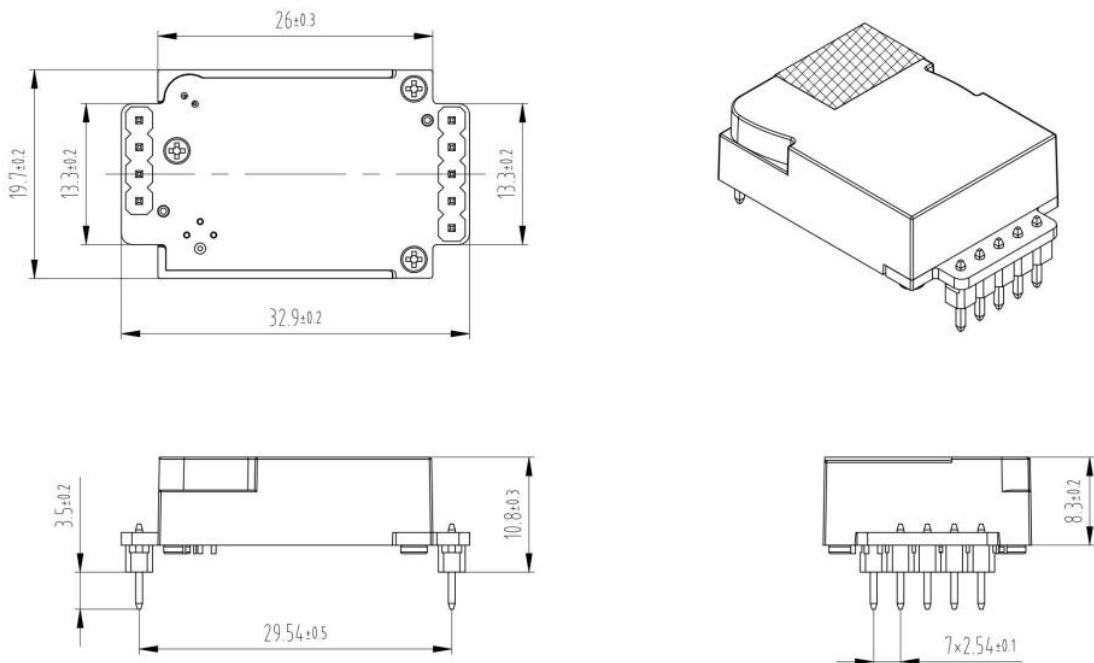


**Figure 2**

### Pin Definition:

| Pin | Pin Definition |
|---|---|
| Vin | Positive pole of power (Vin) |
| GND | Negative pole of power (GND) |
| PWM | PWM |
| Hd | HD(0 point calibration, low level lasting for over 7s is effective) |
| Rx | UART(RXD)TTL Level or IIC-SDA |
| Tx | UART(TXD)TTL Level or IIC-SCL |
| R/T | UART and IIC interface setting pins |

**Table 3**
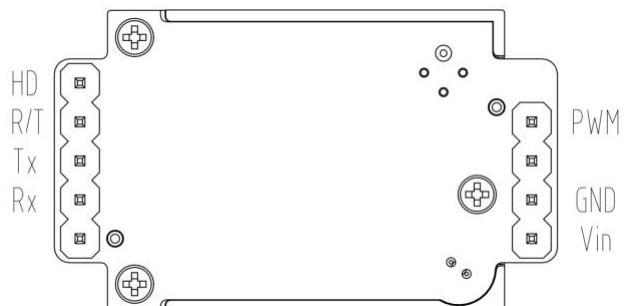


**Figure 3** Pin Diagram

## Terminal type:
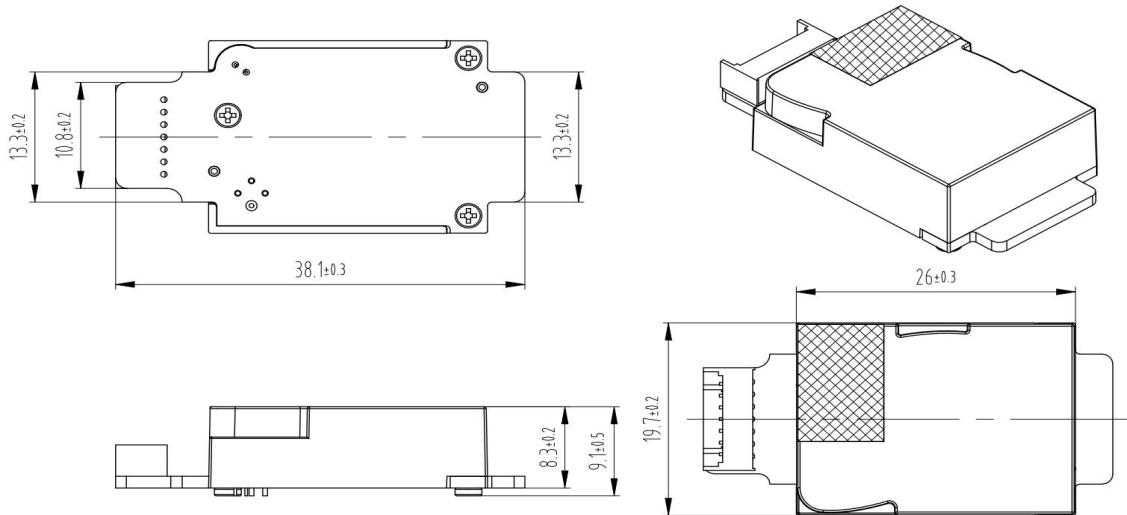


**Figure 4**

| Table 4 Pin definition for terminal type | |
|---|---|
| **Pin** | **Definition** |
| 1 | PWM output |
| 2 | UART(TXD)TTL Level or IIC-SCL |
| 3 | UART(RXD)TTL Level or IIC-SDA |
| 4 | Power **+** (Vin) |
| 5 | Power **-** (GND) |
| 6 | UART and IIC interface setting pins |
| 7 | HD(Zero point calibration, low level lasting for over 7s is effective) |
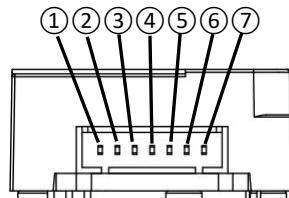


**Figure 5**

**Explanation**

For both pin and terminal models, the R/T pin is the UART and IIC interface setting pin, which defaults to pulling up the high level and is the UART interface; Pulling down to GND, the sensor recognizes the IIC interface when powered on.

## I²C Communication Protocol

### Bus Description

The IIC interface protocol is a bus signal protocol. It consists of three parts: Start (S)(Start Signal), Stop (p)(Stop Signal), and binary data, as shown in the following figure. At the beginning, SCL high and SDA falling edge. Afterwards, send slave device address. After the 7-bit address bit, it controls the read/write bit and selects the read/write operation. After identifying the corresponding address information from the device, a response signal will be sent to the host, pull down SDA in the 9th clock cycle. When stopping, SCL remains high TTL and SDA rising edge.

1. Using standard IIC timing for communication, with a recommended clock frequency of 10kHz and data is big endian format, send the most significant bit first:

2. IIC communication slave address: 0x31.
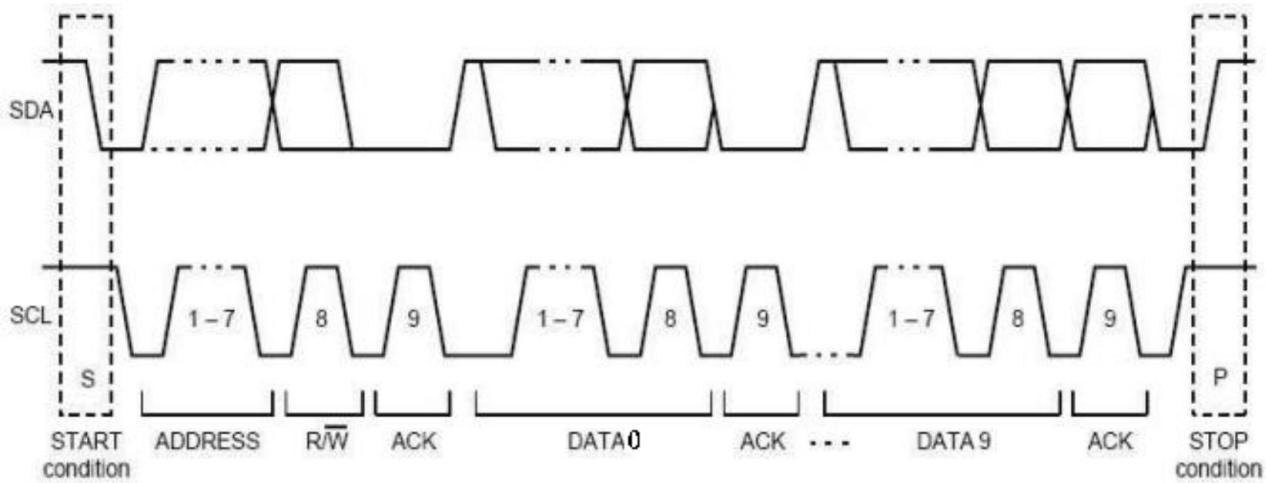


### Instruction Format

Send format: Command word+DATA0+...+ DATAn

1. Command words are used to recognize different instructions;

2. DATA0-DATAn is the parameter carried by the command word, which is a hexadecimal number (optional).

Return format: Command word+DATA0+...+ DATAn+checksum

Command words are used to identify different instructions;

1. DATA0-DATAn is the data returned by the command, which is a hexadecimal number;

Check bit=- (command word+DATA0+...+DATAn)+1, take the lower 8 bits;

### Command Introduction

Slave address is 0x31，salve command as below：

| Serial Number | Command | Function |
|---|---|---|
| 1 | 0x01 | Read measured concentration |
| 2 | 0x03 | Calibration of CO2 |

| **Command** | 0x01 | Read measured concentration |
|---|---|---|

Send Data：0x01

Read data: 0x01+DATA0+DATA1+DATA2+checksum

Data Description:

After receiving command 0x01, the sensor enters the state of reading measured concentration. All data read by IIC without receiving new instructions or restarting are measured concentration data

2. The host receives DATA0 first, and the checksum is received last

3. $CO_2$ concentration value: DATA0 * 256+DATA1 (DATA0 and DATA1 must be converted to decimal first)

4. Example: The host reads a frame of data:

0x01 0x02 0x58 0x01 0xA4

Among them: 0x02 is converted from hexadecimal to decimal, and the data is 2

0x58 is converted from hexadecimal to a decimal, and the data is 88

$CO_2$ concentration value=2 * 256+88=600

| **Command** | 0x03 | Calibration of $CO_2$ |
|---|---|---|

Send Data：0x03+data0+data1

Read data: 0x03+data0+data1+checksum

Data Description:

1. The sensor receives command 0x03, sensor enters the calibration state. All data read by IIC after receiving no new instructions or restarting is calibration data.

2. Calibration value: data0 * 256+data1 (data0 and data1 must be converted to decimal first)

Calibration value range: 400-1500

**Special instructions:**

1. Every time the sensor is powered on, it will first execute a 10s-15s boot program, and then continue to execute the main program to calculate the output concentration;

2. During the execution of the boot program, the sensor does not calculate the output concentration;

3. After the boot program is completed, run the main program, and immediately determine the R/T pin level:

If it is high level, the sensor outputs the concentration through the UART interface,

If it is low level. The sensor outputs the concentration through the IIC interface.

## Cautions:

1．Please avoid the pressure of its optical chamber from any direction, during welding, installation, and use.
2．When placed in small space, the space should be well ventilated, especially for diffusion window.
3．The module should be away from heat, and avoid direct sunlight or other heat radiation.
4．The module should be calibrated termly, the suggested period is no longer than 6 months.
5．Do not use the sensor in the high dusty environment for long time.
6．To ensure the normal work, the power supply must be among 5.0V±0.1V DC rang, the power current must be not less than 150mA. Out of this range, it will result in the failure of the sensor. (The concentration output is low, or the sensor cannot work normally.)
7．During the zero-point calibration procedure by manual or sending command, the sensor must work in stable gas environment (400ppm) for over 20 minutes.
8．Forbid using wave soldering for the sensor.
9．When soldering with soldering iron, set the temperature to be (350±5)℃, and soldering time must be within 3 seconds.
10．We suggest customers to use the way of soldering the socket and plugging/pulling the sensors for easier maintenance.