Particles Sensor

（Model：ZPH01B）

Manual

Version： 1.0

Valid From： 2019.08.06

Zhengzhou Winsen Electronics Technology Co., Ltd

Statement

Thanks for purchasing our product. In order to let customers use it better and reduce the faults caused by misuse, please read the manual carefully and operate it correctly in accordance with the instructions. If users disobey the terms or remove, disassemble, change the components inside of the sensor, we shall not be responsible for the loss.

The specific such as color, appearance, sizes &etc, please in kind prevail.

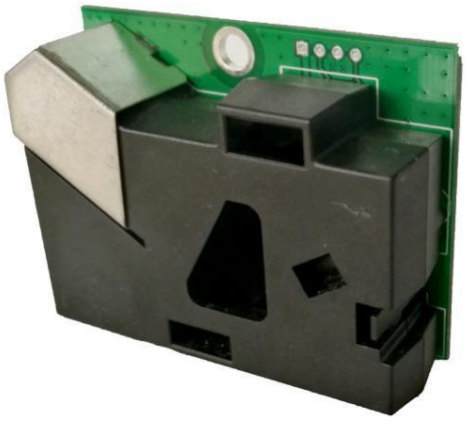
We are devoting ourselves to products development and technical innovation, so we reserve the right to improve the products without notice. Please confirm it is the valid version before using this manual. At the same time, users' comments on optimized using way are welcome.

Please keep the manual properly, in order to get help if you have questions during the usage in the future.

Zhengzhou Winsen Electronics Technology CO., LTD

Particles Sensor

Profile



This sensor adopts advanced PM2.5 detection technology to detect PM2.5. PM2.5 detection adopts particle counting principle to detect the particles (diameter ≥1μm).
Before delivery, the sensor has been aged, debuged, calibrated and has good consistency and high sensitivity.

Features

- Good long-term stability
- High sensitivity
- Rich interface output methods
- Good consistency
- Easy to install and maintain

Applications

- Air purifier
- Air refresher
- Portable meter
- Air ventilating device
- Air conditioner
- smoke alarm &etc.

Technical Parameters Stable.1

Model		ZPH01B
Working voltage range		5±0.2 V DC
Output		PWM /UART
Output Voltage		5±0.2 V DC
Detection ability for minimum particles		1 μm diameter
Warm-up time		≤1 min
Response time		≤5 s
Humidity range	Storage	≤95%RH
	Working	≤95%RH
Temperature range	Storage	-30℃～50℃
	Working	0℃～50℃
Size		59.5×44.5×20mm (LxWxH)
Physical interface		EH2.54-5P terminal socket

Basic dimensions

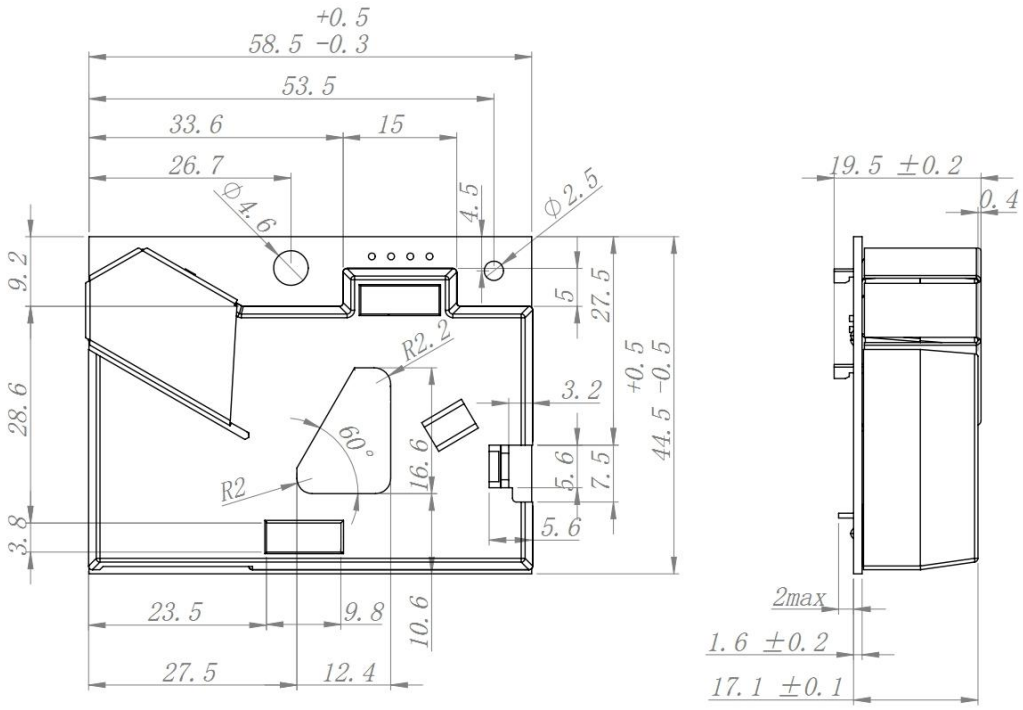


Fig1.Structure

Detection Principle

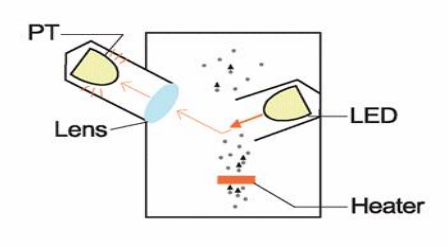


Fig 2. Principle schematic 1

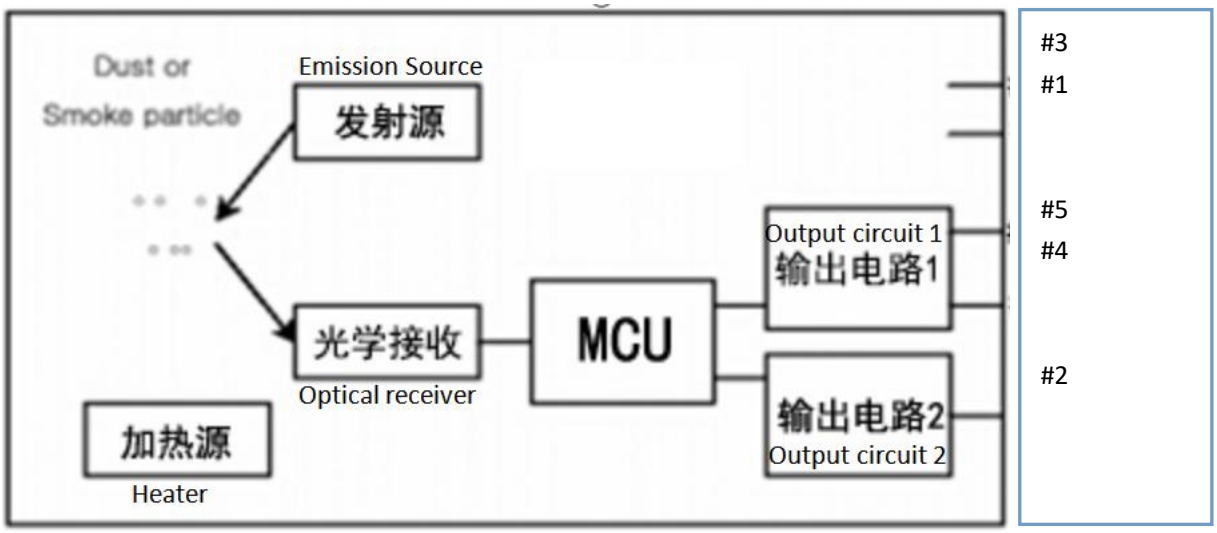


Fig 3.Principle schematic 2

Remarks

The ZPH01B dust sensor uses a power resistor to heat the air, and the rising of the hot air drives the ambient gas (PM2.5) into the detection light path to perform detection. The optical structure determines that the installation and placement of the sensor have certain specifications, otherwise it will cause abnormal detection data.

Pins Definition Stable2.

Pin	PWM model	**UART model**
PIN1	Control pin(refer the detailed instructions)	**GND**
PIN2	Output PM2.5	NC
PIN3	VCC	VCC
PIN4	NC	TXD
PIN5	GND	GND

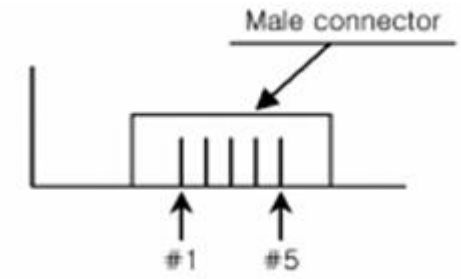


Fig4： Pins sketch

Remarks

The two modes of ZPH01B can only be set before the sensor is normally energized. Please make the hardware connection in advance. Pin1 can only be used as a signal input control pin in UART

mode, and does not assume the GND function of the module's power supply. Otherwise, a power failure will cause irreparable damage to the module.

PM2.5 output wave in PWM mode

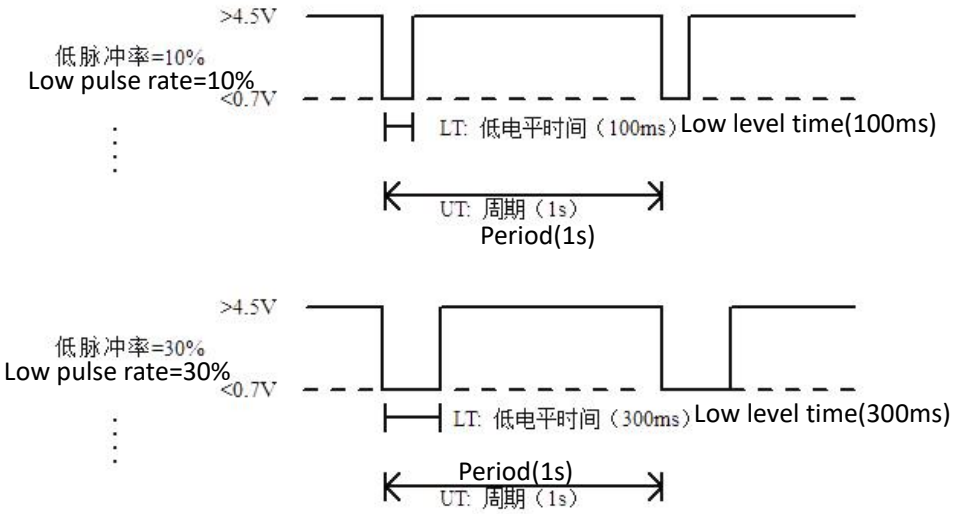


Fig5.PM2.5 output wave in PWM mode

NOTE： 1.LT is the pulse width of low level in one period.
2.UT is the pulse width of one period.
3.Low pulse rate RT: RT=LT/ UT x100%

The relationship between low pulse rate of output and particles number

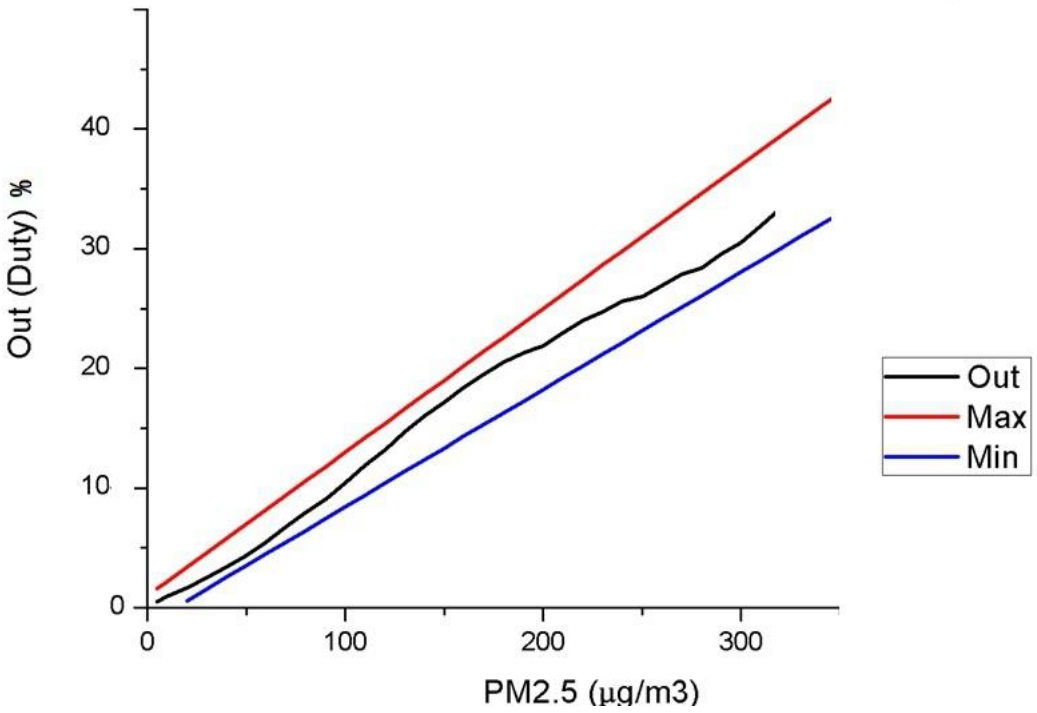


Fig6.The relationship of low pulse rate of output and particles number

NOTE： People usually use different levels (best,good,bad,worst) to describe the air quality condition.

Recommended plan:

Best： 0.00%-4.00%

Good： 4.00%-8.00%

Bad： 8.00%-12.00%

Worst： ＞12.00%

Communication protocol

1.General Settings

Stable 3.

Baud rate	9600
Interface level	5±0.2 V（TTL）
Data bit	8byte
Stope bit	1byte
Check byte	no

2.Communication command

Module sends the concentration value every other one second. Only send,no receive. Command as follow:

0	1	2	3	4	5	6	7	8
Start byte	Detection type name code	Unit (Low pulse rate)	Integer part of low pulse rate	Decimals part of low pulse rate	Reservation	Mode	Reservation	Check value
0XFF	0X18	0X00	0x00-0x63	0x00-0x63	0x00	0x01	0x00	0x00-0xFF

Stable 4.

Note:

1. Conversion of duty cycle: Example:

In a frame of normal data sent by the sensor, the third bit is 0X12 and the fourth bit is 0X13. It means: the duty cycle of the sensor output is 18.19%.

2. Conversion of PM2.5:

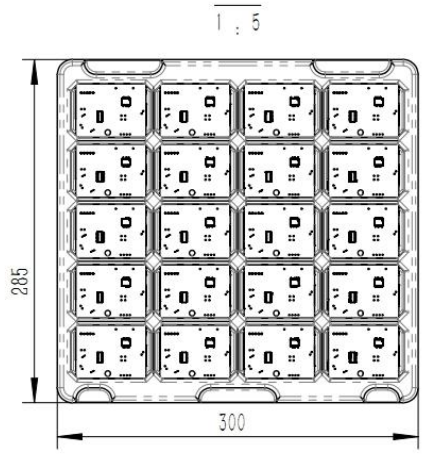
The detected environmental PM2.5 concentration can be obtained by converting the proportional coefficient k * 18.19%. Take 1000 according to the empirical coefficient k.

3.Check and calculation

```
/*****************************************************************************
 * Funtion name: ucharFucCheckSum(uchar *i,ucharln)
 * Funtion description:Sum check(Negate the sum of send and receive protocol 1/2/3/4/5/6/7 and +1 )
*****************************************************************************/
unsigned char FucCheckSum(unsigned char *i,unsigned char ln)
{
    unsigned char j,tempq=0;
    i+=1;
    for(j=0;j<(ln-2);j++)
    {
        tempq+=*i;
        i++;
    }
    tempq=(~tempq)+1;
    return(tempq);
 }
```

Packing

1. Put the dust sensor in the blister tray in the same direction.
2. According to the specifications of the packing box, place the blister tray with the sensor in the corresponding number of layers.
3. Put the packed sensor into the carton.
4. The carton is sealed and packed.
5. Orders with a single shipment quantity less than the smallest box are not limited to this specification.



每个吸塑托盘容纳4*5=20支模组

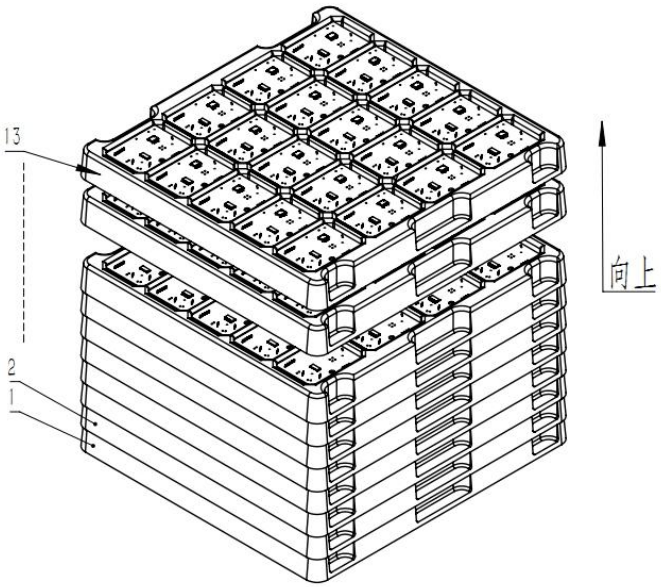


Figure 7 The blister tray contains the sensor

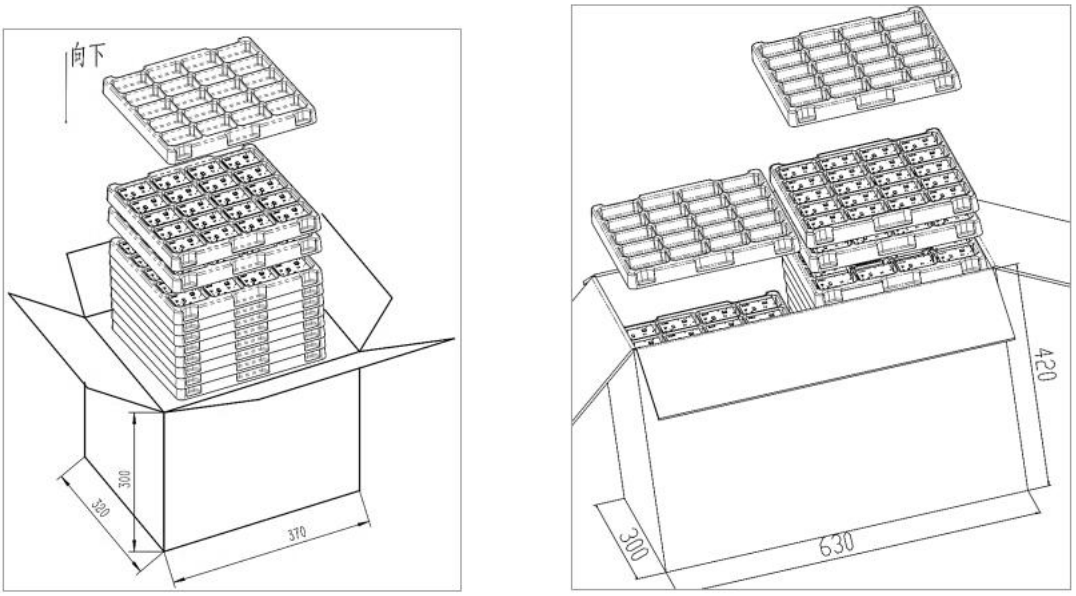


Figure 8 Different specifications of packaging boxes contain sensors

Carton size:

Packing box 1: 355×310×285mm, 20×13=260 sensors can be installed.

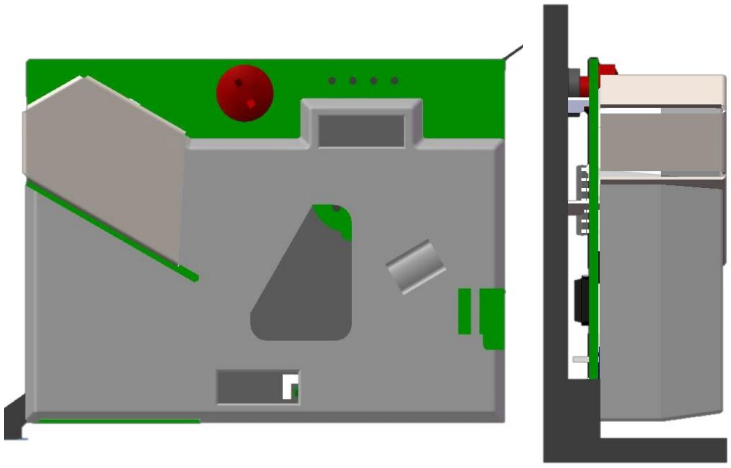
Packing box 2: 630×280×405mm, can fit 20×2×19=760 sensors

Matters needing attention when using the sensor

Terms of Use

1. Installation requirements: The sensor is installed vertically to ensure a smooth detection gas path and avoid contact with organic solvents.

1.1 Must be installed vertically. The sensor as a whole must be fixed and installed perpendicular to the horizontal plane. As shown in Figure 3, the power resistor heats the air, and the rising of the hot air drives the outside air into the optical path and removes it in time. The wrong installation method will make the sensor reading abnormal.



1.2 Ensure a smooth detection air path. The external air flow can enter the optical cavity of the sensor smoothly and be discharged in time. When applied to an air cleaner, the air flow of the fan cannot affect the stability of the air path detected by the sensor, and it can be installed on one side of the body.

1.3 Avoid light The dust sensor uses a specific wavelength light LED and a photoelectric sensor with visible light to detect dust particles. The external light radiation will affect the optical signal of the dust sensor. It is recommended to use a sponge to cover the center triangle hole of the dust sensor (as shown in Figure 1). Block the air inlet and outlet of the sensor.

2. Power supply requirements: The metal shield of the module is connected to the circuit GND. The GND pin should be prevented from being connected to the system with a voltage higher than the safety voltage of the human body. Do not apply to the system involving personal safety

3. Cleaning the lens: The lens needs to be cleaned regularly according to the usage environment, about once every 6 months. When cleaning, use one end of a cotton swab with clean water to gently wipe the surface of the lens, and then use the other end to wipe off water stains in time. Do not wipe the lens with organic solvents such as alcohol.

Avoid bad interference

Avoid contact with water vapor. Keep away from the bathroom or air humidifier. Water mist will cause abnormal fluctuations in PM2.5 data; splashing or immersing in water will cause the sensor's sensitivity to decrease.

Transport storage

1.Avoid vibration. Frequent and excessive vibration during transportation and assembly will cause misalignment of optoelectronic devices and affect the original calibration data.

2. Long-term storage Store in a sealed bag to avoid contact with corrosive gases to damage the circuit board and optical devices

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