



# Particles Sensor

(Model: ZPH01)

# Manual

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Zhengzhou Winsen Electronics Technology Co., Ltd

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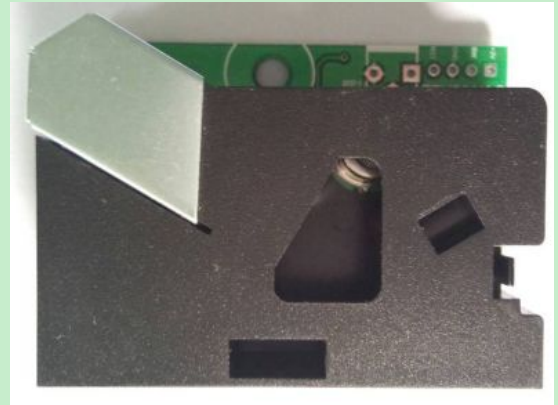
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## Particles Sensor

### 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  $\geq 1\mu\text{m}$ ).

Before delivery, the sensor has been aged, debugged, calibrated and has good consistency and high sensitivity. It has the PWM signal output, and it can be configured to be UART digital serial interface and customized IIC interface.



### Features

High sensitivity, good stability for long time, calibrated before delivery, built-in heater to sniff air automatically. It has the advantages such as small size, light weight, easy to install and use, simple maintenance &etc.

### Applications

Air refresher, air conditioner, ventilating device, monitor equipment for environment, smoke alarm &etc.

### Technical Parameters Stable.1

Model	ZPH01	
Working voltage range	$5 \pm 0.2$ V DC	
Output	PWM /UART	
Detection ability for PM2.5 particles	$\geq 1$ $\mu\text{m}$ diameter	
Warm-up time	$\leq 5$ min	
Detection Range for particles	15000 particles /283ml	
Working Current	$\leq 150$ mA	
Humidity range	Storage	$\leq 90\%$ RH
	Working	$\leq 90\%$ RH
Temperature range	Storage	$-20^{\circ}\text{C} \sim 50^{\circ}\text{C}$
	Working	$0^{\circ}\text{C} \sim 50^{\circ}\text{C}$
Size	$59.47 \times 44.5 \times 20$ mm	
Physical interface	EH2.54-5P	

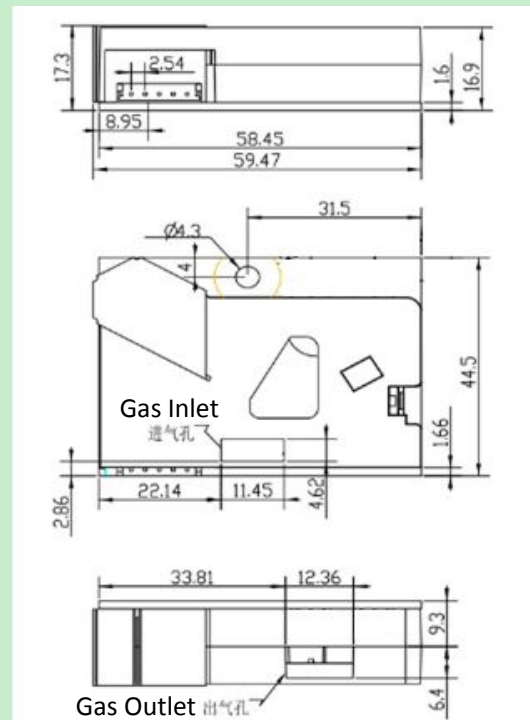
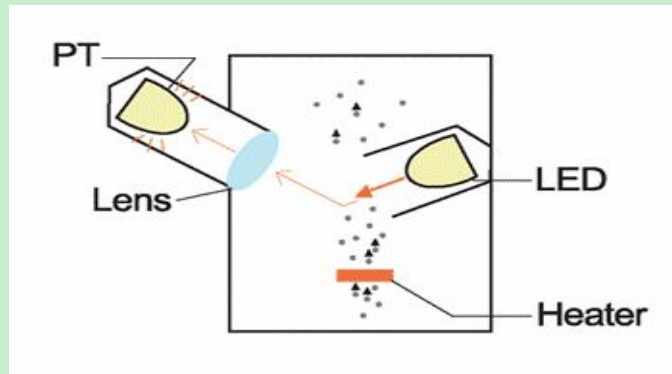
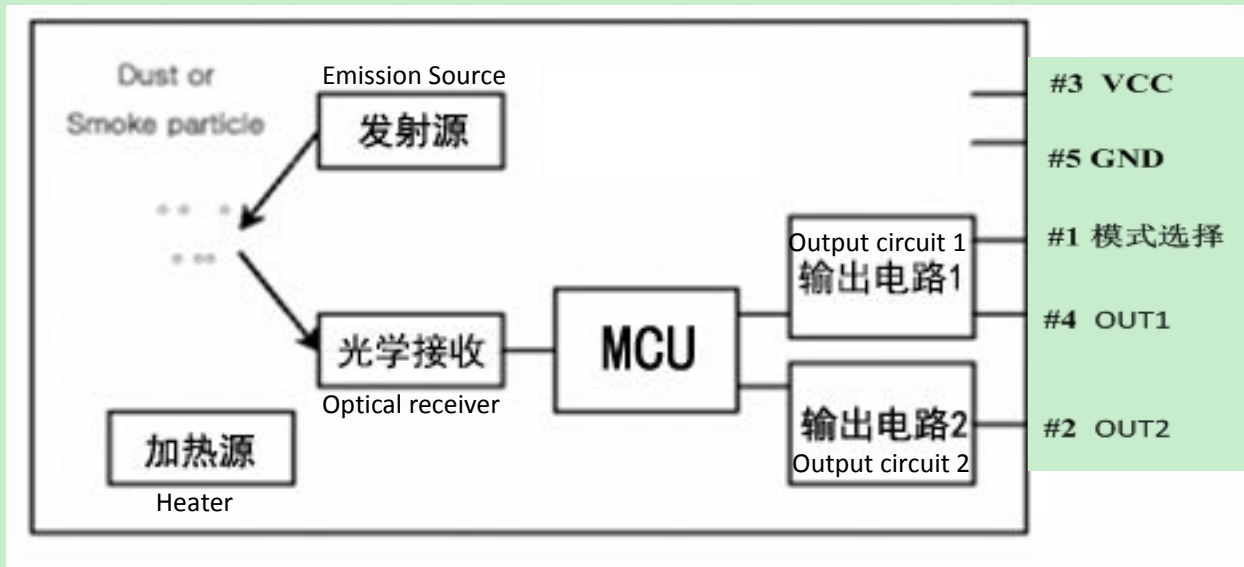


Fig1.Structure

**Detection Principle**



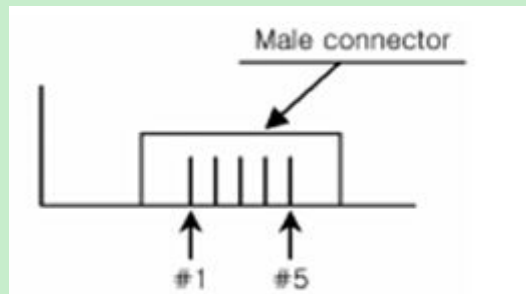
**Fig 2.Principle schematic 1**



**Fig 3.Principle schematic 2**

**Pins Definition Stable2.**

PIN1	Control pin(refer the detailed instructions)
PIN2	Output OUT2/RXD/PM2.5
PIN3	VCC
PIN4	Output OUT1/TXD
PIN5	GND



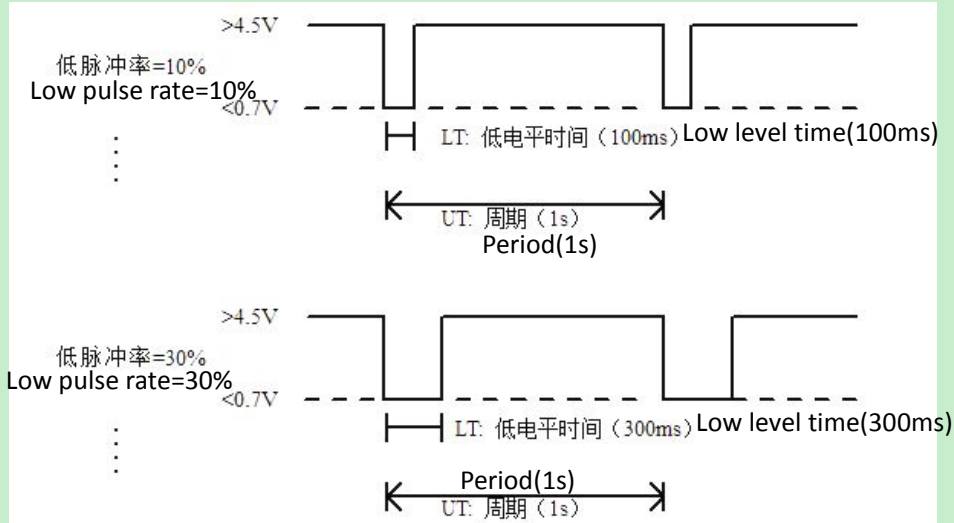
**Fig4: Pins sketch**

**Instructions**

- 1.Heater:the heater is built-in and the heating makes air rise,causing the air outside flow into sensor inside.
- 2.What kind of particles can be detected: diameter  $\geq 1\mu\text{m}$ , such as smoke, house dust, mold, pollen and spores.

- 3.Control pin: this pin is to control output mode.(Vacancy is PWM mode while GND is serial port mode .)
- 4.Output pins OUT2/ RXD: this pin is RXD in serial port mode while it is ordinary output in PWM mode, sensitivity is pre-setted and the min particles which can be detected is 1µm.
- 5.Output pins OUT1/TXD: this pin is TXD in serial port mode.

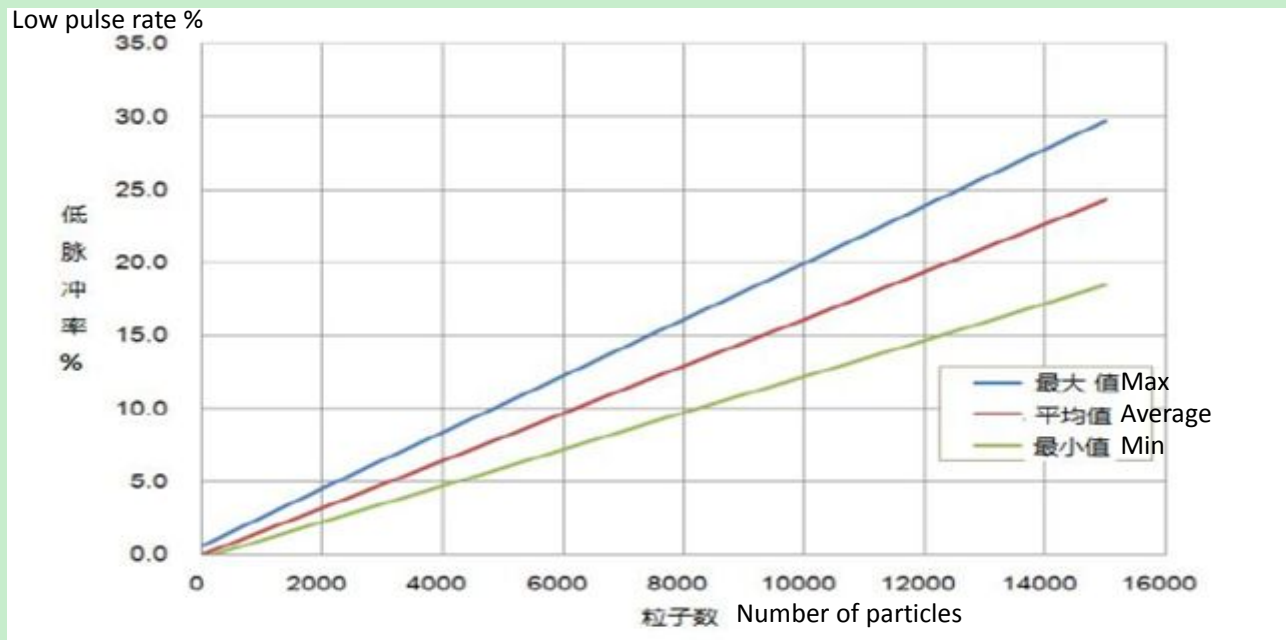
**PM2.5 output wave in PWM mode**



**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:  $RT = LT / UT \times 100\%$

**The relationship between low pulse rate of output and particles number**



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

### The relationship between low pulse rate of output and dust particles concentration

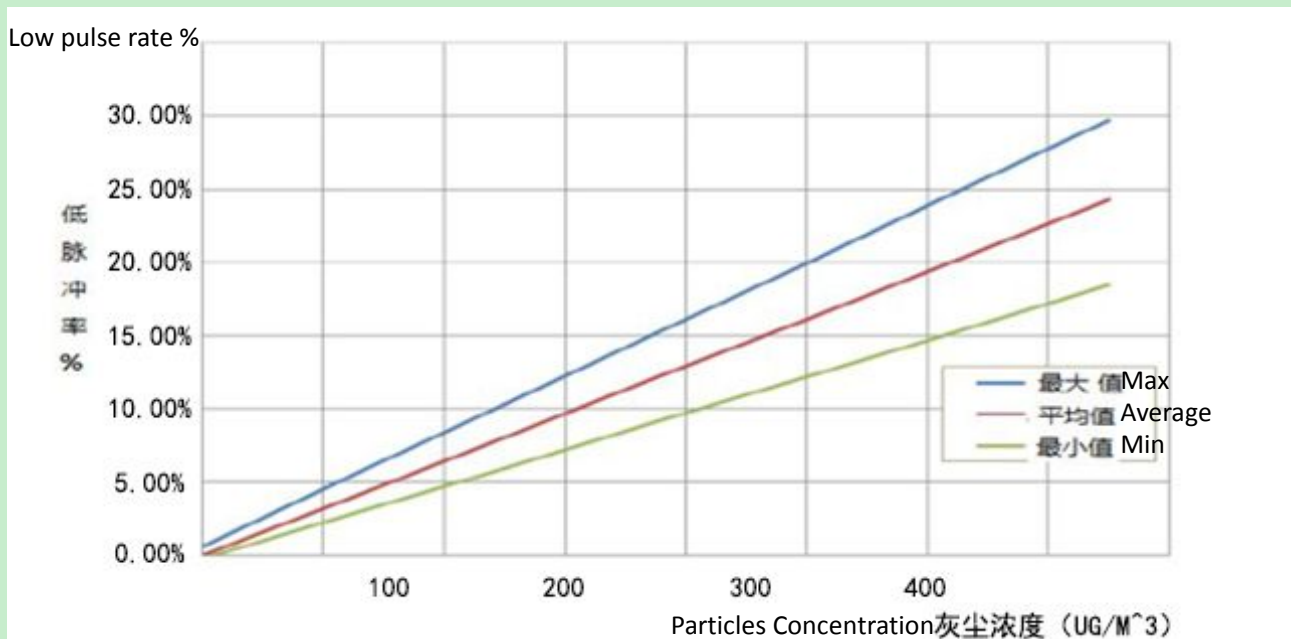


Fig7.The relationship of PM2.5 low pulse rate of output and dust particles concentration

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

#### Program 1.High sensitivity

Best: 0.00%-2.00%

Good: 2.00%-4.00%

bad: 4.00%-6.00%

Worst: >6.00%

#### Program 2.Good consistency

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
Data byte	8 byte
Stop byte	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:** 0x01 means that the PWM output mode with 1Hz.

### 3.Check and calculation

```

/*****
* Funtion name: ucharFucCheckSum(uchar *i,uchar ln)
* 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);
}
    
```

## Cautions

1. Installation must be vertically.
2. Organic solvents (including silica gel and other adhesive), paint, pharmaceutical, oil and high concentration of target gases should be avoided.
3. Artificial air steam such as fan should be far away. For example, when it is used in air refresher, it can't be installed in front or back of fan. Any side of fan shell can be installed on, but ventilation opening on the shell is necessary to guarantee gas from outside flow in.
4. Don't use it in the places where there is vapour such as bathroom, or near to air humidifier.
5. Dust sensor adopts optics working principle, so the light radiation will influence the sensor's accuracy. We suggest users use sponge to cover the triangle hole in the middle of the sensor, avoiding light outside irradiate the sensor. Note that don't cover the gas inlet and outlet.
6. Warmup time should last 5 min or longer for the first time usage and don't apply it in the system involving people safety.
7. Moisture will effect the normal functions of the module, so it should avoid.
8. Lens should be cleaned regularly according to the actual condition (about once per month). Use one end of cotton swab with clean water to scrub the lens, and use the other end to wipe dry. Don't use organic solvent such as alcohol as cleanser.

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