



Particles Sensor

(Model: ZPH02)

Manual

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Zhengzhou Winsen Electronics Technology Co., Ltd

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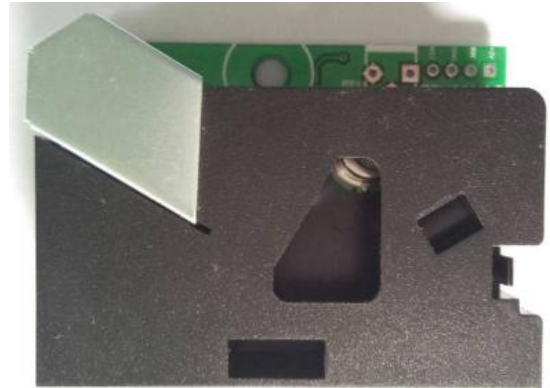
Zhengzhou Winsen Electronics Technology CO., LTD

ZPH02 Particles Sensor

Profile

This sensor integrates infrared PM2.5 detection technology, using particle counting principle to detect PM2.5 in the environment. It can 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

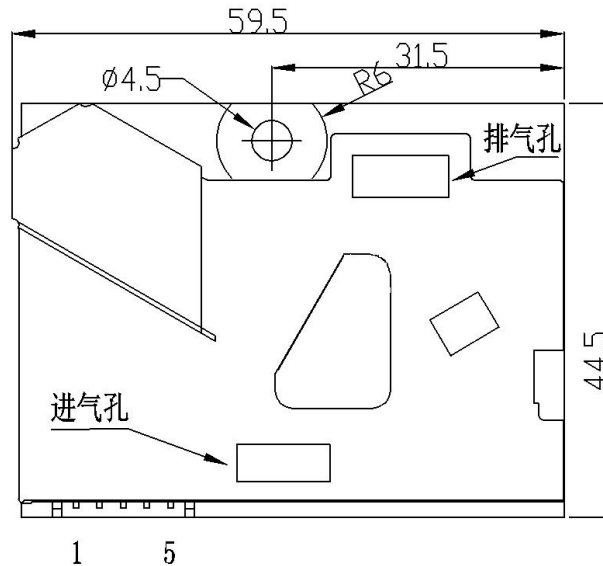
- *Good stability for long time
- *High sensitivity
- *Interface output is rich
- *Good consistency
- *easy to install and use

Applications

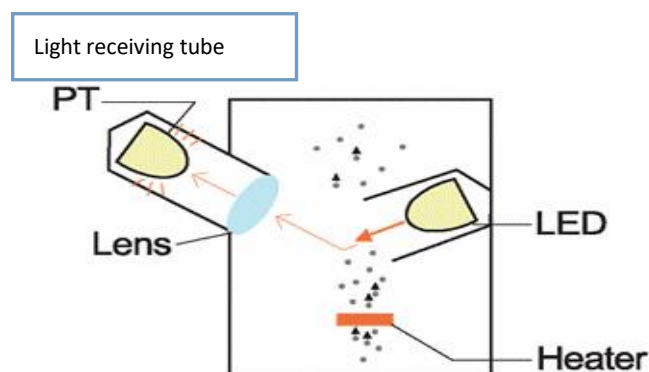
- *Air refresher
- *HVAC system
- *Air refresher
- *Air conditioner
- *Portable instrumentation
- *Smoke alarm system

Technical Parameters

Model		ZPH02
Working voltage range		5±0.2 V DC
Output		UART (9600,1Hz±1%)
		PWM (cycle: 1Hz±1%)
Output voltage		5±0.2 V (TTL)
Detection ability	smallest particles	1 μm diameter
Warm-up time		≤5min
Working current		≤90mA
Humidity range	Storage	≤90%RH
	Workin g	≤90%RH
Temperature range	Storage	-20℃～50℃
	Workin g	0℃～50℃
Size		59.5×44.5×17mm (L×W×H)
Physical interface		EH2.54-5P

Dimensions:**figure 1****Remarks:**

1. For details on the size of the structure, please refer to the Appendix (Figure 2)
2. Connector: 5Pin connector model HER-5; specific specifications please visit <http://www.jst.com/>

Detection Principle**Fig 3.Principle schematic 1**

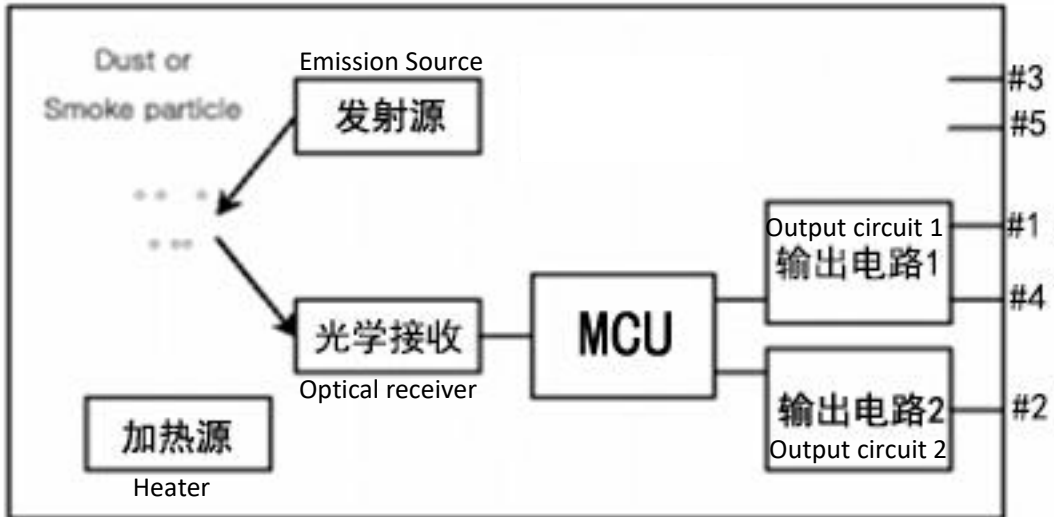


Fig 4.Principle schematic 2

Remarks:

ZPH02 dust sensor using power resistors to heat the air, hot air to promote the ambient gas (PM2.5) into the detection of light path, so as to detect.The optical structure determines the installation of the sensor has a certain specification requirements, otherwise it will lead to abnormal detection data

Pins Definition Table5.

PIN1	控制脚 (MOD) *
PIN2	输出脚 OUT2/RXD
PIN3	电源正 (VCC)
PIN4	输出脚 OUT1/TXD
PIN5	电源地 (GND)

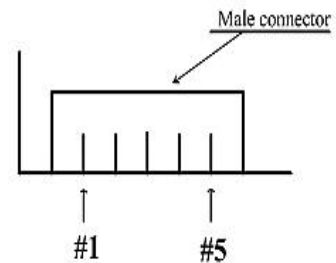


Fig5: Pins sketch

Instructions

- 1.PIN1 Control pin: this pin is to control output mode.(Vacancy is PWM mode while GND is serial port mode .)
- 2.PIN2 Output pins OUT2/ RXD:this pin is RXD in serial port mode,PWM mode 1Hz PWM signal, output PM2.5 concentration
- 3.PIN4 Output pins OUT1/TXD:this pin is RXD in serial port mode,PWM mode pull-up high level no signal, no output
- 4.Heater:the heater is built-in and the heating makes air rise,causing the air outside flow into sensor inside
- 5.Detection of particle type:This sensor is designed to detect particles above 1μm, such as cigarettes, house dust, mold, pollen, spores

PM2.5 output wave in PWM mode

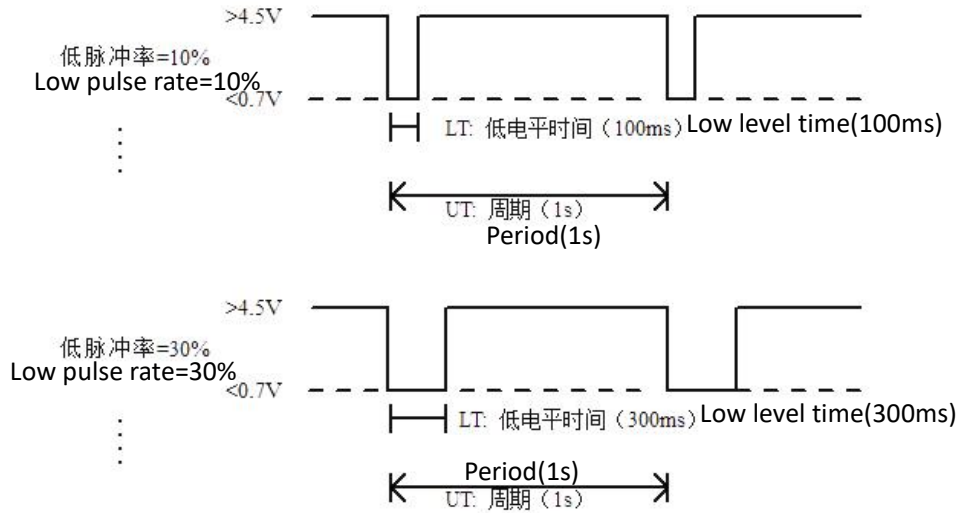


Fig6.PM2.5 output wave in PWM mode

- NOTE: 1.LT is the pulse width of low level in one period.(5-500Ms)
 2.UT is the pulse width of one period(1s)
 3.Low pulse rate RT: $RT=LT/UT \times 100\%$ range(0.5%-50%)

The relationship between low pulse rate of output and particle concentration

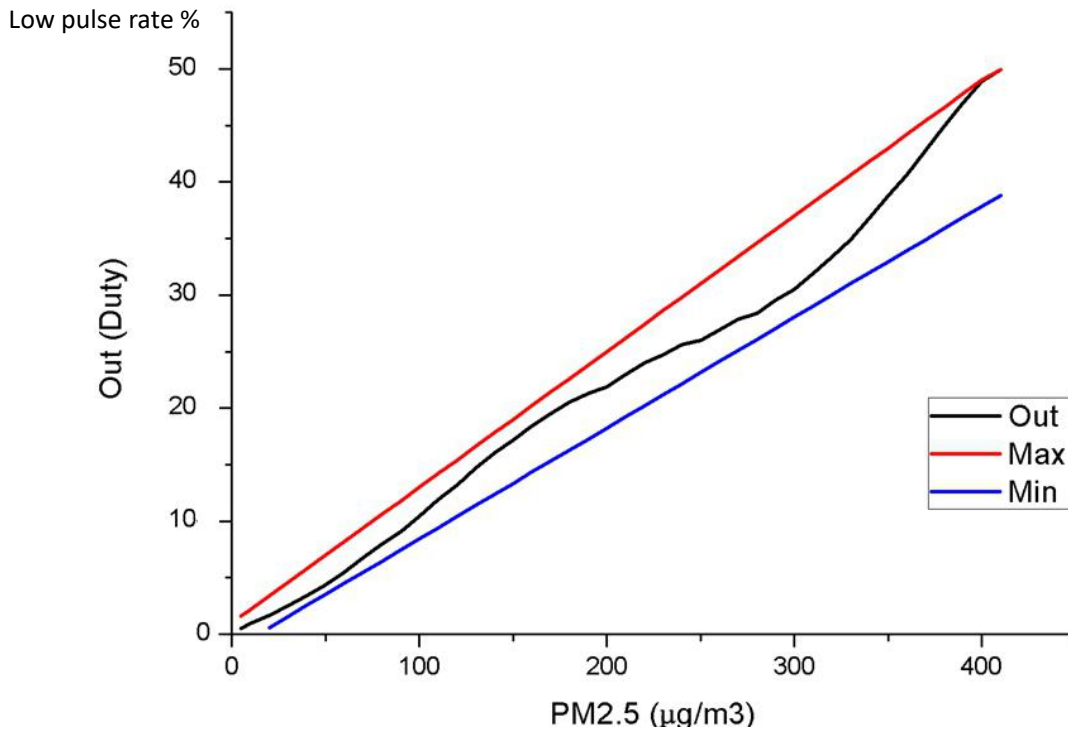


Fig8.The relationship of PM2.5 low pulse rate of output and particle concentration

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

Recommended solution:

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 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	0x00	0x00	0x00-0xFF

Stable 4.

Remarks:

Calculation of PM2.5:

Example:The sensor sends out a frame of normal data, bit 3 0X12, bit 4 0X13.Then the sensor output duty cycle is 18.19%.Serial mode low pulse rate output range of 0.5% -50%.

3.Check and calculation

```

/*****
* Funtion name: ucharFucCheckSum(uchar *i,ucharIn)
* 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 In)
{

```

```
    unsigned char j,tempq=0;
    i+=1;
    for(j=0;j<(ln-2);j++)
    {
        tempq+=*i;
        i++;
    }
    tempq=(~tempq)+1;
    return(tempq);
}
```

Cautions

一. Terms of Use

1. Installation requirements: The sensor must be installed vertically to ensure that the gas path is smooth and avoid contact with organic solvents.
 - 1.1. Installation must be vertically. As shown in Figure 3, the power resistance of the air heating, hot air to promote the external gas into the optical path and promptly removed, the wrong way to install the sensor will read abnormal
 - 1.2. To ensure smooth detection of gas flow outside the air flow can smoothly into the sensor optical cavity and timely discharge. When applied to the air refresher, the fan inlet and outlet air flow can not affect the stability of the sensor detection gas path, can be installed on the side of the body
 - 1.3. To avoid light dust sensor using a specific wavelength light LED and visible light cut off the photoelectric sensor to detect dust particles, external light radiation will affect the dust sensor optical signal, it is recommended to use the sponge cover dust sensor center triangle hole (shown in Figure 1), do not block Sensor inlet and outlet.
2. Power supply requirements: Module metal shield and circuit GND connection, should prevent the GND pin access to higher than the human body safe voltage system, should not be applied to the system involving personal safety.
3. Clean the lens: the lens needs to be cleaned according to the use of the environment, about 6 months time. When cleaning, use a cotton swab to rinse the surface of the lens, and then wipe the water with another head in time. Do not wipe the lens with organic solvents such as alcohol.

二. To avoid bad interference

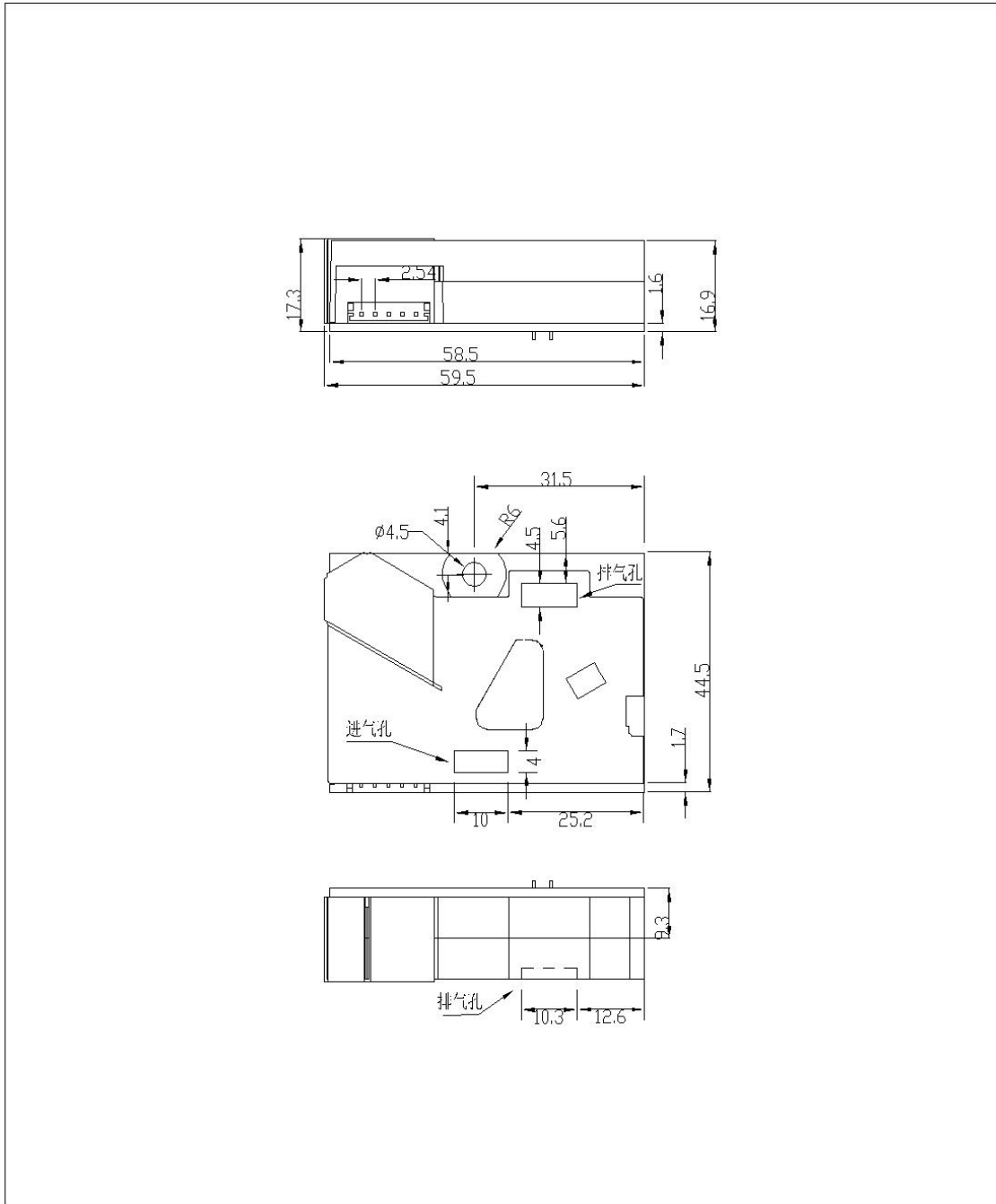
To avoid exposure to water vapor away from the bathroom or air humidifier, the water mist will PM2.5 data abnormal fluctuations; splashing water or immersed in water will cause the sensor sensitive characteristics

三. Transport & storage

1. Avoid vibration: Frequent transport and assembly process, excessive vibration will lead to optical device dislocation affect the original calibration data
2. Long-term storage: Sealed bags sealed to avoid contact with corrosive gas damage to circuit

boards and optics.

Appendix:Structural dimensions



SIZE	COMMON TOLERANCE			UNITS	NAME<INTENDED USE>				
A4	A	B	C	MM	ZPH02	ZHENGZHOU WINSEN ELECTRONICS TECHNOLOGY CO.,LTD			
UP-10	±0.05	±0.1	±0.2	MAT'L	PART NO.<INTENDED USE>	TITLE: ZPH02外形尺寸			
10-100	±0.07	±0.15	±0.3			DWG NO.:			
ABOVE 100	±0.1	±0.2	±0.3			APPD:			
ANGULAR	±0.3	±0.5	±0.8	FINISH	CHKD:	REV.			
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							1	1/1	

Amend record**一. Signal output**

Compared to ZPH01 difference

1. PM2.5 output mode:

In UART mode, the low pulse duty cycle of the serial data is changed from 0.5% to 50%, corresponding to the change of dust concentration.

In PWM mode, the low pulse duty cycle ranges from 0.5% to 50%, corresponding to changes in dust concentration.

二. Structure size

See the appendix for details

三. Change customization

The specific parameters for the custom module series will differ from the above description

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