Particles Sensor

（Model：ZPH04）

Manual

Version： 1.1

Valid From： 2023. 03. 04

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

ZPH04 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 ≥1μm).
Before delivery, the sensor has been aged, debugged, calibrated, and has good consistency and high sensitivity.

Features

*Good Stability for long time *Good Consistency *Modular design & Anti-interference
*High Sensitivity *Easy to install and use *Interface output is multiple

Applications

*Air Purifier *Air Refresher *Civil and Commercial AC
*HVAC System *AC System *Smoke Alarm System

Technical Parameters

Model		ZPH04
Working voltage range		5±0.2 V (DC)
Ripple requirements		⩽50mv
Output Mode		UART / PWM
Output signal voltage		4.3±0.2 V
Detection ability		Smallest particles 1 μm diameter
Detection range		0-500μg/m³
Consistency		±25% or ±25μg/m³
Warm-up time		1min (Device warming-up time)
Working current		≤150mA
Humidity Range	Storage	≤95%RH（ Non-condensing）
	Working	≤95%RH（ Non-condensing）
Temperature Range	Storage	-30℃～60℃
	Working	0℃～50℃
Size		59.5×44.5×20mm（L×W×H）
Physical interface		EH2.54-5P(Terminal socket)
Weight		25.2g

Dimensions:

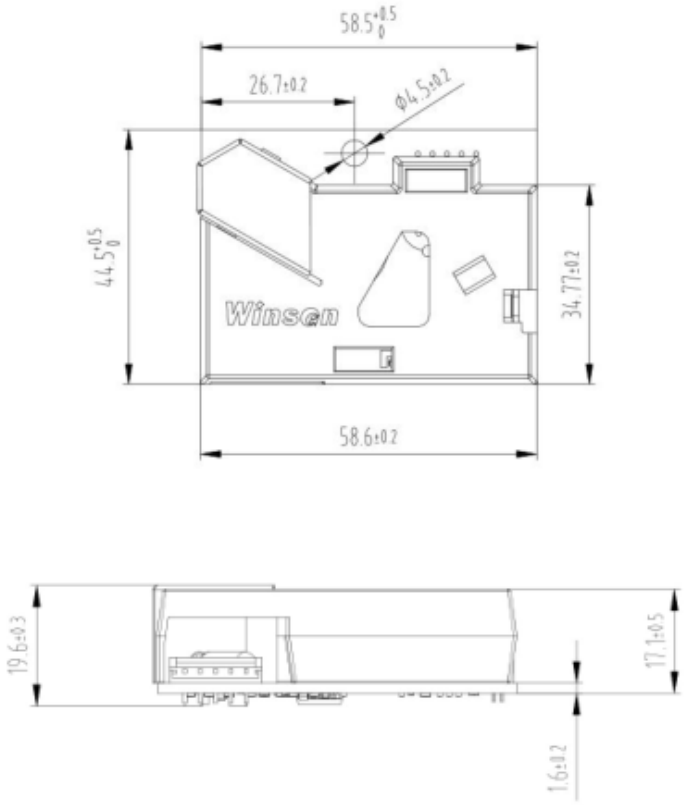


Fig 1

Detection Principle

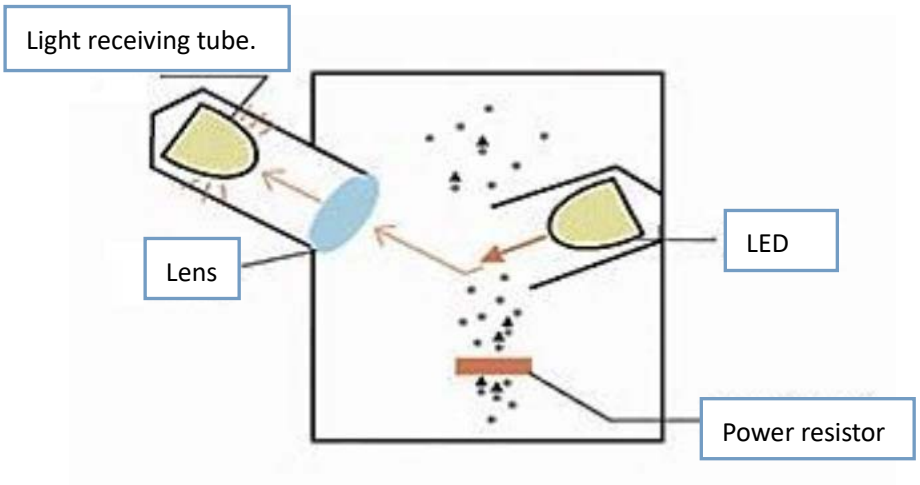


Fig 2. Principle schematic 1

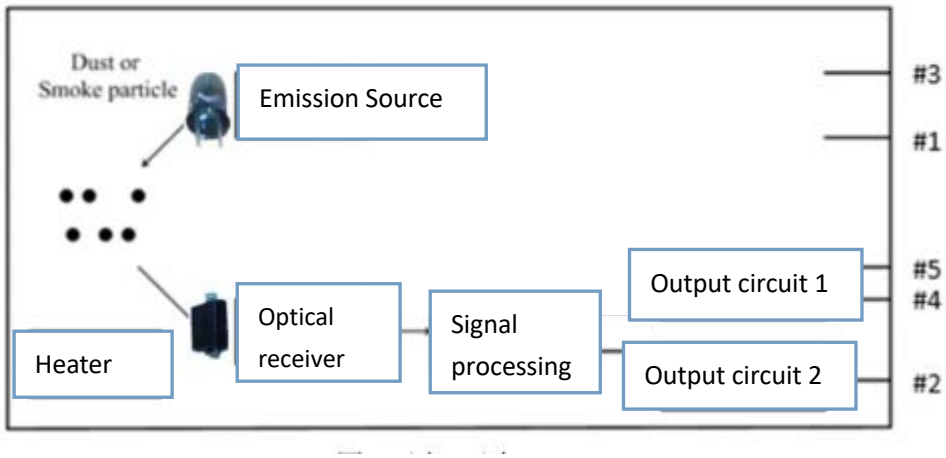


Fig 3. Principle schematic 2

Remarks:

ZPH04 dust sensor uses power resistors to heat the air, the hot air promotes the ambient gas (PM2.5) into the detection of light path, to detect. The optical structure determines the installation of the sensor has certain specification requirements, otherwise it will lead to abnormal detection data.

Pins Definition

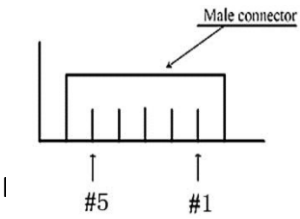


Fig 4. Pins

PIN No.	PMW mode	UART mode
PIN1	GND	GND
PIN2	NC	TXD
PIN3	VCC	VCC
PIN4	PWM	NC
PIN5	NC	Connects to GND

Remarks

The ZPH04's two mode settings can only be performed before the sensor is normally powered on. Please make a hardware connection in advance. Pin5 is the mode control pin, and it does not assume the module power supply GND function, otherwise the power supply failure will cause the module to be irreparably damaged.

PM2.5 output wave in PWM mode

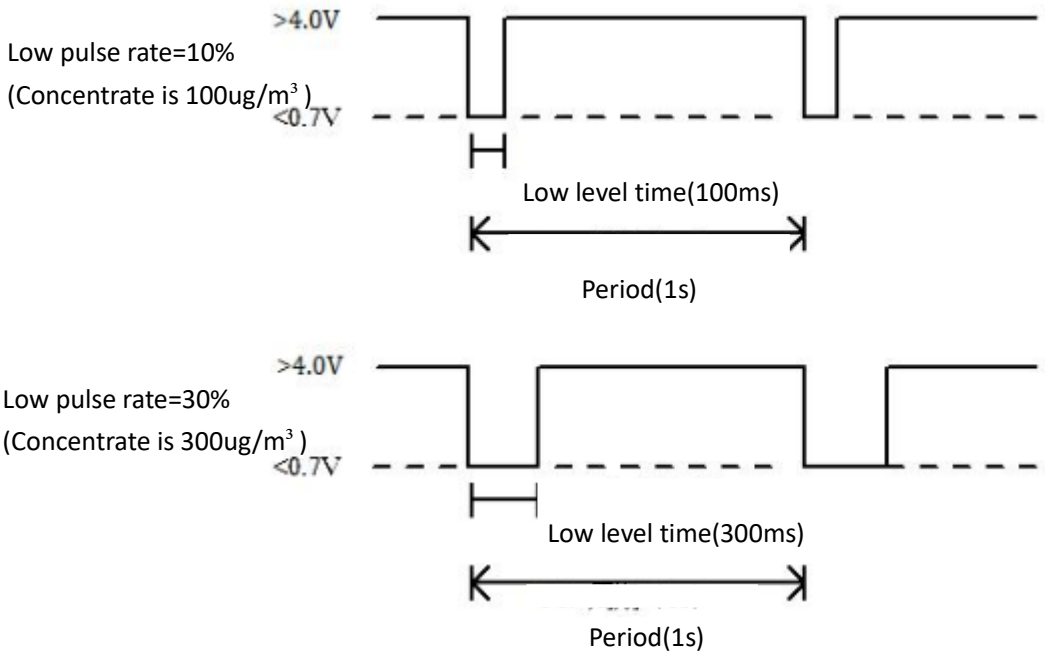


Fig5.PM2.5 output wave

Remarks：1.LT is the pulse width of low level in one period (Unit: ms)
2.UT is the pulse width of one period (Unit: ms)
3.Low pulse rate RT: RT=LT/ UT x100%
4. Low pulse rate corresponds to concentration

The cross-reference of low pulse rate of output and particle concentration

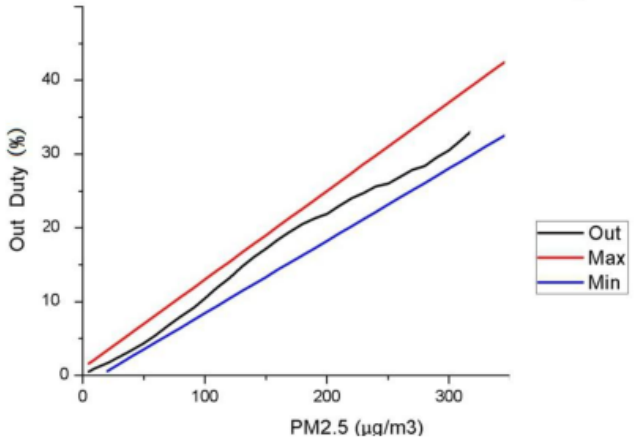


Fig6.The cross-reference of PM2.5 low pulse rate and particle concentration

Remark: Usually dust particle concentration (μg/m³) =K*low pulse rate (%),
In the field of air quality testing, "excellent, good, medium, and bad" are often used to distinguish the current air quality status.
Recommended solution: excellent:0.1%-4.00%

Good:4.00%-8.00%

Medium: 8.00%-12.00%

Bad: ＞12.00%

*This suggestion is just a reference, please set according to users' real demand.

Communication protocol

1. General Settings

Baud rate	9600
Interface level	4.3±0.2 V（TTL）
Data byte	8 bit
Stop byte	1 bit
Parity	none

2.Communication command

Module sends the concentration value every 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	Decimal's part of low pulse rate	Reservation	Reservation	Reservation	Check value
0xFF	0x18	0x00	0x00-0x63	0x00-0x63	0x00	0x00	0x00	0x00-0xFF

Remarks:

1. Conversion of duty ratio:
   Eg: sensor sends one frame data; the third byte is 0x12 and the forth byte is 0x13. It means the duty ration of sensor's output is 18.19%.

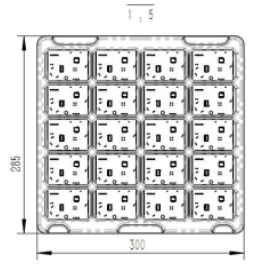
2. Conversion of PM2.5
   K*18.19%=PM2.5 concentration. K is a proportionality coefficient, as experience,
   if K=1000,then 1000 * 18.19% = 181.9ug/m³

3.Check and calculation

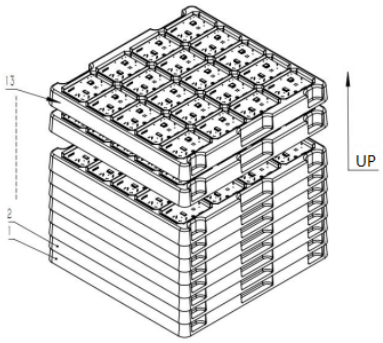
```
/************************************************************************
 * Funtion name: ucharFucCheckSum(uchar *i,ucharln)
 * Funtion description: Sum check (Negate the sum of send and receive protocol 1/2/3/4/5/6/7 and +1 )
Function description: add the element 1-the penultimate element of the array and then invert +1 (the number of elements must be greater than 2)
************************************************************************/
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);
}
```

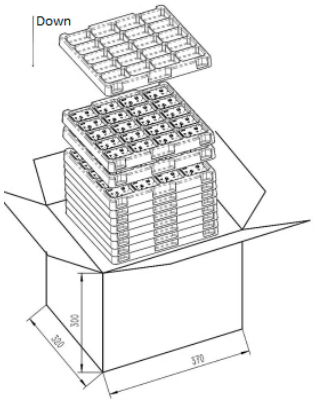
Packing Process

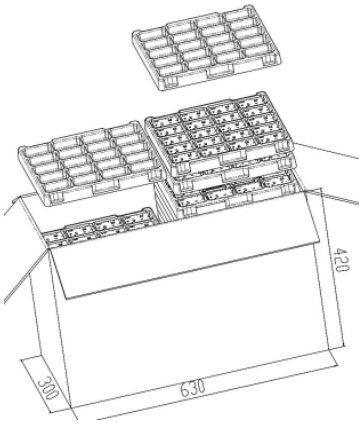
1. Put the sensors into the plastic tray in the same direction.
2. According to the size of the box, put in the plastic tray with the sensor installed.
3. Put the packed sensors into the carton.
4. Sealing and packing.
5. If the quantity is less than the minimum packing box in single shipment, it’s not limited to this standard.



Each tray contains 4*5=20 pcs sensors







Carton Size:
*355x310x285cm
20*31= 260 pcs/carton

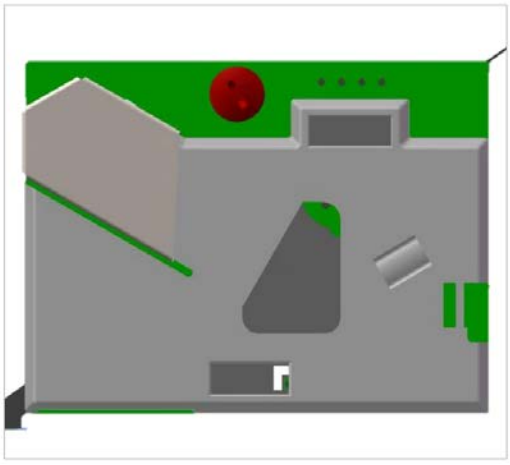
*630x280x405mm
20*2*19= 760 pcs/carton

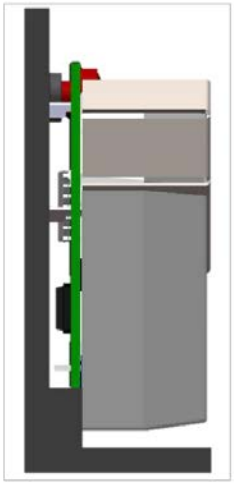
Cautions

1.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 cannot 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 uses 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, once about 6 months. 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.

2.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.

3.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.