Qir-quality and Particles Sensor

（Model：ZPH02）

Manual

Version：1.0

Valid From：2016.09.18

Zhengzhou Winsen Electronics Technology Co., Ltd

Statement

This manual copyright belongs to Zhengzhou Winsen Electronics Technology Co., LTD. Without the

written permission, any part of this manual shall not be copied, translated, stored in database or

retrieval system, also can't spread through electronic, copying, record ways.

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

ZPH02 Air-quality and Particles Sensor

Profile

This module integrates mature VOC detection technology and advanced PM2.5 detection technology to detect VOC and PM2.5 at the same time. The VOC sensor in this module has high sensitivity to formaldehyde, benzene, carbon monoxide, ammonia, hydrogen, alcohol, cigarette smoke, essence and other organic vapors.PM2.5 detection adopts particle counting principle to detect the particles (diameter ≥1μm).

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

*2 in 1	*High Sensitivity	*Good Consistency
*Good Stability for long time	*Interface output is multiple	*Easy to install and use

Applications

*Air Purifier	*Air Refresher	*Portable meter
*HVAC System	*AC System	*Smoke Alarm System

Technical Parameters   Table.1

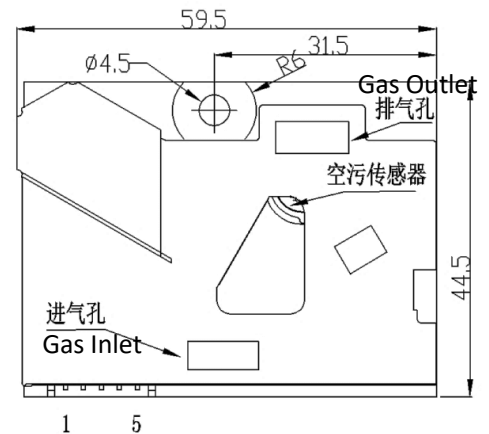| Model		ZPH02
Working voltage range		5±0.2 V DC
Output		UART(9600, 1Hz±1%)
		PWM(period: 1Hz±1%)
Detection Ability	VOC	Formaldehyde(CH2O), benzene(C6H6), carbon monoxide(CO), hydrogen(H2), ammonia(NH3),alcohol(C2H5OH), cigarette smoke, essence &etc.
	Detection ability for particle	1 μm
Warm-up time		≤5min
Working Current		≤150mA
Humidity range	Storage	≤90%RH
	Working	≤90%RH
Temperature range	Storage	-20℃～50℃
	Working	0℃～50℃
Size		59.5×44.5×17mm（LxWxH）
Physical interface		EH2.54-5P terminal socket

Fig1.Structure

Detection Principle
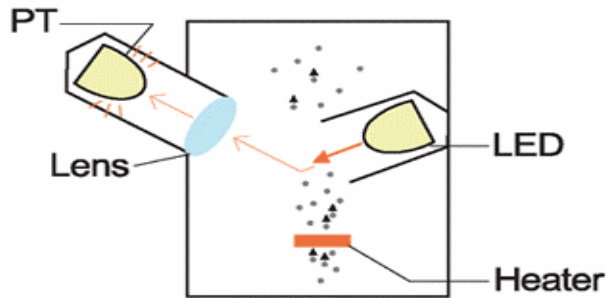
Fig 2.Principle schematic 1
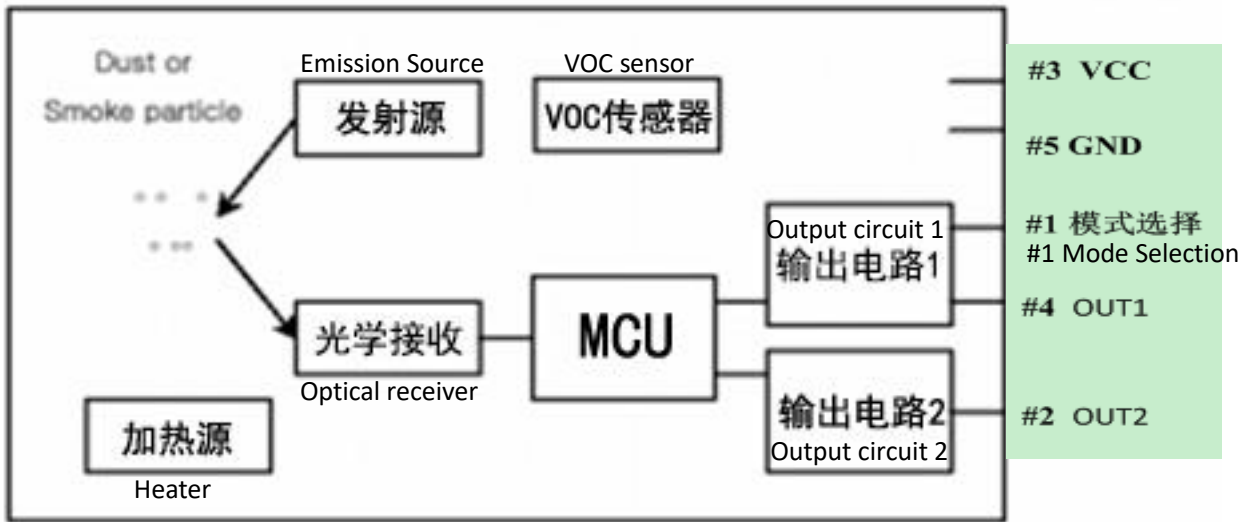
Fig 3.Principle schematic 2

Pins Definition   Table2.

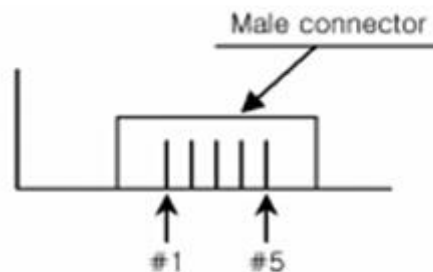| PIN1	Control pin(MOD)
PIN2	Output OUT2/RXD
PIN3	Power positive (VCC)
PIN4	Output OUT1/TXD
PIN5	GND

Fig4：Pins sketch

Instructions

1.PIN1: it is control pin.

The sensor is in PWM mode if this pin is hanging in air

The sensor is in UART mode if this pin is connecting to GND.

2.PIN2: In UART mode, it is RDX; In PWM mode, it is PWM signal with 1Hz. The output is PM2.5 concentration.

3.PIN4: In UART mode, it is TDX; In PWM mode, it is PWM signal with 1Hz. The output is VOC level.

4.Heater: the heater is built-in and the heating makes air rise, causing the air outside flow into sensor inside.

5.What kind of particles can be detected: diamete ≥1μm, such as smoke, house dust, mold, pollen and spores.

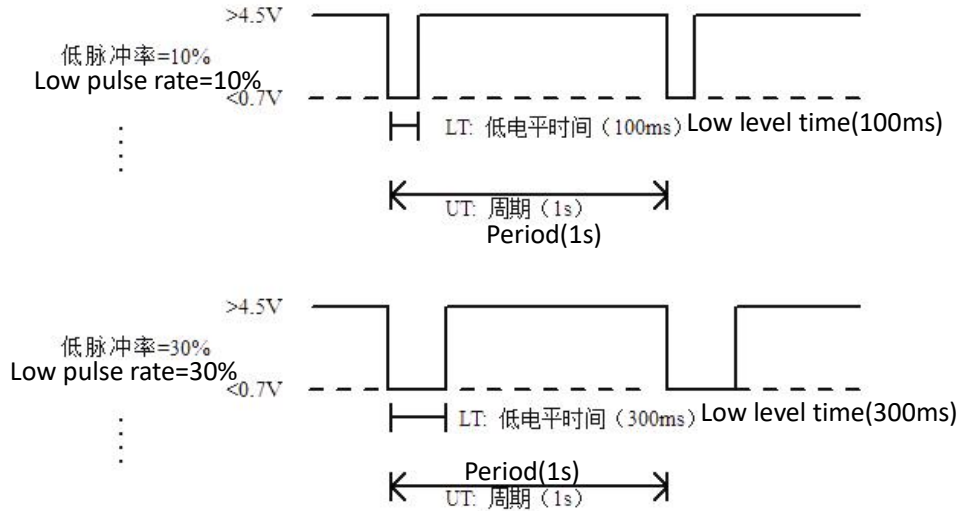## PM2.5 output wave in PWM mode

Fig5.PM2.5 output wave in PWM mode

NOTE：1.LT is the pulse width of low level in one period(5-500Ms)

2.UT is the pulse width of one period(1s).

3.Low pulse rate RT: RT=LT/ UT x100% range (0.5%~50%)

VOC output wave in PWM mode

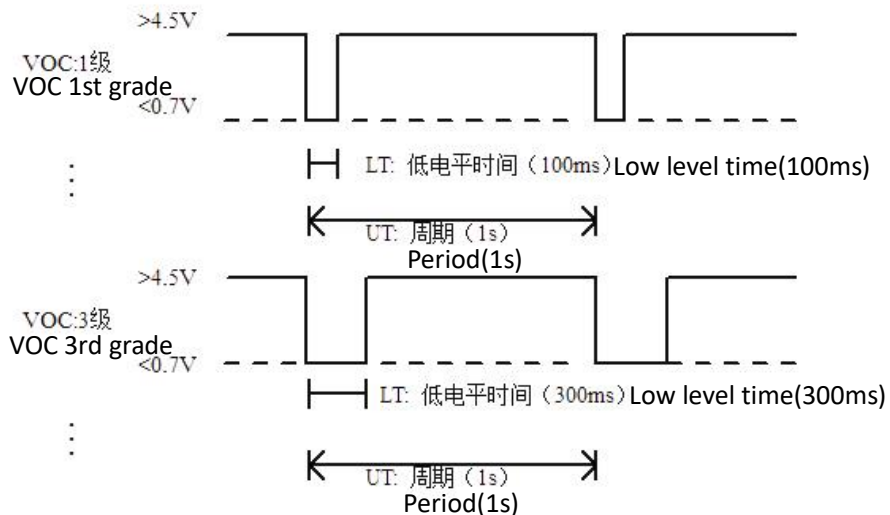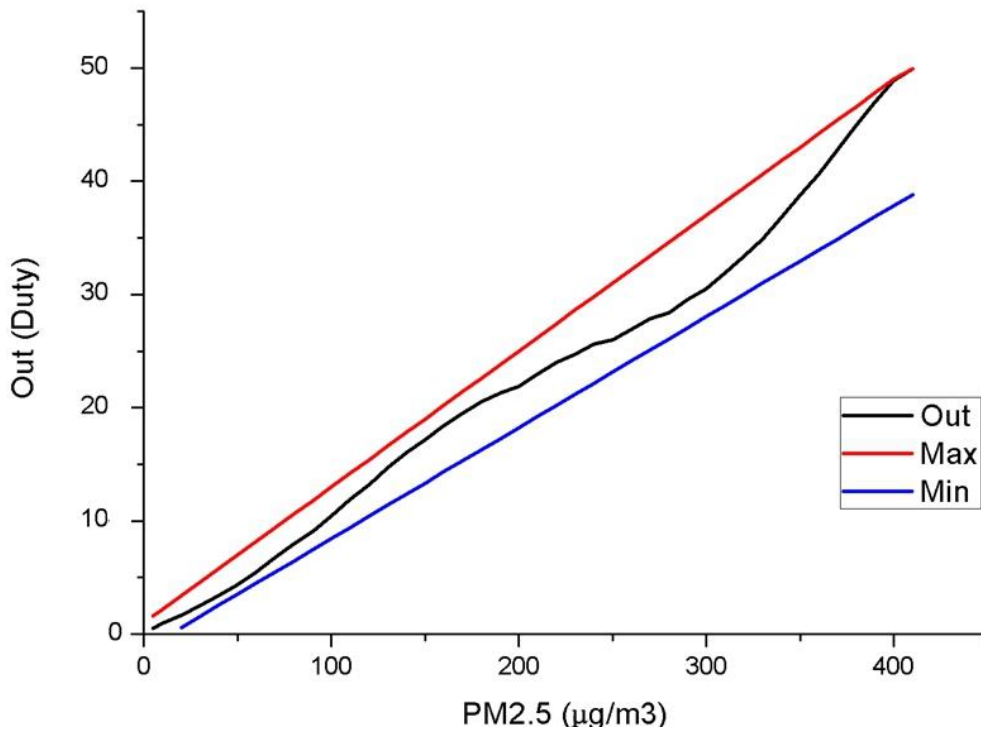**Fig6.VOC output wave in PWM mode**

NOTE：1.LT is the pulse width of low level in one period(n*100Ms)

2.UT is the pulse width of one period(1s).

3.Low pulse rate RT: RT=LT/ UT x100% , four grades, 10% progressive increase (10%~40%) . RT is higher, the pollution is more series.

The relationship between low pulse rate of output and particles concentration

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

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

Recommend the standard as follow:

Best：0.00%-4.00%

Good：4.00%-8.00%

bad：8.00%-12.00%

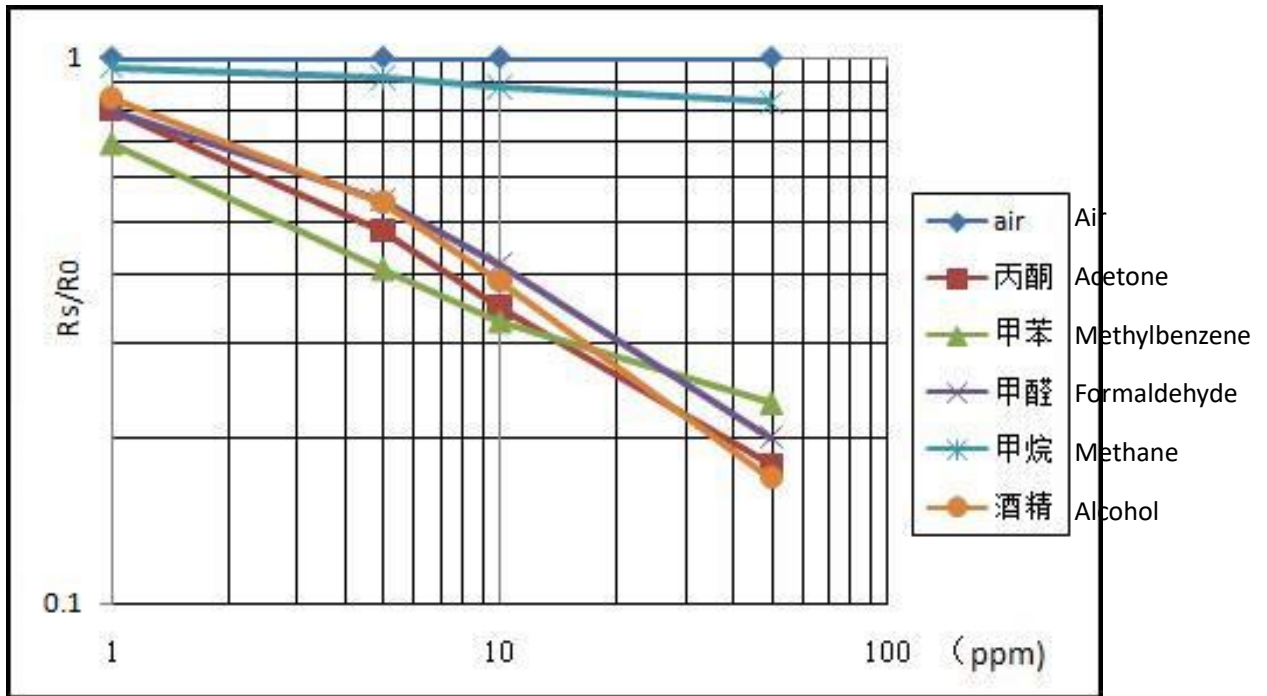Worst：＞12.00%

Sensitivity curve of VOC sensor

Fig8.Sensitivity curve in different gases

NOTE:

The air quality classified into 4 grades: best, good, bad, worst.

The module is calibrated and the output of 0x00-0x03 means from best air-quality level to worst air-quality level.

VOC includes a lot of gases and the grades is a reference for customer to judge the air quality.

Communication protocol

1.General Settings   Table 3.

Baud rate	9600
Data bits	8
Stop bit	1
Parity	none
Interface level	5±0.2V (TTL)

2.Commnucation command

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

Table 4.

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	VOC grade	Check value
0XFF	0X18	0X00	0x00-0x63	0x00-0x63	0x00	0x01	0x01-0x04	0x00-0xFF

PM2.5 calculation:

Byte3 0x12, byte4 0x13, so RT=18.19%
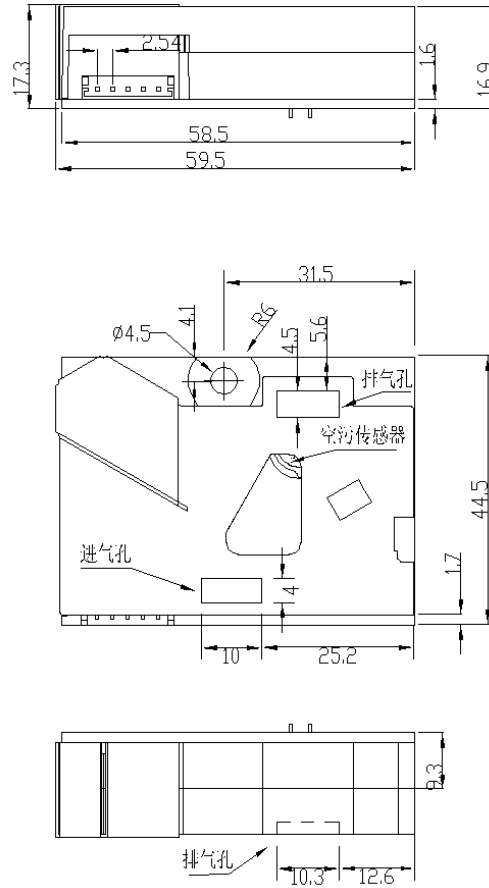
The RT range in UART mode is 0.5%~50%.

VOC calculation:

Byte7 is VOC output. 0x01: best, …,0x04: worst. 0x00 means no sensor installed or malfunction.

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);
}
```

Cautions

1.Installation must be vertically.

2.Organic solvents(including sillica 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 farm 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 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 lasts 5 min or longer for the first time usage and don't apply it in the system involving people safety.

7.Moist 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 six months).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.

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

NAME(INTENDED USE): ZPH02

TITLE: ZPH02外形尺寸

APPD:

CHKD:

DR: name/04-Aug-2014

DWG NO.:

	SCALE	SHEET	REV.
	1	1/1	

THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY OF ZHENGZHOU WINSEN ELECTRONICS TECHNOLOGY CO.,LTD AND SHALL NOT BE REPRODUCED COPIED OR USED IN ANY MANNER WITHOUT THE PRIOR WRITTEN CONSENT OF ZHENGZHOU WINSEN ELECTRONICS TECHNOLOGY CO.,LTD.

Q'TY