



# **PID sensor module (Model ZI01)**

## **Manual**

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**Zhengzhou Winsen Electronics Technology CO., LTD.**

## ZI01 PID sensor module

### Product Introduction

ZI01 is a high-performance PID sensor module, which adopts PID sensor and high-performance microprocessor. The target gas is bombarded with ultraviolet light generated by an ion lamp. Then gas is illuminated by the ultraviolet light produced by ion lamp, which will be ionized after absorbing enough ultraviolet light energy. Concentration of the target gas can be detected by measuring the tiny current generated by gas ionization.

The module can accurately measure the concentration of a variety of volatile organic compounds (VOCs) in the environment. It has digital output and analog voltage output, which is convenient for users to use and debug, and greatly reduces the design and development cycle for users. It perfectly combines PID sensor and circuit to meet the needs of customers for field detection.

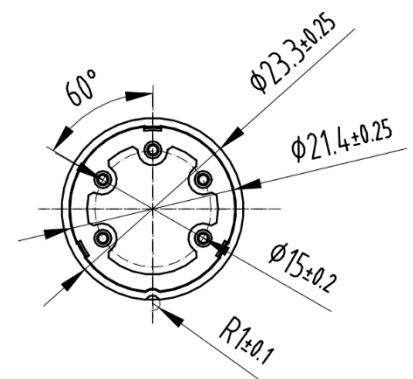
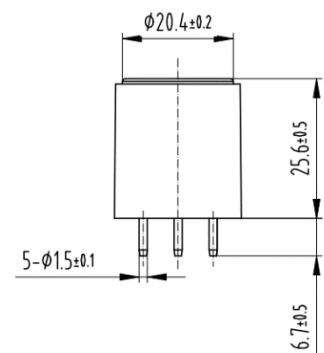


Fig1. Module structure diagram

(units: mm)

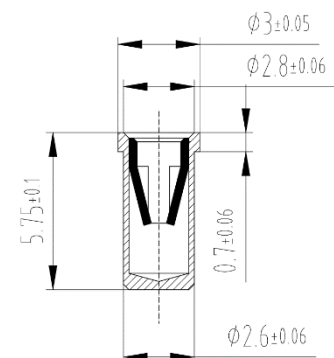


Fig2. Module delivered with tube holder size

(units: mm)

### Features

- High sensitivity and resolution;
- Small sizes;
- UART and analog voltage signal output mode;
- High stability;
- Strong anti-interference ability.

### Main Application

It is widely applicable to portable and fixed gas detectors, as well as various occasions and equipment requiring VOC gas detection.

- ◆ Emergency response
- ◆ Industrial hygiene
- ◆ Personnel safety
- ◆ VOCs detection
- ◆ Environmental quality monitoring
- ◆ Oil and petrochemical safety
- ◆ Soil pollution and treatment

## Main parameters

Table1.

Model No.	ZI01
Detection Gas	VOCs
Detection Range	Subject to table2.
Working voltage	DC 5±0.1 V
Working current	< 30 mA
Output signal	UART (TTL level 3.3 V)
	Analog voltage( The raw amplified signal of the sensor is shown in Table 2)
Lifespan	3 years (Excludes sensor bulb and electrode cover)
Working environment	Temperature: -40 ~ 55°C
	Humidity: 0% ~ 95%RH(No condensation)
Dimension	ø23.3mm*32.3mm (Profile diameter * Profile height)
Weight	< 20 g

## Detection range and Signal output

Table2.

Detection Range	(0-2000)ppm	(0-1000)ppm	(0-100)ppm	(0-50)ppm	(0-10)ppm	---
Resolution	1ppm	1ppm	0.1ppm	0.01ppm	0.001ppm	---
VO Normal voltage range	(0.05-3.2) V	(0.05-3.2) V	(0.05-3.2) V	(0.05-3.2) V	(0.05-3.2) V	---
Response time(T90)	≤10S	≤10S	≤10S	≤10S	≤10S	---

The range of the module and the voltage of VO are not completely one-to-one corresponding. The voltage in the above table is the normal detection range. If the voltage exceeds this range, it may be abnormal for the module. The specific corresponding voltage value of VO shall be subject to the test report or the measured data in the Excel sheet provided.

## Pins connection type

Table3.

GND	Power ground
VCC	Power
VO	Original sensor voltage output
RXD	Serial output
TXD	Serial output

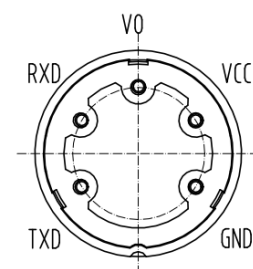


Fig3. Bottom View Pin Definitions

VO (Vout) definition: The original voltage (linear) of the sensor after passing through the amplifier circuit.

If you use the analogue voltage output method, you can calculate the concentration of the gas being measured in the current environment by testing the voltage on the VO pin.

**Note: When purchasing, the user needs to understand that if the analogue voltage output method is required, the user can communicate this to the sales person, who will make a note on the order form that "voltage values are required" (if the user only uses the UART output method, no note is required).**

The clean air concentration value N1 and its corresponding voltage value Vout1 and the ventilation test point concentration value N2 and its corresponding voltage value Vout2 will be provided on the test report included in the shipment.

The user tests the voltage value VoutX of VO in the current environment and calculates the concentration value NoutX of the gas under test in the current environment from N1, Vout1 and N2, Vout2.

Take the 1000ppm range as an example: in clean air, the voltage value Vout1=0.24V, its corresponding concentration value is N1=0ppm, and the voltage value Vout2=0.52V at the ventilation test point, its corresponding concentration value is N2=100ppm. The voltage of VO in the current environment VoutX =1.36V, then the concentration in the current environment:

$$N_{outX} = N1 + \frac{V_{outX} - V_{out1}}{V_{out2} - V_{out1}} * (N2 - N1) = 0 + \frac{1.36 - 0.24}{0.52 - 0.24} * (100 - 0) = 400\text{ppm}.$$

## Communication protocol

### 1. Communication Settings

Table4.

Baud rate	9600
Data Bits	8 bytes
Stop Bits	1 byte
Check bits	Null

### 2. Communication Instructions

The module is configured to actively upload the communication mode when it leaves the factory. The module will send the current concentration value (the concentration is hexadecimal) every second.

If you need to change to question-answer mode, you can change the communication mode to 0x04 (question-answer mode) by sending 0x78 instruction. Then the module will send the current concentration value after receiving 0x86 instruction (read module concentration). It is suggested that the communication cycle is 1 second.

### 3. Communication Commands

The format of the module return value received in active send mode is as follows:

**Table5.**

	0	1	2	3	4	5	6	7	8
Receiving	Start Byte	Command	Gas concentration High byte	Gas concentration Low byte	--	--	--	--	Checksum
	0xFF	0x86	0x00	0x00	0x00	0x00	0x00	0x00	7A
e.g.	FF 86 00 00 00 00 00 00 7A (Receive command with a module concentration value of 0ppm as an example)								

Gas concentration value = (high byte\* 256 + low byte) \* resolution.

0x78--Modify the sensor communication mode

(Communication mode: 0x03 Active transmission mode 0x04 question-answer mode)

**Table6.**

	0x78	Modify the sensor communication mode							
	0	1	2	3	4	5	6	7	8
Sending	Start Byte	Add	Command	Communication mode	--	--	--	--	Checksum
	0xFF	0x01	0x78	0x04	0x00	0x00	0x00	0x00	0x83
e.g.	FF 01 78 04 00 00 00 00 83 (Switch to Q&A mode)								
Receiving	Start Byte	Command	Return to the calibration	--	--	--	--	--	Checksum
	0xFF	0x78	Success: 0x01 Failure: 0x00	0x00	0x00	0x00	0x00	0x00	0x87 0x88
e.g.	FF 78 01 00 00 00 00 00 87 (Receipt of this return command indicates a successful Q&A mode switch)								

To switch to active mode, just send FF 01 78 03 00 00 00 00 84 (hex).

0x86--Reading sensor concentration

**Table7.**

	0x86	Reading sensor concentration value							
	0	1	2	3	4	5	6	7	8
Sending	Start Byte	Add	Command	--	--	--	--	--	Checksum
	0xFF	0x01	0x86	0x00	0x00	0x00	0x00	0x00	0x79
e.g.	FF 01 86 00 00 00 00 00 79 (Read the sensor concentration and send this command)								
Receiving	Start Byte	Command	Gas concentration High byte	Gas concentration Low byte	--	--	--	--	Checksum
	0xFF	0x86	0x00	0x00	0x00	0x00	0x00	0x00	0x 7A
e.g.	FF 86 00 00 00 00 00 00 7A (The receiving command is based on a module concentration value of 0ppm)								

Gas concentration value = (high byte\* 256 + low byte) \* resolution.

#### 4. Check value calculation

```
/*  
* The function name: ucharFucCheckSum(uchar *i,uchar ln)  
* Checksum = (Negative (Byte1+Byte2+Byte3+Byte4+Byte5+Byte6+Byte7))+1  
* Functional description: Add the elements from 1 to the penultimate element  
to get inverse +1 (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);  
}
```

#### Notes

- 1、 Prohibit plugging and pulling the sensor on the module.
- 2、 Prohibit to directly weld the pins of the module. Welding can be carried out on the socket of the pins.
- 3、 Sensor shall avoid organic solvent (including silicone and other adhesives), coatings, medicine, oil and high concentration gases. It is recommended to use a silicone-free epoxy adhesive for fixing.
- 4、 The module cannot withstand excessive impact or vibration.
- 5、 Please keep the modules warming up for at least 1 minute when first time using.
- 6、 Please do not use the modules in systems which related to human being's safety.
- 7、 Please do not use the modules in strong air convection environment.
- 8、 Please do not expose the modules in high concentration organic gas for a long time.
- 9、 The data returned by the serial port of the module is the real-time concentration value in the current environment. In the case of no standard gas, please do not attempt the calibration command, as this command will cause the calibration data to be

cleared and the data returned by the serial port is not accurate.

10、 To determine whether the communication of the module is normal, it is recommended to use the USB to TTL tool (communication level 3.3V), and observe and judge according to the communication protocol through the serial port debugging assistant software.

11、 When selecting modules, products with different ranges and resolutions should be selected according to different application fields and applications.

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