Ultrasonic Oxygen Sensor
（Model：US1010）

User's Manual

(Version 1.0)

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ISO9001 Certificated Company

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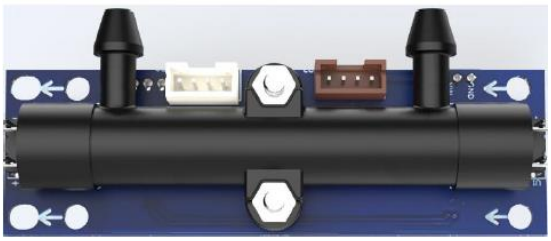
Please keep the manual properly, in order to get help if you have questions during the usage in the future.

Zhengzhou Winsen Electronics Technology CO., LTD.

US1010 Ultrasonic Oxygen Sensor

Profile

The US1010 ultrasonic oxygen sensor is mainly used in the detection of oxygen concentration and flow in oxygen concentrators and related products. It uses ultrasonic sensors to detect the propagation speed of ultrasonic waves in gas, and uses temperature compensation to accurately calculate oxygen concentration and flow.



Main Features

*Good consistency
*Real-time response
*High precision
*Good stability
*long lifespan
*Calibration-free
*LED indicator light

Applications

*Household oxygen generator
*Medical oxygen concentrator

Detection principle

The propagation time of ultrasonic waves in a binary gas mixture changes with the concentration and flow of the two gases. According to this law, the gas concentration and flow velocity can be calculated at the same time without affecting the normal flow of the gas.

Model No.		US1010
Detection method		ultrasound
Detection gas		O2
Concentration	Measuring range	20.5% ~ 95.6%
	Measurement accuracy	± 1.5%FS @(5 ~ 45)℃
	Resolution	0.1%
	Response time	≤1.5s T90 (Can be customized according to customer requirements, the fastest ≤0.1s)
Flow	Measuring range	0 ~ 10L/min
	Measurement accuracy	±0.2L/min@(5 ~ 45)℃
	Resolution	0.1L/min
	Response time	≤1.5s T90 (Can be customized according to customer requirements, the fastest ≤0.1s)
Working voltage		4.5 ~ 13.2V
Average current		≤30mA
Working environment		0 ~ 55℃; 0 ~ 95%RH (no condensation)
Storage environment		-30 ~ 65℃; 0 ~ 95%RH (no condensation)
Output signal		UART(3.3V)
Dimensions		Standard version: 78.2mm*30mm*20mm(L*W*H) Long screw version: 78.2mm*30mm*30.4mm(L*W*H)
Weight		20g
Lifespan		≥5 years

Table 1 - Technical Specifications

Pin sequence:

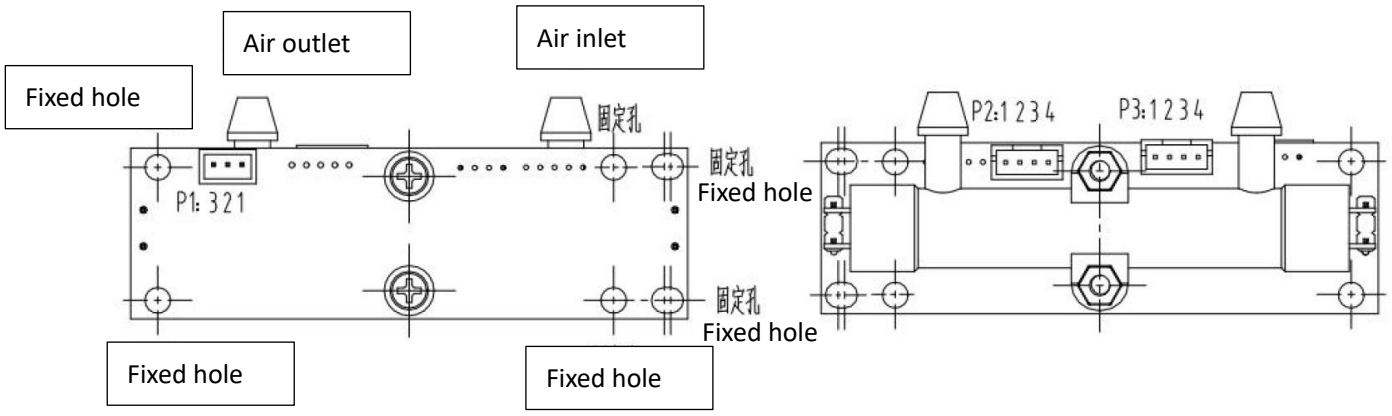


Figure 1 - Pin sequence

Terminal description: P1 model is PH2.0-3P (interval 2.0mm ,no snap joint), P2 models are PH2.0-4P (internal 2.0mm, with snap joint), P3 models are PH2.0-4P (interval 2.0mm, no snap joint).

Pin definition: **Table 2 - Pin Definition**

Pin name	Pin description
P1-1	VCC(4.5～13.2V)
P1-2	NC (hang in air)
P1-3	GND
P2-1	GND
P2-2	UART(TXD) Serial port sending (3.3V)
P2-3	UART(RXD) Serial port receiving (3.3V-5V)
P2-4	VCC(4.5~13.2V)
P3-1	GND
P3-2	UART(TXD) Serial port sending (3.3V)
P3-3	UART(RXD) Serial port receiving (3.3V～5V)
P3-4	VCC (4.5~13.2V)

LED status description:

When the LED blinks once every 5 seconds, the sensor is powered and working normally;

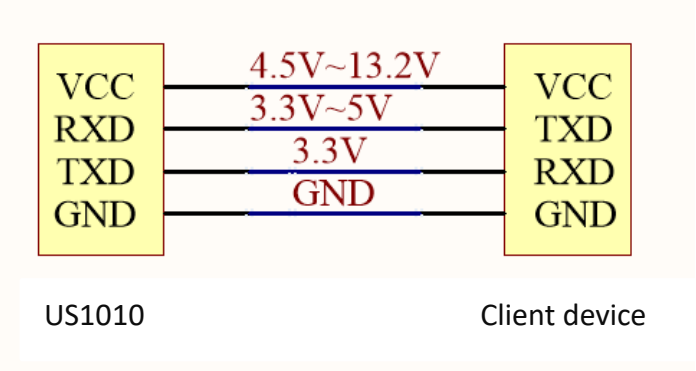
When the LED blinks too fast, too slow or does not blink, the sensor is abnormal;

Communication Description:

1. Hardware connection

Connect the VCC-RXD-TXD-GND of the sensor to the VCC-TXD-RXD-GND of the customer's board respectively, as shown in the figure below (the user side needs to use TTL level, if it is RS232 level, it must be converted).

A typical interface circuit is as follows:



2. Serial parameters

Table 3 - Serial port configuration

name	description
Baud rate	9600
Data byte	8
Stop byte	1
Parity	None

3. Protocol Description

start byte	length	Command	data	checksum
Head	Length	Command	Data	Checksum
1Byte	1Byte	1Byte	nByte	1Byte

Data instruction:

Note: 1. The data are all hexadecimal data, 1Byte refers to single-byte unsigned number (0-255), nByte refers to n-byte unsigned number;

The high byte of double-byte data comes first, and the low byte follows.

Data name	Illustrate
Start byte	The upper computer send is fixed at 0x11, and the sensor module response is fixed at 0x16
Length	= command length (1) + data length (n) (note: data length n can be 0)
Command	The sensor executes the command, 0x01 is to read the oxygen data measured by the sensor, and the rest are reserved.

Data	The data sent by the host or the sensor, the length is n bytes, or there is no data (n=0)
Checksum	=(0xFF-（Head + Length + Command + Data))+1 (Note: checksum = all values except the checksum are accumulated and inverted + 1)

4. Example

	start byte	length	command	check value
host sends	11	01	01	ED

	start byte	length	command	data (D1)	data (D2)	data (D3)	data (D4)	data (D5)	data (D6)	data (D7)	data (D8)	checksum
sensor send	16	09	01	03	A7	00	0C	01	1B	00	00	0E

Note: The sensor has two data output modes. In the question & answer mode, it is recommended that the host send the interval not less than 0.5S, and the active upload mode of the sensor is to send a set of data every 1S.

Function：

Read O_2 concentration

Data analysis：

D1 and D2 are concentration values, O2 concentration value = (D1*256 + D2)/10 (Vol %)

D3 and D4 are flow values, O2 flow value = (D3*256 + D4)/10 (L/min)

D5 and D6 are temperature values, O2 temperature value = (D5*256 + D6)/10 (°C)

(Note: The temperature returned by the sensor is the temperature of the gas in the sensor chamber)

D7 and D8 are reserved data

Example calculation results:

Each value is hexadecimal data, it should be converted to decimal number when calculating

D1=0x03=3, D2=0xA7=167, O_2 concentration value=(3*256+167)/10=93.5%

D3=0x00=0, D4=0x0C=12, O_2 flow value=(0*256+12)/10=1.2L/min

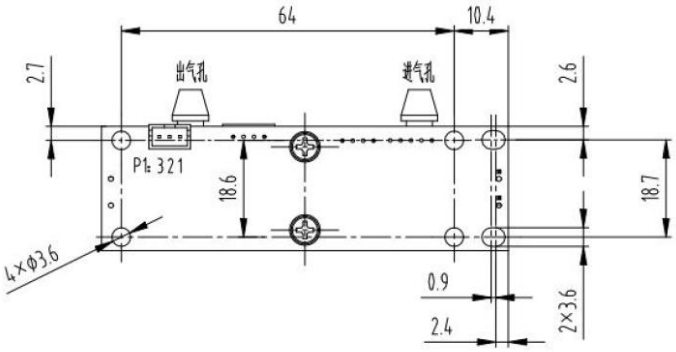
D5=0x01=1, D6=0x1B=27, O_2 temperature value=(1*256+27)/10=28.3℃

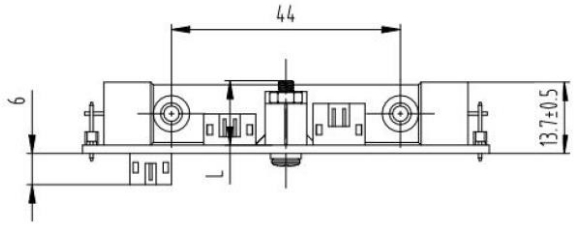
Notes：

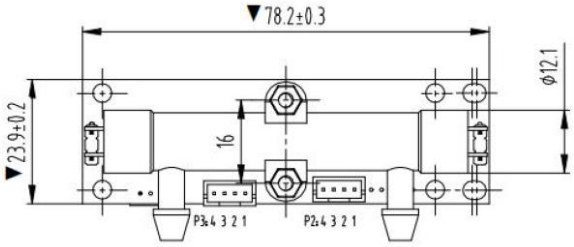
- When the sensor is installed and used, it is forbidden to touch the pins of the transducers at both ends of the sensor;
- Do not disassemble the sensor gas pipeline fixing screws at will;

- The air inlet and outlet holes of the sensor must not be blocked or polluted, and liquids and debris are prohibited from entering the sensor gas pipeline;
- The sensor should not be subject to excessive impact or vibration;
- Do not use if the shell is damaged or deformed;
- Do not continue to use the sensor if the LED indicator is not blinking periodically

Product Size







Unmarked tolerance is ±0.3mm

Standard version: L =12.4±0.5mm

Long screw version: L=22.8±0.5mm

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