AOF2000 Instruction Manual

Ultrasonic Oxygen Sensor

- The principle of ultrasonic wave propagation
- High precision
- Long Lifespan
- Strong anti-interference ability
- Ultra-small volume
- Sensitive response
- Simultaneously detect the concentration and flow rate
- Standard serial port communication

Product Brief

The AOF2000 is an economical and efficient oxygen concentration sensor that utilizes ultrasonic propagation principles to accurately measure oxygen concentration, flow rate, and temperature, and instantly output measurement values. It features full-range temperature compensation, low cost, high reliability, ease of use, strong anti-interference capabilities, and no need for regular calibration. Compared to traditional electrochemical sensors, the AOF2000 has a significantly extended service life. Throughout its entire lifecycle, it can automatically calibrate without requiring maintenance, offering users great convenience. Its oxygen concentration detection range is extremely wide (0% to 100%), making it particularly suitable for detecting oxygen concentrations of 21% to 95.6% in oxygen generators, making it an ideal choice for oxygen generator OEMs.

Application Scope

The AOF2000 ultrasonic oxygen sensor, with its outstanding high reliability and accuracy, is widely used in medical, industrial, chemical, mining and food fields, especially playing a key role in oxygen concentration and flow detection equipment in multiple important fields such as medical oxygen generators, industrial oxygen production equipment, mining and food storage and production.

Figure 1.AOF2000 Ultrasonic Oxygen Sensor

1. Principle of ultrasonic oxygen sensor

Based on the physical transmission characteristics of ultrasound, the concentration and flow rate of oxygen are calculated by measuring the upstream and downstream transit times. As shown in Figure 2, oxygen enters the sensor through the inlet, flows from the transceiver-integrated ultrasonic probe 1 to the transceiver-integrated ultrasonic probe 2, and then exits the sensor through the outlet. The forward flow time is the time required for the transceiver ultrasonic probe 1 to send a signal to the transceiver ultrasonic probe 2, while the reverse flow time is the time required for the transceiver ultrasonic probe 2 to send a signal back to the transceiver ultrasonic probe 1. The flow rate and concentration of oxygen are dependent on environmental temperature. The temperature measurement module within the sensor detects the gas temperature and applies real-time temperature compensation to the gas concentration and flow rate through an algorithm.

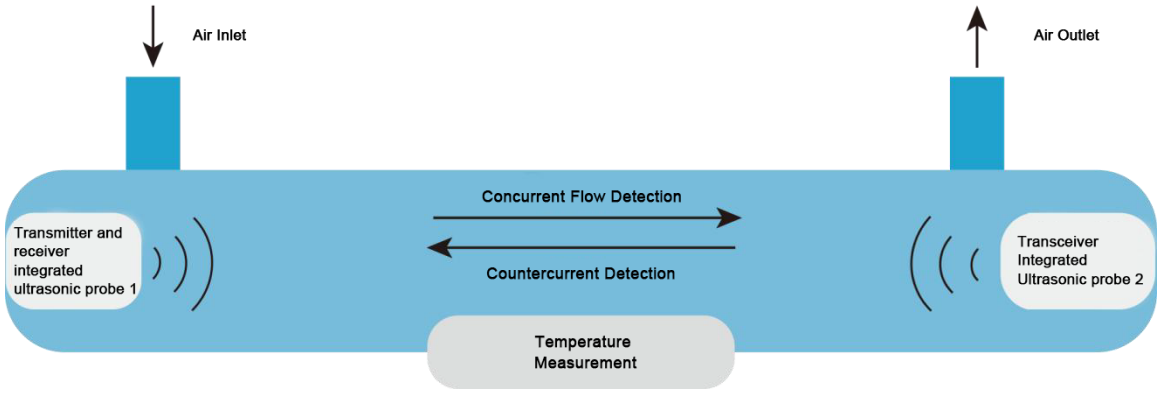

Figure 2. Working Principle Diagram

2. Technical Parameters

Table 1. Technical Parameters

Parameters	Parameter Description
Concentration Detection Range	21%～95.6%（Customizable 0%～100%）
Concentration Resolution	0.1%
Concentration Detection Range	±1.5%F.S.
Flow Detection Range	0～15L/min
Flow Resolution	0.1L/min
Flow Detection Accuracy	±0.2L/min
Detection Cycle	500ms
Preheating Time	<10s
Communication Mode	Serial UART/9600bps
Communication Level	TTL 2.5V~3.5V,Typical value3.3V
Working Temperature	5～55℃
Storage Temperature	-5~60℃
Working Voltage	DC 5V~12V(±0.25V)
Working Current	≤40mA
Working power	≤200mW
Appearance Size	L50mm×W24mm×H13.6mm
Sensor Weight	10.3±1g
Shell Material	PBT plastic raw material
Service Life	>6 Years

3. AOF2000 Dimension Parameter

3.1 AOF2000 Dimension Figure

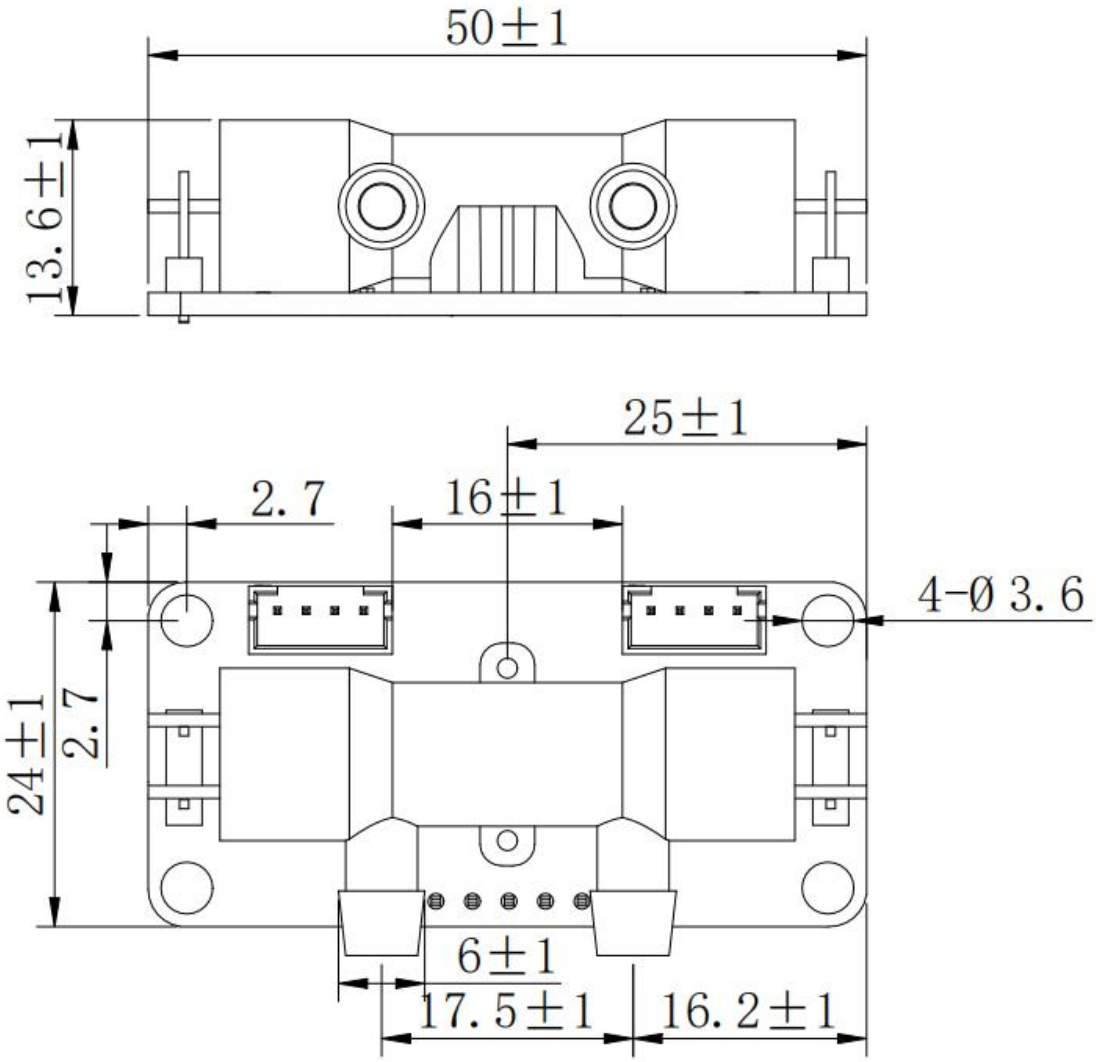

Figure 3. AOF2000 dimension drawing (unit: mm, tolerance: ±1 mm)

3.2 Operation and Maintenance

3.2.1 Precautions for use

To achieve AOF2000 accuracy and optimal performance, please note the following points when using the device: 1. The gas to be detected must be free of water and dust;
2. Do not touch the circuit board with your hands while the device is powered on;
3. Wear an anti-static wristband when installing the sensor to prevent static electricity from damaging the components;
4. When installing the sensor, ensure that the gas inlet and outlet pipes are installed in the direction indicated by the arrows on the sensor.

3.2.2 Interface wiring method

The AOF2000 uses serial port communication, with the interface shown in Figure 4. The power supply voltage input interface in Table 2 is for production use and does not need to be used by the user. The digital signal output interface in Table 3 is used by the user to send and receive data when the power is turned on.

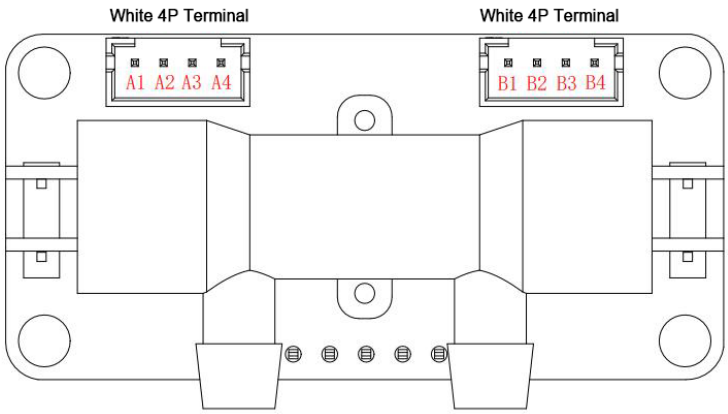

Figure 4. Interface diagram

Table 2. Power supply voltage input interface (4P 2.0mm terminal)

Joint Number	Description
A1	Power supply ground
A2	/
A3	/
A4	Power supply input DC 5~12V

Table 3. Digital signal output interface (4P 2.0mm terminal)

Joint Number	Description
B1	Power Supply Ground
B2	Serial port signal transmitter
B3	Serial port signal receiving terminal
B4	Power supply inputDC 5~12V

4. Protocol Parsing

The AOF2000 uses standard serial port communication with a baud rate of 9600 bits per second. The communication format is shown in Figure 5, which includes 1 start bit, 8 data bits, and 1 stop bit, and does not include parity bits.

Figure 5. The sending and receiving formats of characters

The AOF2000 uses automatic transmission mode, which is automatically activated when the sensor is powered on (transmitting once every 500 ms).

Example:

When the concentration is 50%, the flow rate is 10 L/min, and the temperature is 21.0° C, the data frame sent by the sensor is as shown in Table 4. The data frame is as follows:

0x16 0x09 0x01 0x01 0xf4 0x00 0x64 0x00 0xd2 0x00 0x00 0xb5

Table 4. Analysis of data transmission commands

Data frame	Analysis
① 0x16 0x09 0x01	Frame Header (fixed)
② 0x01 0xf4	Concentration value: 0x01 0xf4 High and low 8 bits combined into 0x01f4=500 (concentration = 50.0%)
③ 0x00 0x64	Flow rate value: 0x00 0x64 High and low 8 bits combined into 0x0064=100 (flow rate = 10.0 L/min)
④ 0x00 0xd2	Temperature value: 0x00 0xd2 High and low 8 bits combined into 0x00d2=210 (temperature = 21.0° C)
⑤ 0x00 0x00	Frame tail (fixed and unchanging)
0xb5	check digit: 256 - (①+②+③+④+⑤)

Checksum calculation:

Add the ① to ⑤ bytes obtained by decomposing the data frame:

0x16+0x09+0x01+0x01+0xf4+0x00+0x64+0x00+0xd2+0x00+0x00 = 0x024B

Define an unsigned char data type variable that can only hold one byte. Take the lower 8 bits of the calculation result 0x024B, i.e., 0x4B, and subtract it from 0x100 (256) to obtain the check digit:

0x100-0x4B = 0xB5