

SPECIFICATION FOR APPROVAL

Product Name: Ultrasonic oxygen sensor

Specification: OCS-3FS-1.2S

Customer:

CUST P/N:

Supplies : Winpower Technology Co.,Ltd.

Date :

CUSTOMER APPROVAL	CHK	APPD

DHW	CHK	APPD

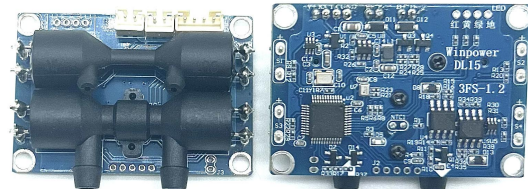
The product specifications are for reference only and shall be signed for confirmation in case of batch supply.

User Manual

OCS_3FS-1.2S Ultrasonic Oxygen Sensor is a new type of gas sensor developed by Winpower Technology Co., Ltd. It uses the ultrasonic principle to detect the oxygen concentration, flow rate, single supply volume of gas, and human breathing. It has the following many features:

Features

- ◆ High accuracy
- ◆ Strong anti-interference ability
- ◆ Response quickly
- ◆ Long-term stability
- ◆ No need for regular calibration
- ◆ Life expectancy greater than 5 years



The OCS_3FS-1.2S ultrasonic oxygen sensor supports concentration, flow rate and breathing detection, and integrates various working mode related air supply control. It is suitable for oxygen generator manufacturers for the rapid development of portable oxygen generators. Also, it can be used for the renovation and upgrade of traditional oxygen generators to reduce the machine size, increase the equivalent oxygen flow, save energy and reduce emissions, and respond to national policies to achieve the "dual carbon" goal as soon as possible.

Application

- ◆ Portable/non-portable molecular sieve oxygen generator

Attention

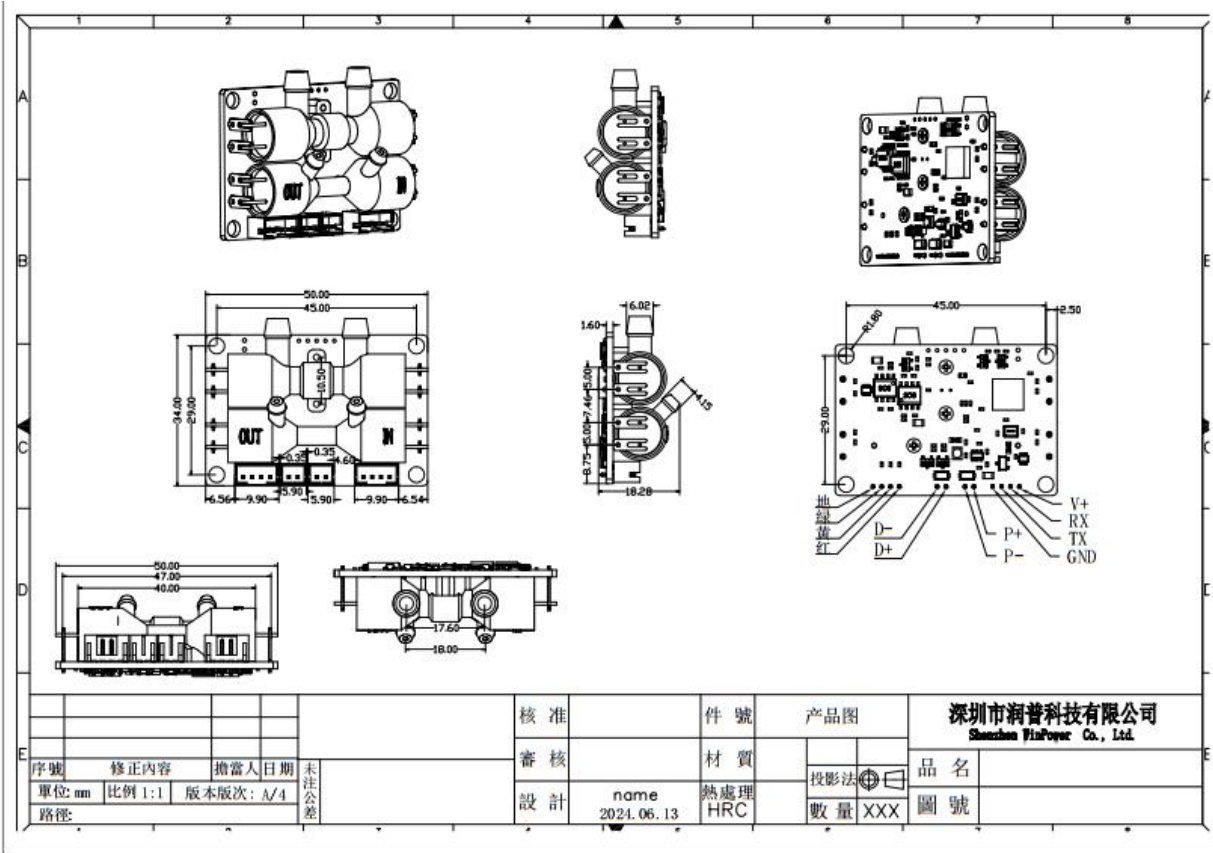
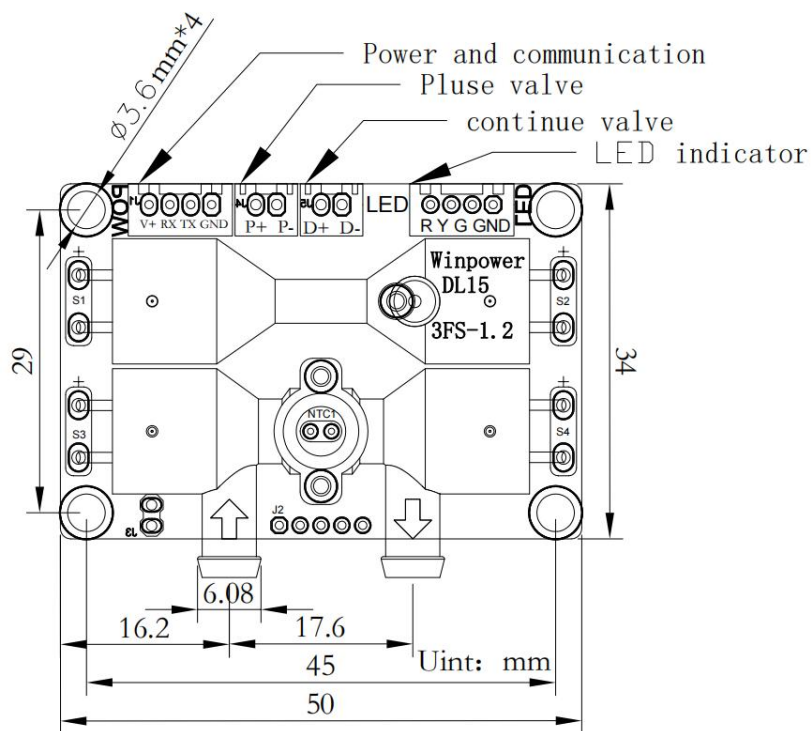
- ◆ Ensure that the detected gas is free of water, oil and dust.
- ◆ Without the permission of the manufacturer, do not disassemble the sensor. Any damage to the sensor caused thereby will not be covered by warranty or repair by the manufacturer.
- ◆ This sensor and the data manual may be changed due to product technical improvements. No prior notice will be given. Please forgive us.
- ◆ Our company has the final interpretation right for this sensor's data manual.
- ◆ For other special customization requirements, you can consult: 0755-82415317
phc@winpower.com.cn

Technology Characteristics

Range of concentration	21%-95.6%
Resolution	0.1%
Accuracy	$\pm 2\%FS @ (5 - 55) ^\circ C$ Due to the deviation in breathing rhythm
Range of flow	0-15L/min
Resolution	0.1L/min
Accuracy	$\pm 0.2L/min$ or 5% of reading
UART data report	500ms or respond immediately after received instruction
Digital Output	115200bps UART 3.3V TTV level
Working temperature	5~55°C
Storage temperature	-5~65°C
Working humidity	5~85%RH
Withstand pressure	0-150Kpa, but the pipeline pressure will affect the flow accuracy of the sensor, and the flow reading will be low.
Power Supply	DC 8V-15VDC depending on the solenoid valve
Respiratory sensitivity	2-12ml/min adjustable, Smaller and more sensitive
Dimensions	50mm x 38mm x 25mm (L x W x H)
Weight	About 17g
Gas supply gear	1-20 adjustable gears
Sensitivity	2 - 12 mL/min adjustable
Power supply	8 - 15 $\pm$ 0.5 VDC (considering the power supply requirements for the solenoid valve)

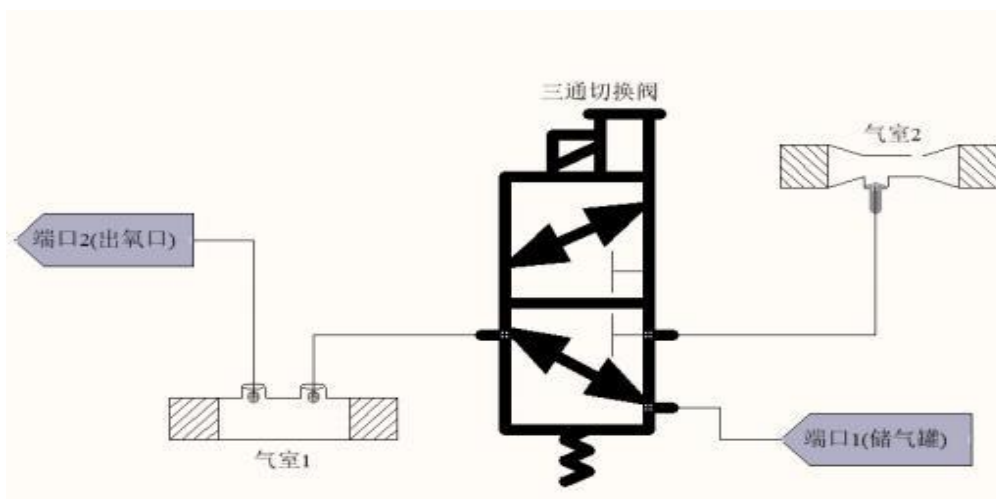
Socket And Size

(J4 and J5 are 2P * 2.0mm, and J1 is 4P * 2.0mm.) Unit: mm, tolerance: ±0.2mm



Interface Number	Function
J1	Power supply and digital signal output
J4	Two-way three-way valve pulse electromagnetic valve
J5	Direct supply air solenoid valve

Pipeline structure and electromagnetic valve wiring



a. When entering the detection period, the solenoid valve connects to the air chamber 2 for breath detection. When the detected breath flow exceeds the set threshold, the solenoid valve connects to the air reservoir for venting, and air chamber 1 can measure the concentration and flow rate.

b. Mode switching is possible. Air chamber 1 is connected to the air reservoir to provide direct supply

Working logic of pulse sensor is explained in detail

Pulse sensor is a part used in oxygen concentrator, Winpower Technology Co., Ltd. tailor-made for its rich working mode to meet the various potential needs of different customers.

Before using the pulse sensor, it is necessary to understand its several working modes.

- ① **Off mode:** The portable oxygen generator is in standby/stop mode, the sensor can be set to off mode, and the sensor will close the relevant solenoid valve to reduce power consumption and extend battery life.
- ② **Pulse mode:** When the portable oxygen generator is in pulse mode, the sensor is set to pulse mode. When the sensor detects the breathing signal, it will open the pulse valve for gas supply according to the air supply time set by the main board for the sensor.

Note: When breathing is not detected for a period of time, the sensor will automatically enter a fixed pulse mode. That is, according to a fixed period, open the pulse valve with a fixed time to supply gas, to avoid the failure of the machine caused by breathing, and automatically switch back to the pulse mode when breathing is detected.

③ **Direct supply mode:** When the portable oxygen generator is in direct supply mode, the portable oxygen generator's gas supply mode is the same as that of the traditional oxygen generator, which continues to supply gas at a certain flow rate.

④ **Fixed pulse mode:** The portable oxygen generator is in fixed pulse mode, which is generally not used.

Readings and button explanations



Single vent volume/ml	Gas supply gear					
	1st gear	2nd gear	3rd gear	4th gear	5th gear	6th gear
15	11	22	33	44	55	66
20	10	20	30	40	50	60
25	8	16	24	32	40	48
30	6	13	20	26	33	40
35	5	11	17	22	28	34
40	5	10	15	20	25	30

Display content			
Conc	oxygen purity	Temp	temperature
Flow	Continuous flow	Mode	Sensor working mode
Si-Volume	Single vent volume	Gear	Pulse flow rate gear
AdjF	Flow adjustment	BPM	Respiratory rate
Unadj	The adjusted data is not saved	adj	The adjusted data is saved
UnSync	Storage data adjustment is not synchronized	Sync	Storage data adjustment is synchronous
P+	Increase values	M-	Reduce values
Breath-sen	breathing sensitivity	Auto-adj-Stop	The automatic adjustment mode is not enabled
On the left are the number of keystrokes and key values			
On the right are the oxygen purity, single vent volume, and calibration counts of analyzer A01			

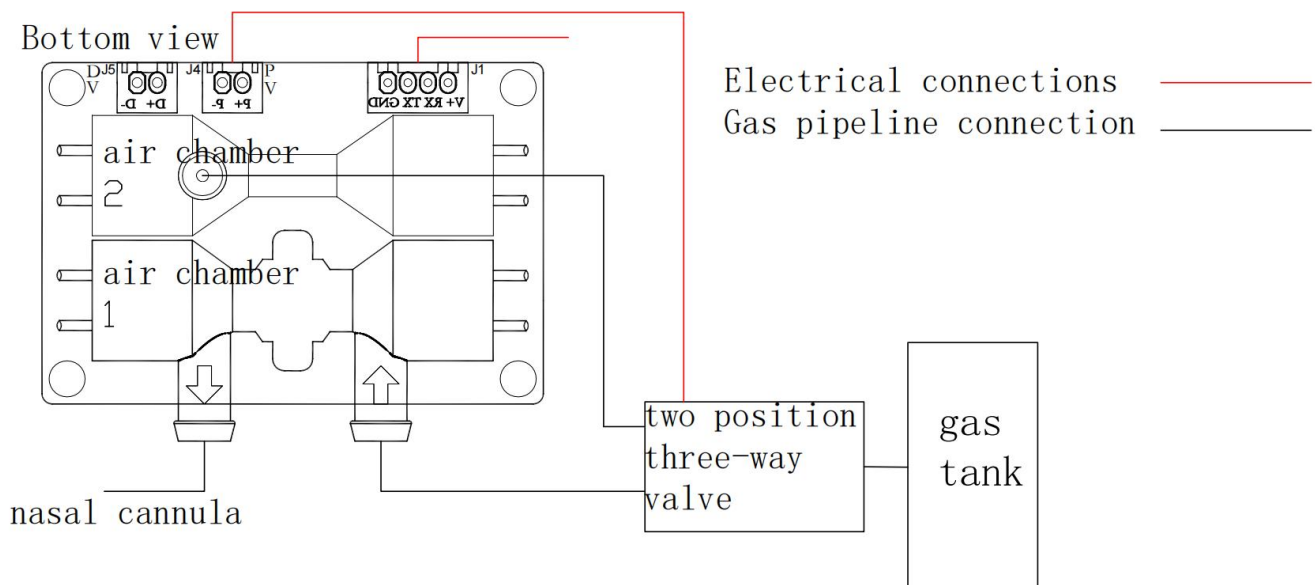
Function of the button			
1,4 button	Cursor up and down	3 button	No function, do not use this button
2,5 button	add and subtract numerical value	6 button	Adjust and save data synchronization

Note:

- ① The concentration and flow rate cannot be activated by default, and can only be activated by pressing the 6 button.
- ② Gas supply mode: **Off mode; Pulse mode; Direct supply mode; Fixed pulse mode**
- ③ The range of respiratory rate is generally **10 to 40ppm**.
- ④ Sensitivity of breath detection, value range 2-12. The smaller the value, the higher the sensitivity.
- ⑤ Concentration adjustment regardless of mode.
- ⑥ Flow adjustment is divided into continuous flow and pulse flow.
- ⑦ Continuous flow is multiplied by the coefficient.
- ⑧ Pulse flow rate is adjusted according to the current gear data. Normal gears are **1 to 6**.
- ⑨ If there is no breathing for 30 seconds in the pulse mode, the sensor will automatically enter a fixed pulse mode

Pipeline structure

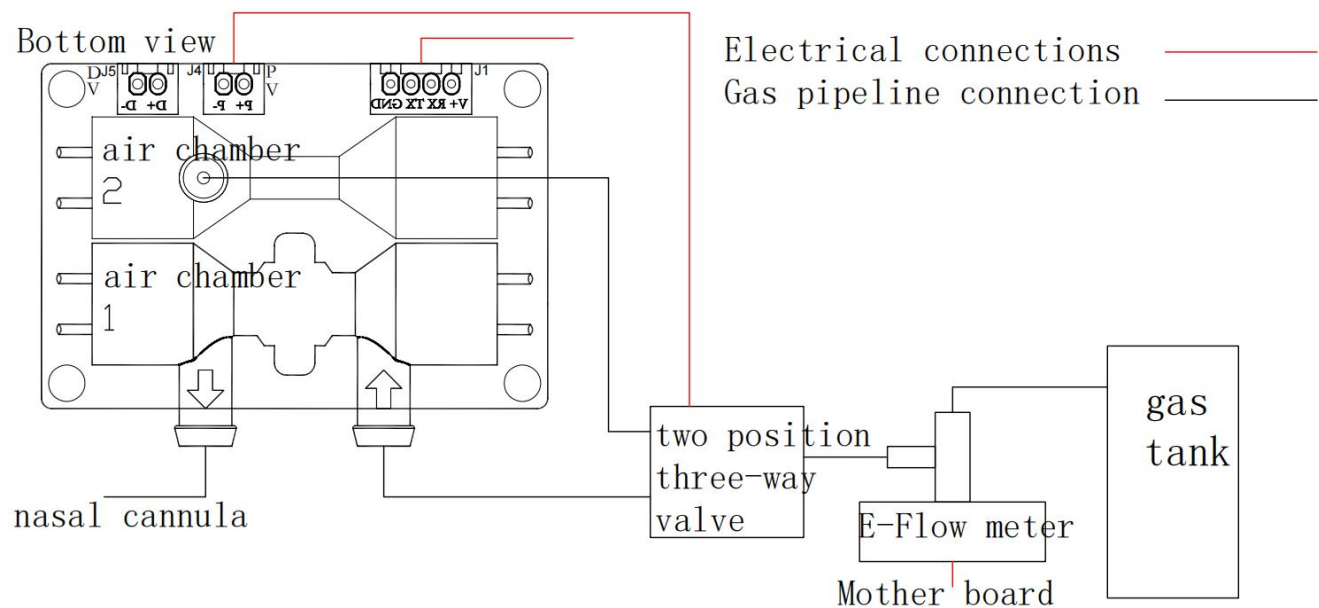
(1) Portable oxygen concentrator with pulse gas supply only



Application of portable oxygen generator with pulse gas supply

Note: When the sensor works in mode 1 (pulse mode), air chamber 1 and air chamber 2 will be connect by the two-position three-way valve to detect breathing. When breathing is detected, two position three-way valve will be open, air chamber 1 and gas tank will be connected by the two-position three-way valve.

(2) Portable oxygen concentrator with pulse gas supply and multi-level continuous gas supply



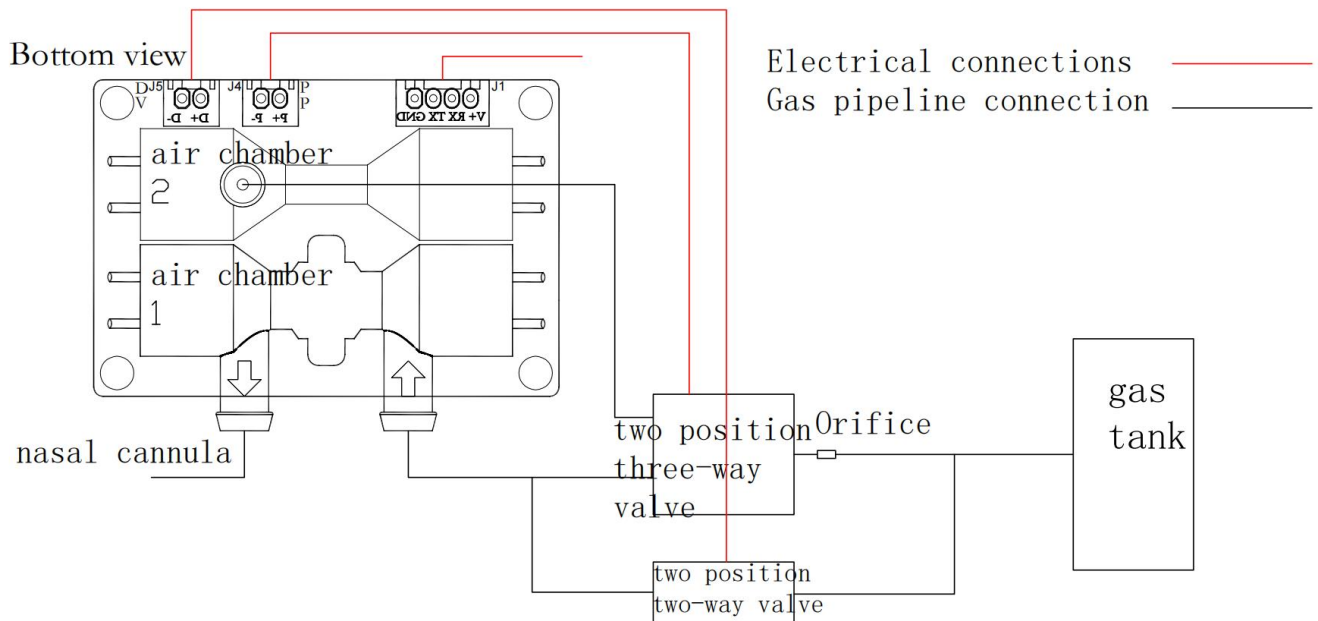
Application of pulse gas supply and multi-level continuous gas supply

Note:

① When the sensor works in mode 1(pulse mode). air chamber 1 and air chamber 2 will be connect by the two-position three-way valve to detect breathing. When breathing is detected, two position three-way valve will be open, air chamber 1 and E-Flow meter will be connected by the two-position three-way valve. The electronic flow meter must be turned to its maximum.

② When the sensor works in mode 2(continuous mode). air chamber 1 and E-Flow meter will be connected by the two-position three-way valve. The E-Flow meter control multi-level flow.

(3) Portable oxygen concentrator with pulse gas supply and single-level continuous gas supply(Program needs to be customized)



Application of pulse gas supply and single-level continuous gas supply

Note:

① When the sensor works in mode 1(pulse mode). air chamber 1 and air chamber 2 will be connected by the two-position three-way valve to detect breathing. When breathing is detected, two position three-way valve and two position two-way valve will be open, air chamber 1 and gas tank will be connected by the two-position three-way valve.

② When the sensor works in mode 2(continuous mode). air chamber 1 and gas tank will be connected by the two-position three-way valve. The two-position two-way valve will be closed. The flow rate is adjusted through the orifice.

UART communication parameters

Baud rate: 115200 bps

Character length: 1 start bit, 8 data bits, 1 stop bit, no parity check.

Communication protocol description (customizable)

All data in this agreement are hexadecimal data. For example, "0x46" is 70 in decimal notation.

The data sent by this product is hexadecimal unsigned data.

When receiving data, the lowest eight bits of the sum of all data are 0 and the data header is correct, the data is received correctly. When sending data, the check bit is (0 minus the sum of other bits). Refer to the conventional sensor calibration method.

For instance:

Set single cycle oxygen supply time 0.12S, pulse oxygen supply mode:

Send the command to the sensor:

0x16	0x09	0x01	0x05	0x01	0x1E	0x0C	0xB0
data head			Gas supply gear	Gas supply mode	ABC1	sensitivity	Check

Note:

Gas supply gear: The gas supply gear setting will automatically supply gas according to the single gas supply volume in the figure below combined with the breathing rate.

Single vent volume/ml		Gas supply gear					
		1st gear	2nd gear	3rd gear	4th gear	5th gear	6th gear
frequency respiratory	15	11	22	33	44	55	66
	20	10	20	30	40	50	60
	25	8	16	24	32	40	48
	30	6	13	20	26	33	40
	35	5	11	17	22	28	34
	40	5	10	15	20	25	30

Gas supply mode: Off: 0x00; Pulse: 0x01; Direct supply: 0x02; Fixed pulse: 0x03.

Send corresponding commands to switch to the corresponding mode.

When there is no breath for 30 seconds in pulse mode, it will automatically enter a fixed pulse, that is, fixed gas supply N times per minute, N=ABC1.

ABC1: The frequency of gas supply per minute in fixed pulse mode is limited to 4-40 times, that is, each time in 15-1.5 seconds; If the setting is not within the limited range, the system automatically sets it to 18, that is, 18 times per minute.

Sensitivity: Sensitivity of breath detection, value range 2-12, the smaller the value, the higher the sensitivity.

Sensor response results:

0x16	0x09	0x01	0x01	0xF4	0x0C	0x01	0x0A
data head			oxygen concentration		gear	Oxygen supply mode	Flow rate

0x1A	0x01	0x14	0x1E	0x0C	0x7B
temperature	Respiratory sign	respiratory rate	ABC1	sensitivity	check

Note:

oxygen concentration: 0x01, 0xF4, concentration = $0x01 * 256 + 0xF4 = 500 = 50.0\%$

Flow rate: 0x0A, single gas supply 10ml in pulse & fixed pulse mode, real-time flow rate 1L/min in off & direct supply mode.

Temperature: 0x1A, temperature $0x1A = 26 = 26^{\circ}\text{C}$.

Breathing sign: 0x01, inspiratory, pulse valve open, can be used to drive the indicator light to indicate breathing status.

Respiratory rate: calculated based on the interval between the last two breaths.

Note: Oxygen supply time less than 0.1 seconds, may affect the oxygen concentration.

Detailed Explanation of the Working Logic of the Pulse Sensor:

Before using the pulse sensor, it is necessary to understand the several working modes of the pulse sensor. Winpower Technology Co., Ltd. has specially designed a rich set of working modes for the pulse sensor used in portable oxygen generators to meet the various potential needs of different customers.

- When the portable oxygen generator is in **standby/idle mode**, the sensor can be set to the off mode. The sensor will turn off the related solenoid valve to reduce power consumption and extend the battery usage time.
- When the portable oxygen generator is in **pulse mode**, the sensor is set to the pulse mode at the same time. When the sensor detects the breathing signal, it will open the pulse valve according to the supply time set by the main board to supply oxygen. Note: If no breathing is detected for a period of time, the sensor will automatically enter the fixed pulse mode, that is, it will open the fixed-duration pulse valve at a fixed cycle to supply oxygen to avoid the machine getting stuck and causing pipe burst and other faults. When breathing is detected, it will automatically switch back to the pulse mode.
- When the portable oxygen generator is in **direct supply mode**, the oxygen supply method of the portable oxygen generator is the same as that of the traditional oxygen generator, providing continuous oxygen at a certain flow rate.
- When the portable oxygen generator is in **fixed pulse mode**, this mode is generally not used.

sample code

(sensor report)

```

temp_u8=0;
for(i=0;i<14;i++) temp_u8 += USART2_RXbuffer[i];
if((temp_u8==0)&&(USART2_RXbuffer[0]==0x16)&&(USART2_RXbuffer[1]==0x09)&&(USART2_RXbuffer[2]==0x01)) //The sum is zero.
{
    o2_concent = USART2_RXbuffer[3]*256 + USART2_RXbuffer[4]; //o2 concentration (o2_concent/10) %
    gear = USART2_RXbuffer[5]; // gear
    mode = USART2_RXbuffer[6]; //working mode : mode 0 close 、 mode 1 pulse 、 mode 2 continuous、 mode 3 fixed pulse
    o2_flow = USART2_RXbuffer[7] // (o2_flow/10) L/min or (o2_flow) ml, depend on working mode
    o2_temp = USART2_RXbuffer[8]; //temperature (o2_temp) °C
    breez = USART2_RXbuffer[9]; // Inspiratory sign
    hz = USART2_RXbuffer[10]; //breath rate hz/min
}

(mother board instructions)
USART2_TXbuffer[0] = 0x16; // Protocol header
USART2_TXbuffer[1] = 0x09; // Protocol header
USART2_TXbuffer[2] = 0x01; // Protocol header
USART2_TXbuffer[3] = gear; // gear
USART2_TXbuffer[4] = mode; // working mode : mode 0 close 、 mode 1 pulse 、 mode 2 continuous、 mode 3 fixed pulse
USART2_TXbuffer[5] = 0x1E; // Fixed pulse rate per minute
USART2_TXbuffer[6] = 0x0C; //sensitivity
temp = 0; //clear
for(i=0; i<7; i++) //check sum
{
    temp += USART2_TXbuffer[i];/////////Note: "temp" is an 8-bit unsigned type.
}

USART2_TXbuffer[7] = 0x00 - temp;

```

Package

Small box: Packing capacity 30PCS / layer * 4 layers = 120PCS Length, width and height: 42*30*24cm	Logistics box: length, width and height: 50*32*44cm Two small boxes inside: 120*2=240PCS	Net weight:5KG Gross weight: 7.2KG
		

深圳市润普科技有限公司 地址： 广东省深圳市平湖白坭坑宝盛工业区 A 区 6 栋, 12 栋 电话： (86) 755-82415317 82421607 传真： (86) 755-82265337 网站： http://www.winpower.com.cn/ 邮箱： phc@winpower.com.cn	Winpower Technology Co., Ltd. Address: 12# Building, Baosheng District A Bainikeng, Pinghu, Shenzhen, Guangdong Province, China Tel: (86) 755-82415317 82421607 Fax: (86) 755-82265337 Website: http://www.winpower.com.cn/ Email: phc@winpower.com.cn
--	---