

# SPECIFICATION

**Product Name: Ultrasonic Oxygen Sensor**

**Sensor Item No.: Gasboard-8500FS-L240**

**Version: V0.1**

**Date: November 19, 2021**

# Revision

No.	Version	Content	Date
1	V0.1	First Edition	2021-11-19

# Ultrasonic Oxygen Sensor Gasboard-8500FS-L240



## Applications

- ✧ Family and Medical Ventilator
- ✧ High-flow Oxygen Therapy Device
- ✧ Respiratory Device, Anesthetic Machine and Vaporizer
- ✧ Gas Detection in Binary Gas (Including O<sub>2</sub>)

## Description

Gasboard-8500FS-L240 is ultrasonic technology 5-in-1 combined sensor solution to measure flow rate, oxygen concentration, temperature and humidity. The flow rate range of Gasboard-8500FS-L240 can be up to 240L/min. Benefit from ultrasonic technology and principle of TOF (time of flight) measurement, Gasboard-8500FS-L240 has excellent performances with advantages of high accuracy, fast response, no drift, no need for routine calibration and maintenance-free, etc. Gasboard-8500FS-L240 can be widely used in high-flow nasal cannula oxygen therapy ventilation, positive airway pressure ventilation, anesthetic ventilator and other medical equipment related to breath.

## Features

- ✧ Ultrasonic measurement technology, 5-in-1 combined sensor solution and flow rate up to 240L/min
- ✧ Based on principle of TOF (time of flight) measurement, continuous monitoring, no drift, no need routine calibration, maintenance-free.
- ✧ Excellent stability, high accuracy, fast response
- ✧ Full scale matrix temperature and humidity compensation
- ✧ No-consuming parts, long Lifespan
- ✧ Small size, flexible installation
- ✧ High performance-cost-ratio
- ✧ Support serial port accurate measurements and analog output available
- ✧ CMC, CE, EMC, ROHS, REACH compatibility
- ✧ Connection design in compliance with ISO5356

Principle of ultrasonic flow detection: when ultrasonic wave is propagating in the fluid, it is affected by the fluid velocity and carries the flow velocity information. The flow velocity can be measured by detecting the received ultrasonic signal, so as obtain the flow rate. Ultrasonic flow measurement has the characteristics of not impeding fluid flow.

Ultrasonic concentration detection theory: when the binary gas mixture composition has molecular weight difference, sound travel speed varies from different gas composition.

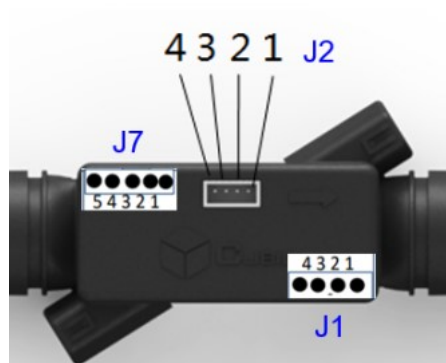
## Specification

Ultrasonic Oxygen Sensor Gasboard 8500FS-L240 Specification	
<b>Detect Principle</b>	Ultrasonic Technology
<b>Detection Range</b>	O2 Concentration: 0%~100% vol Flow Rate: 0~240L/min
<b>Pressure Drop</b>	600Pa @240L/min flow rate
<b>Sampling Interval</b>	10ms (100 data per second)
<b>Detection Accuracy<sup>1</sup></b>	O2 Concentration: $\pm 3\%$ FS @ (5~45) °C Flow Rate: $\pm 0.2$ L/min (<10L/min) $\pm 2.0\%$ reading ( $\geq 10$ L/min)
<b>Resolution</b>	O2 Concentration: 0.1% vol Flow Rate: 0.1L/min
<b>Response Time<sup>2</sup></b>	O2 Concentration: <0.1s Flow Rate: <10ms
<b>Work Condition</b>	5~45°C, 0~95%RH (Non-condensing)
<b>Storage Condition</b>	-20~70°C; 0~95%RH (Non-condensing)
<b>Power Supply</b>	DC 4.75-12.6V, Ripple Wave $\leq 50$ mV
<b>Work Current</b>	Average Current <20mA; Peak Current <50mA
<b>Analog output<sup>3</sup></b>	O2 Concentration: 0.2-2.5V Flow Rate: 0.2-2.5V
<b>Communication</b>	UART_TTL (3.3V)/IIC (IIC is reserved)
<b>Dimension</b>	L80*W42.5*H29mm
<b>IP Grade</b>	IP54
<b>Life Span</b>	$\geq 10$ Years
<b>Compensation</b>	Integrated temperature, humidity and atmosphere pressure sensors, compensation correction, to ensure the accuracy of detection

Note:

1. Here the response time means T63, defined at condition of flow rate  $\geq 10$ L/min
2. The defined accuracy is with 10 data moving average output.
3. Analog output is converted from digital output (PWM output), please review the pin map for analog output definition.

# Pin Definition



**Drawing1 Gasboard-8500FS-L240 Pin Definition**

**Table 2. Connector Pin Definition**

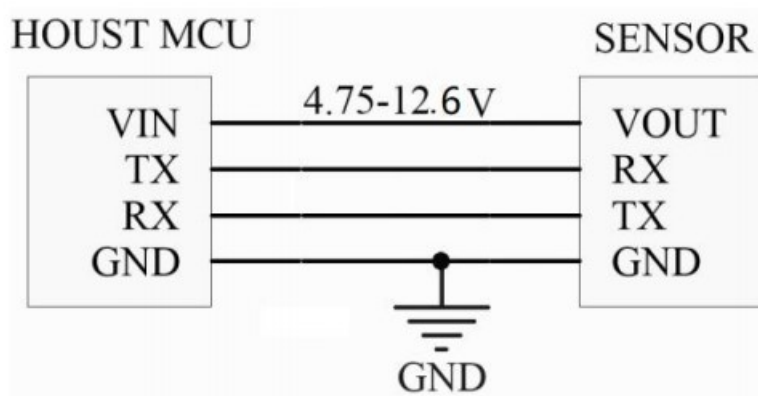
J2			J1 (Reserved, need to be customized)		
NO	Pin	Description	NO	Pin	Description
1	Vcc	4.75-12.6V, External Power Supply Input Pin	1	GND	Analog output
2	Rx	UART-Rx Receiving (3.3V)	2	O2	0.2V-2.5V output pin, 0.2V corresponds to 0%Vol 2.5V corresponds to 100%Vol
3	Tx	UART-Rx Sending (3.3V)	3	Flow	0.2V-2.5V output pin, 0.2V corresponds to 0L/min 2.5V corresponds to 240L/min
4	GND	Power Ground	4	Vcc	4.75-12.6V, External Power Supply Input Pin
Remark: IIC is reserved			Remark: The function is customized		
J7 (Reserved, need to be customized)					
NO	Pin	Description			
1	GND	Power Ground			
2	LED1	Alarm Output 1			
3	LED2	Alarm Output 2			
4	LED3	Alarm Output 3			
5	Vcc	Power Output: 3.3V			
Remark: This function is customized					

**Table 3. Connector Description**

Port	Terminal	Connector	Pin Pitch
J1	PH2.0-4A	PH2.0-4P	2.00mm
J2	PH2.0-4A	PH2.0-4P	2.00mm
J7	PH2.0-5A	PH2.0-5P	2.00mm

## Reference Circuit

Application Scenarios: UART TTL 3.3V Output



Drawing 2 UART Communication Connection Circuit

# Communication Protocol

## UART Communication Protocol

### 1. Protocol Overview

(1) Baud Rate: 9600, Data Bits: 8, Stop Bits: 1, Parity: No, Flow Control: No

Note: Some equipment may lose data when receiving data; can send change baud rate command to switch high-speed mode: baud rate 115200;

(2) The protocol data are hexadecimal data. For example, "46" is [70] in decimal;

(3) [xx] is single byte data(unsigned,0-255); In double byte, the high byte is in front of low byte;

(4) The default is active sending.

### 2. Serial Communication Protocol Format

#### Host Send Format

Start Symbol	Length	Order No	Data 1	.....	Data n	Check Sum
HEAD	LEN	CMD	DATA1	.....	DATAn	CS
11H	XXH	XXH	XXH	.....	XXH	XXH

#### Protocol Format Description

Protocol Format	Description
Start Symbol	PC sending is fixed to [11H], module response is fixed to[16H]
Length	Length of frame byte, =data length+1 (include CMD+DATA)
Order No	Directive number
Data	Read or written data, the length is variable
Check Sum	The sum of data accumulation, =256-(HEAD+LEN+CMD+DATA)

### 3. Serial Protocol Order Number List

No	Function Name	Command
1	Read the measurement result	0x01
2	Read the software version number	0x1E
3	Inquiry instrument serial number	0x1F
4	Change baud rate	0x08
5	Read temperature, humidity and atmosphere pressure	0x03

## 4 Detailed Description

### 4.1 Read the Measurement Result

**Send:** 11 01 01 ED

**Response:** 16 09 01 DF1-DF8 [CS]

**Description:** O<sub>2</sub> Concentration = (DF1\*256 + DF2) /10 (Vol %)

O<sub>2</sub> Flow Value = (DF3\*256 + DF4) /10 (L/min)

O<sub>2</sub> Temperature Value = (DF5\*256 + DF6) /10 (°C) (Gas temperature in the sensor chamber)

DF7-DF8 reserve

Remark:

1. The default is active data sending. The sensor can also output the value automatically without sending the command.

When send 11 01 07 E7, can change active data sending mode to request-response mode.

# Communication Protocol

2. The O2 concentration here is for pure oxygen source, for PSA source, then the transfer relationship is:  
 Sensor reading=(target concentration\*1.142)-3.42%, in which target concentration is based on PSA oxygen source.

**Response Example:**

Response: 16 09 01 00 CD 00 00 00 C2 00 1E 33

Hexadecimal Convert into Decimal: CD is 205; C2 is 194

O2 Concentration =0\*256 + 205=205 (20.5%)

O2 Flow Value=0\*256+0=0 (L/min)

O2 Temperature Value=0\*256+194=194 (19.4°C)

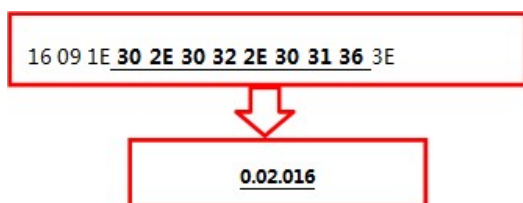
## 4.2 Read the Software Version Number

Send: 11 01 1E D0

Response: 16 09 01 DF1-DF8 [CS]

Instruction: DF1-DF8 refers to the ASCII code of particular version number

For example: When module version number is 0.02.016, response data:



Hexadecimal Convert into ASCII Code:

## 4.3 Inquiry Instrument Serial Number

Send: 11 01 1F CF

Response: 16 0B 1F (SN1) (SN2) (SN3) (SN4) (SN5) [CS]

Explanation: Instrument serial number of output software. SNn range is 0~9999, 5 integer type constitute 20 serial number

## 4.4 Change Baud Rate

Send: 11 02 08 0X [CS]

Response: [ACK] 02 08 0X [CS]

Instruction: When 0X=02, change baud rate from 9600 to 115200;

When 0X=03, change baud rate from 115200 to 9600.

Command will effective when power off or restart

## 4.5 Read temperature, humidity, atmosphere pressure

Send: 11 01 03 EB

Response: 16 07 03 DF1 DF2 DF3 DF4 DF5 DF6 [CS]

**Description:**

temperature = (DF1\*256 + DF2) /10 (°C)

humidity = (DF3\*256 + DF4) /10 (%)

pressure = (DF5\*256+ DF6) /10 (KPa) (for some version without pressure sensor, the output is 0)

Example response: 16 07 03 00 C8 01 67 03 FD B0

Hexadecimal Convert into Decimal: CD is 205; C2 is 194

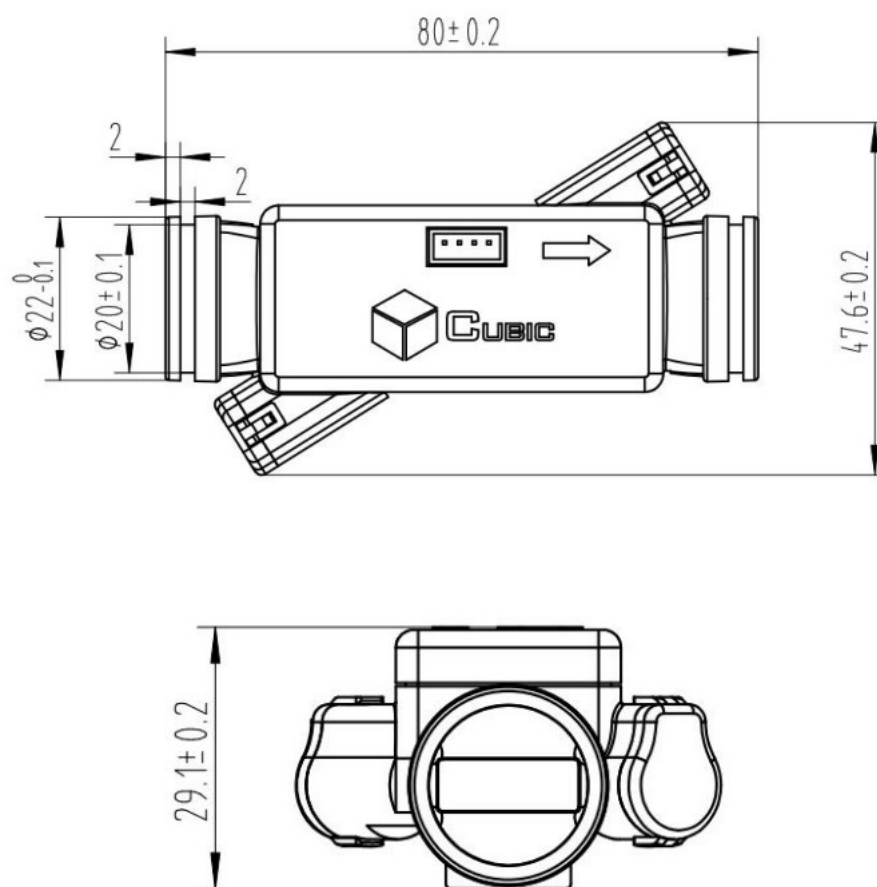
Temperature Value=0\*256+194=194 (19.4°C)

Humidity value=1\*256+103=359 (35.9%)

Atmosphere pressure=3\*256+253=1021 (102.1KPa)



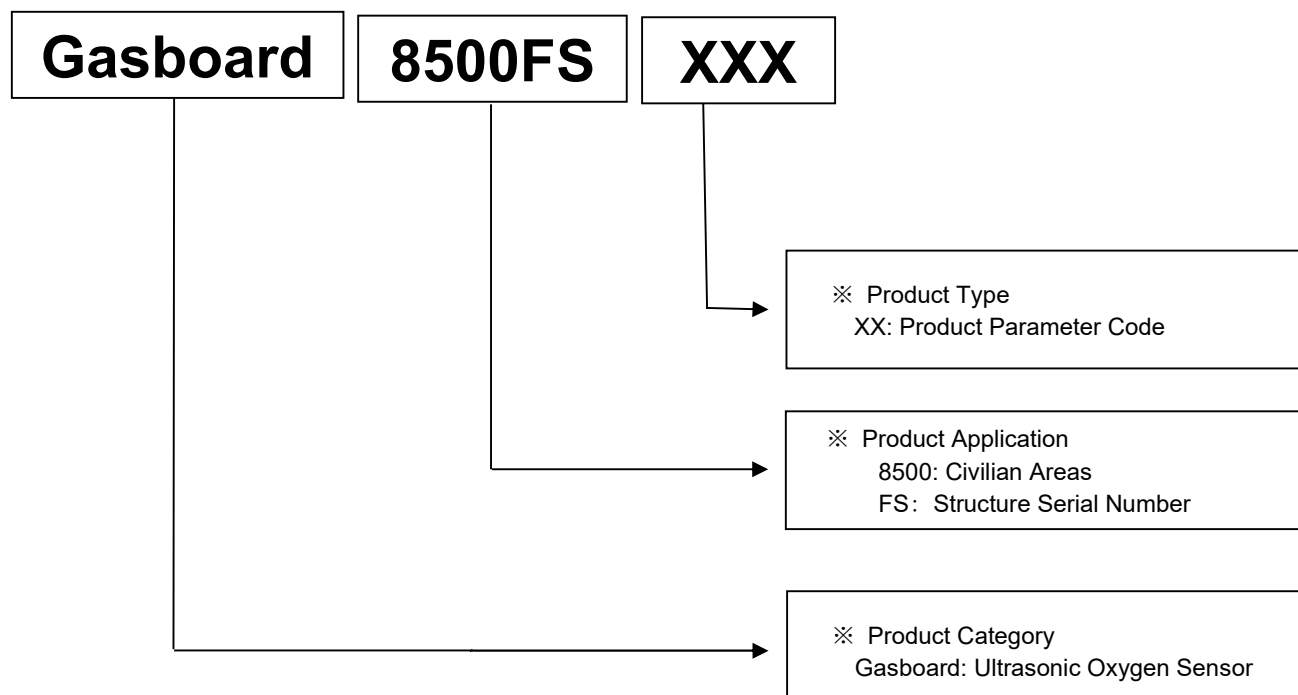
## Dimension



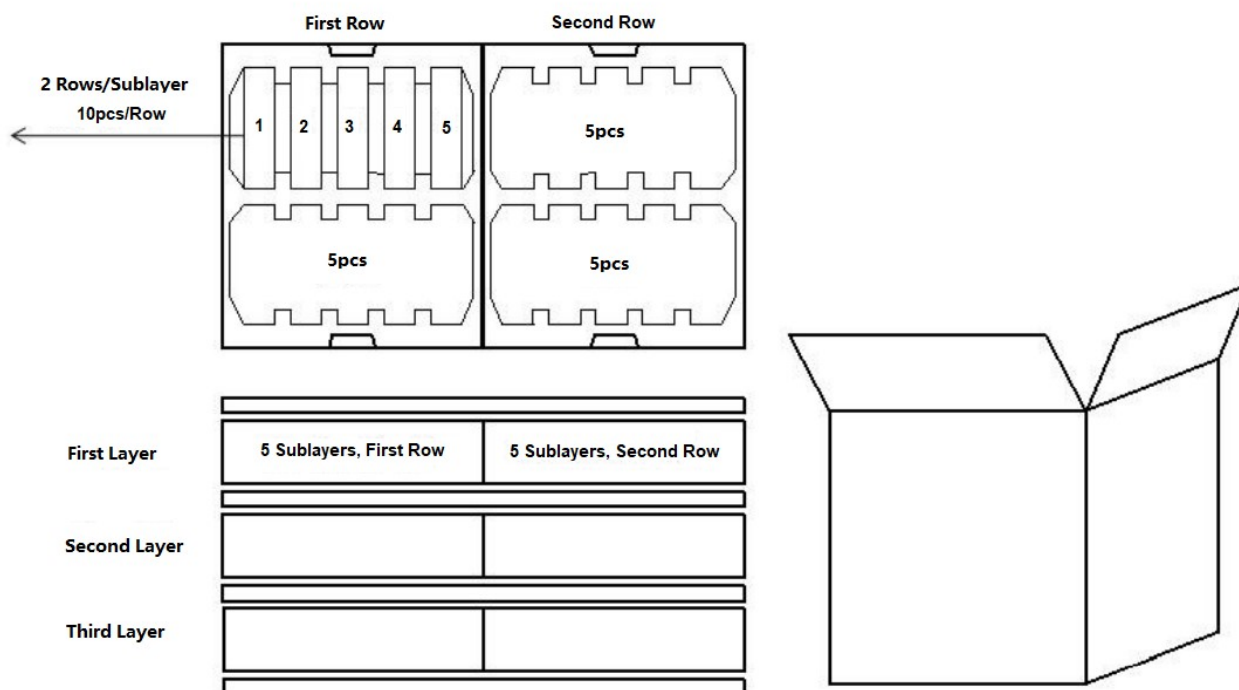
**Drawing 3 Dimension of 8500FS-L240 (Unit: mm)**

## Product Code Instruction

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# Packing Information



**Drawing 4** Packing information

Qty/Layer	Small Tray Qty	Big Tray Qty	Sensor per Carton	Carton Dimension	Packing Material
20pcs	5 layers	3 layers	300pcs	W395 * L320 * H470mm	Anti-static Plastic Tray

Remark:

Packing specification might be updated without prior notice.

## User Attention

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Please pay attention to below:

- (1) Install the sensor as far away as possible from the heat source and heat dissipation outlet of the compressor, and install the sensor as close as possible to the oxygen outlet, and install a one-way valve to prevent the water from humidifying glass from entering sensor.
- (2) In order to ensure reliability and long service life, do not use or store the sensor in a place where the temperature is higher than the rated temperature, and do not use the sensor in an environment where the voltage is higher than the rated voltage of the sensor.
- (3) Without necessary compensations, please do not use the sensor in the environments of high humidity water steam, abnormal pressure, and low temperature.
- (4) The product shall not be used or stored in a place with corrosive gas, especially hydrogen sulfide gas, acid, alkali, salt or similar. The products stored in the warehouse should be stored in normal temperature and humidity, and avoid direct sunlight.
- (5) When there is a problem with the Cubic's products, please contact Cubic team in time; the sensor must not be disassembled privately, and Cubic will not bear any consequences if it is damaged by disassembled privately.

## Consultancy & After-sales Service

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