

SPECIFICATION

Product Name: Ultrasonic Oxygen Sensor

Sensor Item No.: Gasboard-7500F

Version: V1.0

Date: August 09, 2019

Revision

No.	Version	Content	Reviser	Date
1	V1.0	First Edition	Una Zhan	2019-08-09

Ultrasonic Oxygen Sensor Module Gasboard-7500F



Applications

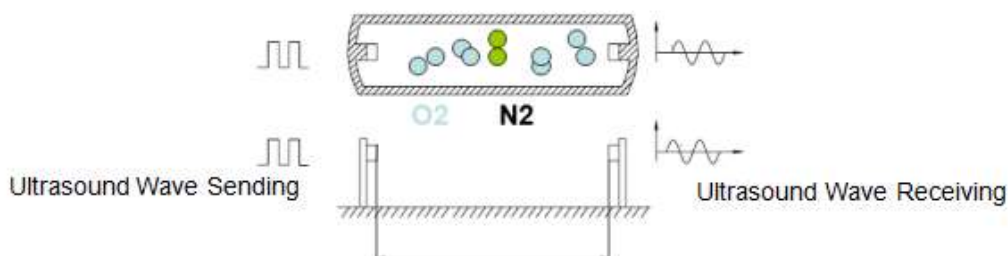
- ✧ Family and Medical Oxygen Concentrator/Generator
- ✧ Measurement the Flow of Clean Gas
- ✧ Gas Detection in Binary Gas (Including O₂)

Description

The Gasboard-7500F oxygen sensor is cost-effective and efficient sensor for measuring oxygen flow in binary gases. By adopting ultrasonic detecting technology, the sensor has remarkable characteristics, such as great stability, quick response, no need calibration, maintenance-free, no drift etc. The oxygen flow rate range is measured up to 40L/min, can be widely used in family and medical concentrator/generator.

Working Principle

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.



Features

- ✧ Principle of ultrasonic measurement adopted to measure flow rate of binary gas
- ✧ Measured flow rate up to 40L/min
- ✧ Full scale course temperature compensation
- ✧ Small size, quick response, stable, high accuracy
- ✧ Meet medical and other special requirements
- ✧ Long lifespan, self-calibration, maintenance-free
- ✧ RoHS, REACH, CMC, EMC, CE certificated

Specification

Ultrasonic Oxygen Sensor Specification	
Detect Principle	Ultrasonic Technology
Detection Range	0~40L/min
Detection Accuracy	±0.6L/min@ (10~50) °C
Resolution	0.1L/min
Response Time	<0.5S
Work Condition	10~50°C; 5~85%RH (Non-condensing)
Storage Condition	-20~60°C; 0~95%RH (Non-condensing)
Work Voltage	5~12V±0.5VDC
Average Work Current	<50mA
Communication Interface	UART_TTL
Product Size	W123*H41*D31mm
Life Span	≥5 Years

Pin Definition

Pin Definition List

J1(Optional)			J2		
NO	Pin	Description	NO	Pin	Description
1	GND	Power Ground	1	Vout	+3.3V/100mA Power Supply Output /5V-12V Power Supply Input
2	Vout1	0-5V Output Pin, Correspond 0%-99.9% Oxygen Concentration (Customized Option)	2	Rx	UART-Rx Receiving (3.3V/5V)
3	Vout2	0-5V Output Pin, Correspond 0-40L/min Oxygen Flow Rate (Customized Option)	3	Tx	UART-Rx Sending (3.3V)
4	NC	No Definition	4	GND	Power Ground

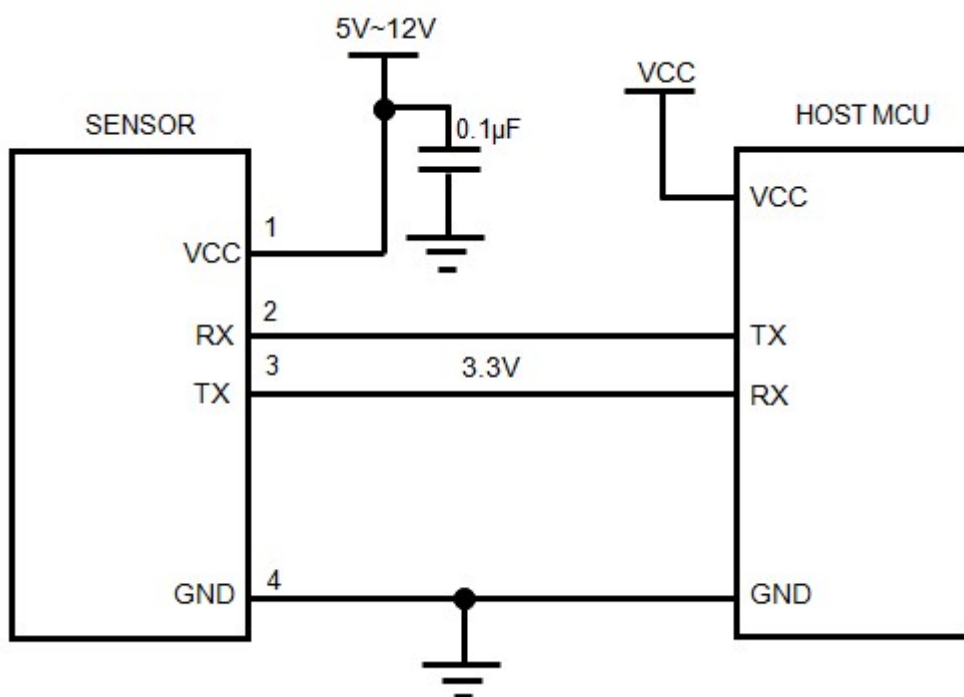
J5			Alarm Output		
NO	Pin	Description	NO	Pin	Description
1	Vcc	5-12VDC, External Power Supply Input Pin	1	Alarm Output	Alarm Output (Customized Options)
2	NC	No Definition			
3	GND	Power Ground			

Connectors Type

NO	Terminal	Connector	Pitch
J1	PH2.0-4A	PH2.0-4P	2.0mm
J2	PH2.0-4A	PH2.0-4P	2.0mm
J5	PH2.0-3A	PH2.0-3P	2.0mm

Reference Circuit

Application Scenarios: UART TTL 3.3V Output



Drawing 1 UART Communication Connection Circuit

Communication Protocol

UART Communication Protocol

1. Protocol Overview

- 1) Baud Rate: 9600, Data Bits: 8, Stop Bits: 1, Parity: No. Platform cannot send the data to PC automatically, module responses related data only after PC send command.
- 2) The protocol data are hexadecimal data. For example, "46" is [70] in decimal;
- 3) [xx] is single byte data (unsigned, 0-255); (xx) is double byte, signed (-32768 to +32767), the high byte is in front of low byte. Behind "—" is remark.
- 4) All data are integer, may there is (100,10,1) times corresponding relationship with the actual display data (sensor related).
- 5) The byte length of the entire command [LB]+3.

2. Communication Format

Send: [IP] [LB] [CMD] [DF] [CS]

[IP] = 0x11 Address (Fixed11)
 [LB] Follow length of byte exclude CS
 [CMD] Command number
 [DF] The parameter of the command, optional
 [CS] CS=256- [(START+LENGTH+CMD+DATA) %256]

Response:

2.1 When command is executed correctly, respond

[ACK] [LB] [CMD] [DF] [CS]
 [ACK] = 0x16 Command correct
 [LB] Follow length of byte exclude CS
 [CMD] Command number
 [DF] The parameter, optional
 [CS] CS=256- [(START+LENGTH+CMD+DATA) %256]

2.2 When command is not executed correctly, respond

[NAK] [LB] [CMD] [EC] [CS]
 [NAK]= 0x06 Command is not executed correctly
 [LB] = 2 Follow length of byte exclude CS
 [CMD] Command number
 [EC] The error code of command not executed correctly
 [CS] CS=256- [(START+LENGTH+CMD+DATA) %256]

[EC]

EC Value	Description
0x01	CS verification error
0x02	No this CMD, send this error code when the module receive unrecognized command
0x03	The length of data is incorrect
0x04	The date saved and set is out of range or the type of reading does not exist.

Communication Protocol

3. Serial Protocol Order Number List

No	Function Name	CMD	Function Description
1	Read the measurement result	0x01	In addition to returning measurement results, also return some status information
2	Set atmospheric pressure	0X0D	Set atmospheric pressure at the current environment
3	Read the software version number	0x1E	Read the software version number
4	Inquiry instrument serial number	0x1F	Inquiry instrument serial number

4. Detailed Description

4.1 Read the Measurement Result

Send : 11 01 01 ED

Response : [ACK] 09 01 (O2) (Flow1) (T) (Flow2) [CS]

Function : Read the measurement result

Description :

- (O2) is concentration of O2, unit is %; (FLOW1) is the standard condition flow rate, unit is L/min, (FLOW2) is real time flow rate, unit is L/min; (T) is temperature, unit is °C. The value is 10 times larger. (O2) (FLOW1) (T) (Flow2) is a 16-bit signed integer. The highest bit is the sign bit.

Example:

Hexadecimal data "0xFF 0xFF" is corresponding the data "-1".

Standard condition flow rate: 0.5L/min, temperature: 30.3°C, real time flow rate: 0.9L/min; then the returned character

string "16 09 01 01 0E 00 05 01 2F 00 09 93".

- The formula between standard condition flow rate and real time flow rate is as follows:

$$\text{Flow1 (standard condition flow rate)} = \text{Flow2 (real time flow rate)} * (\text{atmospheric pressure K_press}) / 101.3$$

Remark: When the instrument is powered on or reset, the sensor signal is not stable in a short time. At this time, the output results of the sensor from the serial port and voltage are irregular and meaningless.

4.2 Set Atmospheric Pressure

Send: 11 04 0D 05 [DF1] [DF2] [CS]

Response: [ACK] 04 0D 05 [DF1] [DF2] [CS]

Function: Set atmospheric pressure at the current environment

Description :

- Set Value = (DF1*256+ DF2) / (multiple);
- The description of "multiple" is the same as that defined in "read the measurement result" command. The atmospheric pressure is 10 times as high, example

Communication Protocol

Set the atmospheric pressure value as 101.3Kpa

[DF1] = (101.3*10)/256=03;

[DF2] = (101.3*10) %256=F5;

Set [DF1] as 03, [DF2] as F5

- [DF1] [DF2] = 0Xff 0xff read the value of atmospheric pressure

4.3 Read the Software Version Number

Send : 11 01 1E D0

Response : [ACK] 09 1E [CH1] [CH2] [CH3] [CH4] [CH5] [CH6] [CH7] [CH8] [CS]

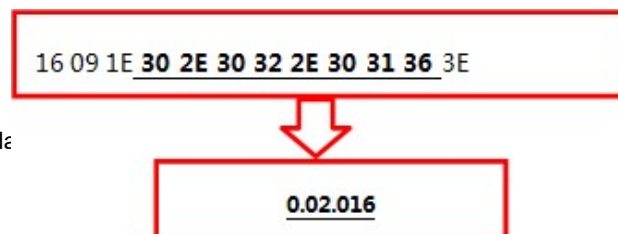
Function : Read the software version number

Instruction :

Read the software version number.

[CHx] is software version number, refers to the ASCII code

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



Hexadecimal Convert into ASCII Code:

4.4 Inquiry Instrument Serial Number

Send : 11 01 1F CF

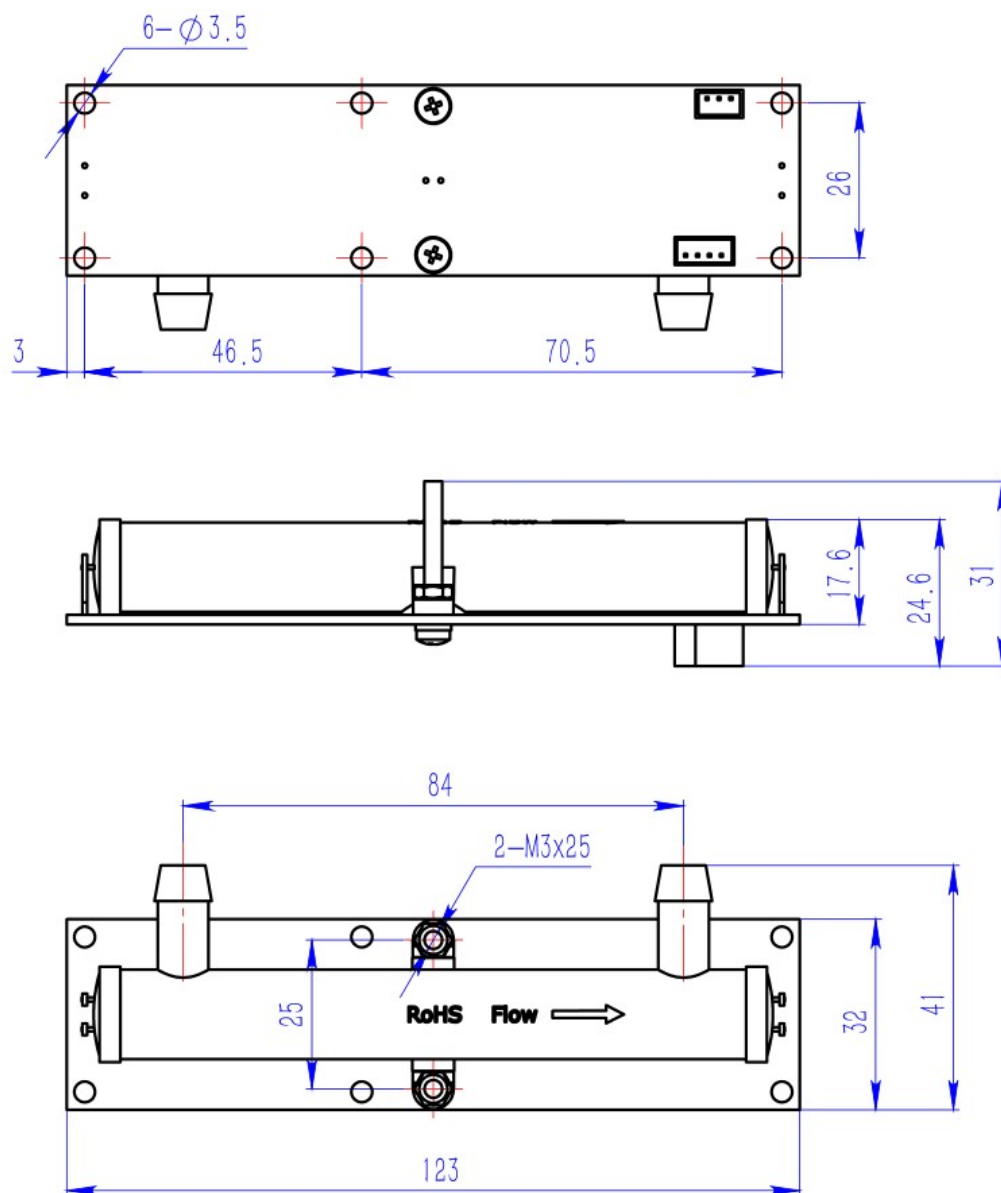
Response : [ACK] 0B 1F (SN1) (SN2) (SN3) (SN4) (SN5) [CS]

Function : Read version number for module firmware

Explanation :

Output instrument serial number of software. SN1 range is 0~9999, the first byte is 0, as 0100. 4 integer type constitute 20 serial number.

Dimension

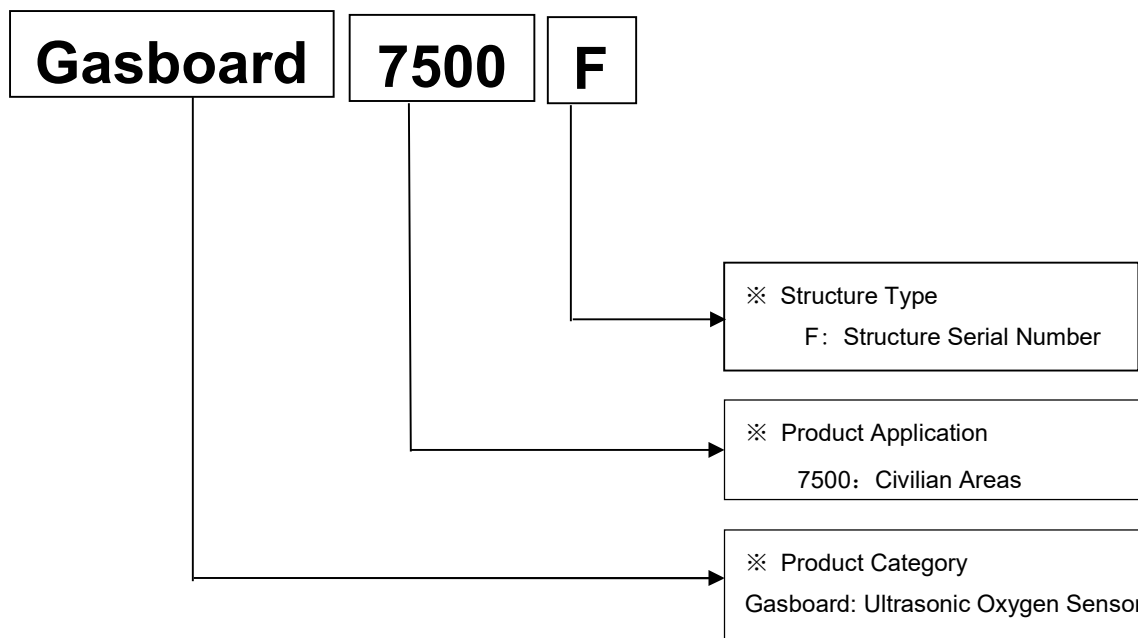


Drawing 2 (Unit:mm, Tolerance:±0.2mm)

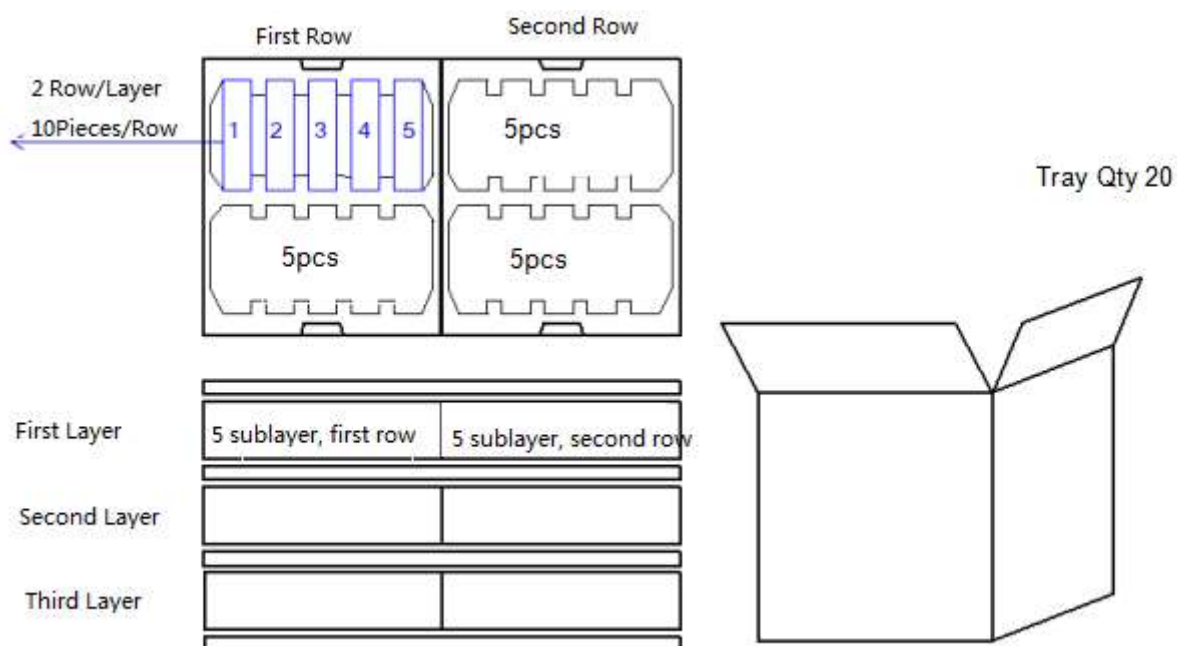
Reliability Testing

Item	Requirement	Criterion	Sample (n) Failed (c)
Flow Performance	Indoor temperature requirement: $25\pm 2^{\circ}\text{C}$, humidity (50 ± 10) %RH, after the sensor connect with serial port and power on, switch over the flow in 3L/min、5L/min、8L/min respectively to make measurement of oxygen concentration and accuracy.	Make new tests in different oxygen flow, all can meet deviation criterion.	n=70 c=0
Low Temperature Storage	Storing the sensor for 96H with no power under $-20^{\circ}\text{C}\pm 2^{\circ}\text{C}$ environment condition, then test the measuring deviation under normal temperature condition.	After staying under normal temperature condition for 2 hours, the test all can meet deviation criterion.	n=0 c=0
Low Temperature Operation	Indoor temperature requirement: $-10\pm 2^{\circ}\text{C}$, test the measuring deviation of sensor under normal temperature condition after operating for 96H with electricity.	After staying under normal temperature condition for 2 hours, the test all can meet deviation criterion.	
High temperature Storage	Storing the sensor for 96H with no power under $60^{\circ}\text{C}\pm 2^{\circ}\text{C}$ environment condition, then test the measuring deviation under normal temperature condition.	After staying under normal temperature condition for 2 hours, the test all can meet deviation criterion.	
High Temperature Operation	Indoor temperature requirement: $50\pm 2^{\circ}\text{C}$, test the measuring deviation of sensor under normal temperature condition after operating for 96H with electricity.	After staying under normal temperature condition for 2 hours, the test all can meet deviation criterion.	
High-low Temperature Shock	Keep the sensor under -20°C for 60 mins, then switch it to 60°C in 10s and stay for another 60 mins, this is one cycle. Totally 10 cycles with the sensor power off.	After staying under normal temperature condition for 2 hours, the sensor accuracy should meet the specification standard.	
High Temp & Humidity	Keep the sensor under high temp & humidity ($40\pm 2^{\circ}\text{C}$, 95%RH), after working under rated voltage for 500H, test the measuring deviation under normal temperature condition.	After staying under normal temperature condition for 2 hours, the sensor accuracy should meet the specification standard.	
Salt Spray Test	Standard: GB/T2423.17, place the sensor in the salt fog box under 35°C and spray it with NaCl solution (concentration is 5%) for 24 hours, then flushing it with distilled water and drying it with airflow.	Keep the sensor under standard environment more than 1h and less than 2 h, it should no appearance defect, no corrosion.	
Vibration Test	Bare sensor should bear the specified vibration test in X/Y/Z direction, frequency range 10~55~10Hz/min, amplitude 1.5mm, scan circulation 2 hours.	No appearance defect after vibration test, the sensor can meet basic performance test standard.	n=4 c=0
Package Drop Test	Drop height: setting the height as specified weight according to standard GB/T 4857.18. Making the drop test according to the GB/T4857.5 standard. Test sequence is one corner, three edges, six sides.	No appearance defect after drop test, no components fall off, the sensor should work normally.	n=1 ctn c=0

Product Code Instruction



Packing Information



Qty/Layer	Small Tray Qty	Big Tray Qty	Sensor per Carton	Carton Dimension	Packing Material
20 pcs	5 layers	3 layers	300pcs	W520 * L330 * H480 mm	Anti-static Plastic Tray

User Attention

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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