SPECIFICATION

Product Name：Ultrasonic Oxygen Senor

Sensor Item No.: Gasboard-7500H

Gasboard-7500HA

Gasboard-7500HA-RH

Gasboard-7500HA-BC

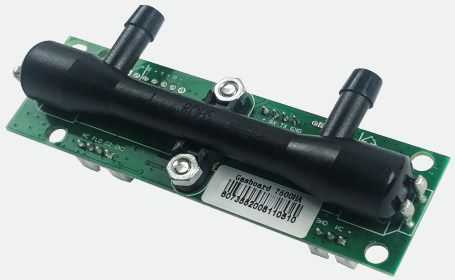
Version: V1.1

Date: May 7th,2022

Revision

No.	Version	Content	Date
1	V1.0	First Edition	2020-08-11
2	V1.1	- O2 concentration detection range changes from 20.5%~95.6% to 0 ~ 100% - Replace term “response time” with “data update time” - Add footnote to explain analog output to concentration conversion	2022-05-07

Ultrasonic Oxygen Sensor Module Gasboard-7500H Series



Applications

- ✧ Family and Medical Oxygen Concentrator/Generator
- ✧ Medical Ventilator
- ✧ Respiratory Device, Anesthetic Machine and Vaporizer
- ✧ Flow Measurement of Clean Air

Description

Gasboard-7500H series is a type of ultrasonic oxygen gas sensors, which can realize accurate and stable measurements for oxygen concentration and flow rate. Gasboard-7500H series provide a new, economical, durable option for system designers who is seeking for medical oxygen sensor for PSA oxygen generator, medical ventilator, respiratory device, anesthetic machine and vaporizer. By adopting ultrasonic detecting technology and principle of TOF (time of flight) measurement, Gasboard-7500H series have great performances: excellent stability, high accuracy, fast response, continuous monitoring, no drift, no need routine calibration, maintenance-free, etc.

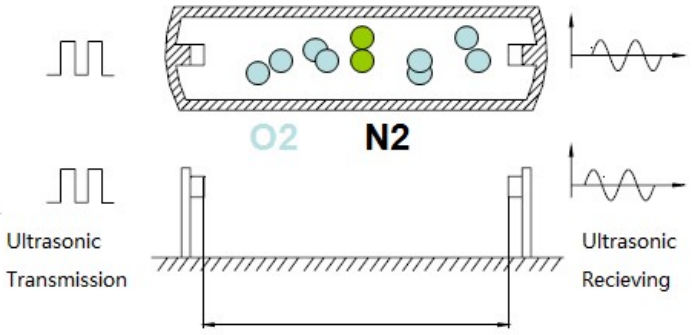
Features

- ✧ Ultrasonic technology, for both oxygen concentration and flow rate measurement
- ✧ 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 compensation (humidity compensation is also available)
- ✧ No-consuming parts, long Lifespan
- ✧ Small size, flexible installation
- ✧ High performance-cost-ratio
- ✧ Support serial port and analog output accurate measurements
- ✧ Enhanced EMC performance
- ✧ RoHS, REACH, CMC, CE certificated

Working Principle

Flow rate measurement principle: measure the TOF (time of flight) difference between the pulses of ultrasound propagating into and against the direction of the flow to calculate the flow rate.

Concentration measurement principle: when there is a molecular mass difference between the components of binary gas mixture, the sound propagation velocity varies with the composition of the two gases.



Specification

Ultrasonic Oxygen Sensor Gasboard 7500H Series Specifications				
Model	7500H	7500HA	7500HA-RH	7500HA-BC
Detect Principle	Ultrasonic Technology			
Detection Range [1)]	O2 Concentration: 0%~100%			
	Flow Rate: 0~10L/min			Flow Rate:0~2L/min
Accuracy [2)]	O2 Conc.: ±1.5%FS		O2 Conc.: ±3%FS	O2 Conc.: ±1.5%FS
	Flow Rate: ±0.2L/min			Flow Rate: ±0.1L/min
Resolution	O2 Concentration: 0.1%			
	Flow Rate: 0.1L/min			Flow Rate: 0.01L/min
Data Update Time	100ms (10 samples per seconds)			
Analog output [3)]	NA	O2 Concentration: 200mV - 2500mV (DC)		NA
	NA	Flow Rate: 200mV - 2500mV (DC)		NA
Work Condition	5~50℃; 0~95%RH(Non-condensing)			
Storage Condition	-20~60℃; 0~95%RH(Non-condensing)			
Work Voltage	DC 4.75-12.6V, Ripple Wave <50mV			
Work Current	Average Current ≤ 35mA; Peak Current < 50mA			
Communication Interface	UART_TTL (3.3V)			
Product Size	W80*H22*D25 mm			
Life Span	≥15 Years			

Note:

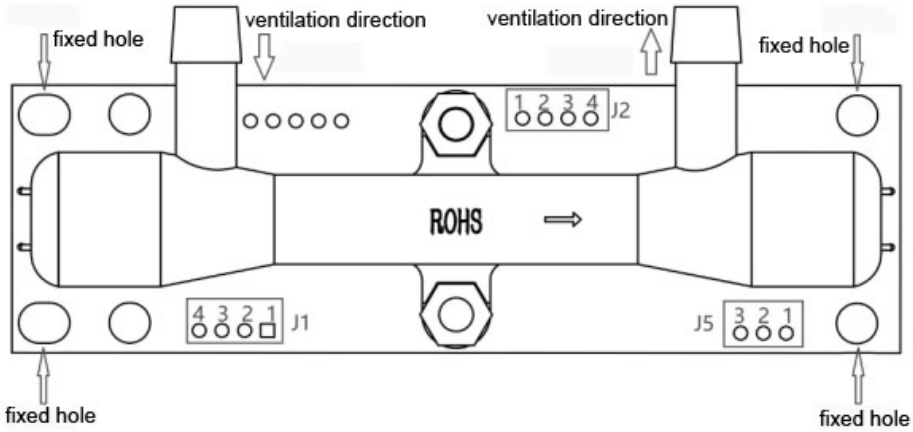
*1) 7500H series are calibrated with PSA oxygen source and the concentration output is for PSA oxygen with detection range 20.5% to 95.6%. In case of a pure oxygen source, the concentration should be converted using formula (transfer relationship is: target concentration = (sensor reading * 1.142) - 3.42, in which target concentration is for pure oxygen source). Measuring range for pure oxygen is 0~100%. Please note that the sensor's serial port sends active data by default with concentration range from 20.5% to 95.6% and concentration range from 0 to 100% can be read by sending commands (see "Communication Protocol" chapter for details).*

2) 7500H, 7500HA and 7500HA-BC sensors are for dry oxygen measurements with concentration accuracy ±1.5%FS @ (5~45) ℃. 7500HA-RH sensors are improved with humidity compensation with oxygen concentration accuracy ±3%FS @ (5~45) ℃ ; 0~95%RH (Non-condensing), which can be also used for applications such as ventilators etc., where the oxygen contains humidity. Flow rate accuracy is guaranteed @ (5~45) ℃; 101.3kPa.

3) 7500HA and 7500HA-RH sensors' concentration analog output is with 200mV corresponds to concentration 0%, 2500mV corresponds to 100% and 683mV in air by default corresponds to oxygen concentration 21%. For PSA oxygen source, the concentration result can be directly converted with the linear relationship between the output voltage and concentration. In case of a pure oxygen source, first convert the analog output voltage to oxygen concentration in percentage by the linear relationship, then transfer the concentration to pure oxygen concentration using formula mentioned in note 1).

Model	**7500H**	**7500HA**	**7500HA-RH**	**7500HA-BC**
Temperature compensation	√	√	√	√
Humidity compensation			√	
Analog output		√	√	
High accuracy at low flow rate				√

Pin Definition



Drawing 1 Gasboard-7500H Series Pin Definition

Table 1. Connector Pin Definition

J2			J5		
No.	**Pin**	**Description**	**No.**	**Pin**	**Description**
1	Vcc	4.75-12.6V, External Power Supply Input Pin	1	Vcc	4.75-12.6V, External Power Supply Input Pin
2	Rx	UART-Rx Receiving (3.3V)	2	NC	No Definition
3	Tx	UART-Rx Sending (3.3V)	3	GND	Power Ground
4	GND	Power Ground			
Remark: J2 Definition is for 7500H, 7500HA, 7500HA-RH, 7500HA-BC			**Remark: J5 Definition is for 7500H, 7500HA, 7500HA-RH**		

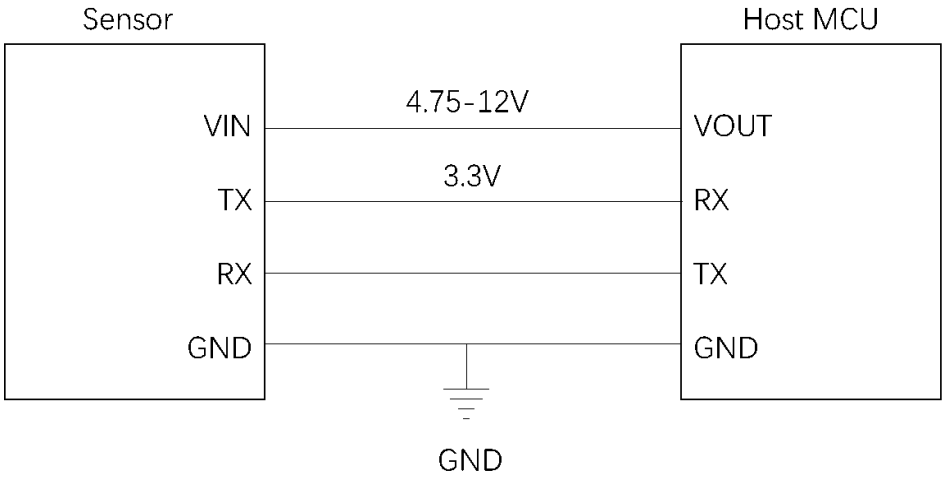
J1		
No.	**Pin**	**Description**
1	GND	Analog output
2	O2	200mV-2500mV output pin, 200mV corresponds to 0%Vol oxygen concentration; 2500mV corresponds to 100%Vol oxygen concentration
3	Flow	200mV-2500mV output pin, 200mV corresponds to flow rate of 0L/min 2500mV corresponds to flow rate of 10L/min
4	NC	Not connected
Remark: J1 Definition is only for 7500HA, 7500HA-RH		

Table 2. 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
J5	PH2.0-3A	PH2.0-3P	2.00mm

Reference Circuit

Application Scenarios: UART 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
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 a head of low byte;
4) The sensor will send data actively by default and the sending interval is 0.5 seconds. If you need to read more other data, send the corresponding commands directly to the host and the host will respond immediately.

2. Serial Communication Protocol Format

Host Send Format

Start Symbol	Length	Command	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	Byte length of the frame, =data length+1 (include CMD+DATA)
Command	Command 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 Command List

No	Function Name	Command
1	Read the measurement result of O2	0x01
2	Read the software version number	0x1E
3	Inquiry instrument serial number	0x1F
4	Open reading value<20.5%	0x02

4. Detailed Description

4.1 Read the Measurement Result of O2

Send: 11 01 01 ED

Response: 16 09 01 DF1-DF8 [CS]

Function: Read the measurement result of O2

Description:

O2 Concentration = (DF1*256 + DF2)/10 (Vol %)

O2 Flow Value = (DF3*256 + DF4) /10 (L/min)

O2 Temperature Value = (DF5*256 + DF6) /10 (℃)

Note:

1) DF7-DF8 reserved

2) The default is active data sending. The sensor can also output the value automatically without sending the command. When sending 11 01 07 E7, the output can be changed from active data sending mode to request-response mode.

Response Example:

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

Remark: Hexadecimal convert into Decimal: CD is 205; C2 is194

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℃)

4.2 Read the Software Version Number

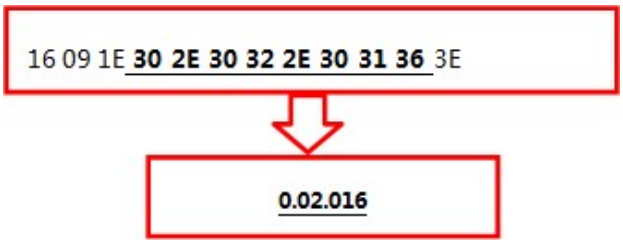
Send: 11 01 1E D0

Response: 16 09 1E DF1-DF8 [CS]

Function: Read the module's firmware version

Description: 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]

Function: Read the module's serial number

Explanation: Outputs the module's serial number. SNn range is 0~9999, 5 integers constitute a 20-bit serial number.

4.4 Open Reading Value (0-100%)

Send: 11 02 02 00 EB

Response: 16 0C 02 00 DF1 DF2 DF3 DF4 DF5 DF6 DF7 DF8 DF9 DF10 [CS]

Function: Read the measurement result of O2 (0-100%)

O2 flow = (DF9*256 + DF10) /10 (L/min)

O2 concentration = (DF7*256 + DF8) /10 (Vol %)

O2 temperature = (DF5*256+ DF6) /10 (℃) (gas temperature in sensor chamber)

Example:

Response: 16 0C 02 00 5D 90 5D 7E 00 C2 00 CD 00 00 7B

Remark:

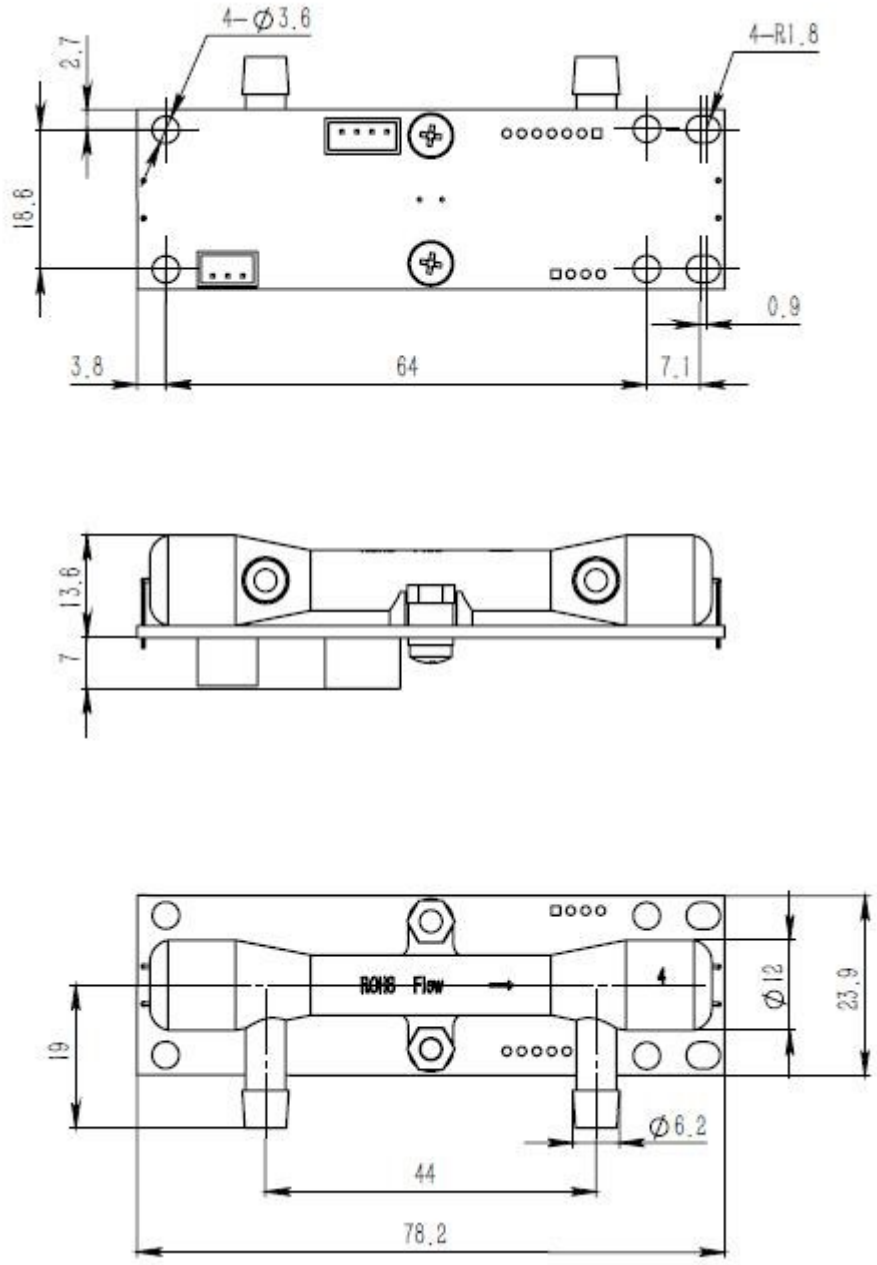
Hexadecimal convert into Decimal: CD is 205; C2 is194

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

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

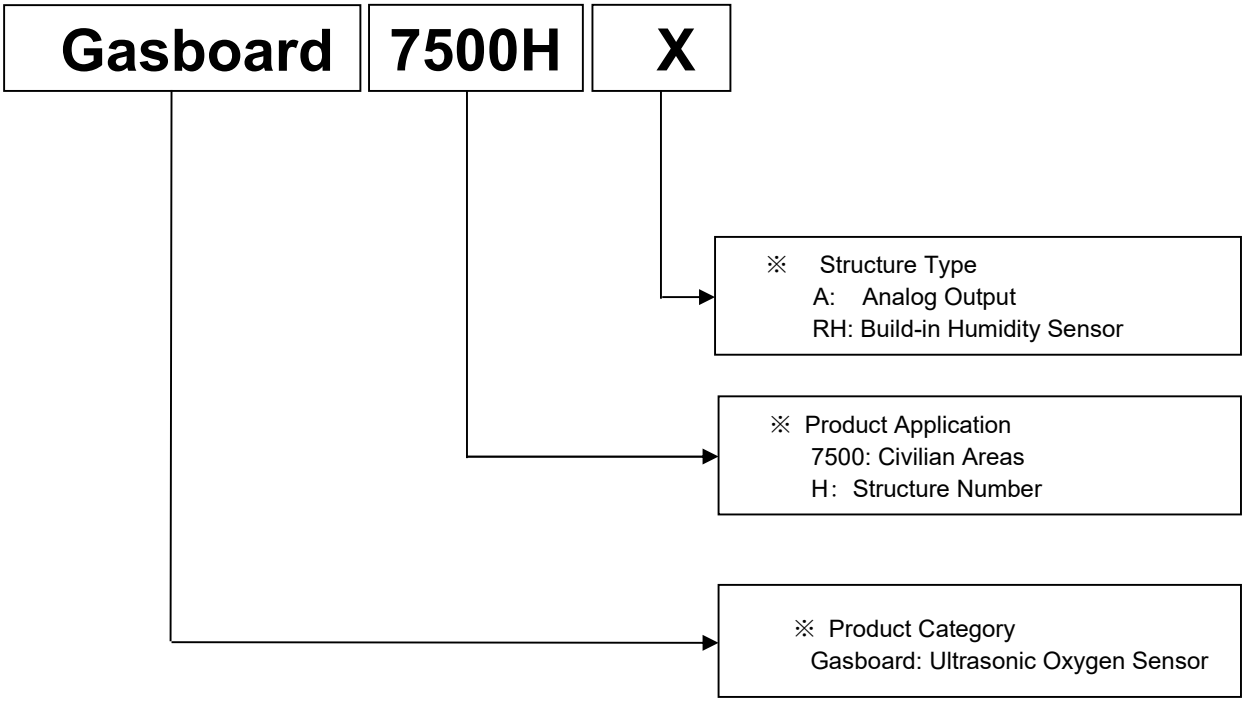
O2 Temperature Value=0*256+194=194 (19.4℃)

Dimension



Drawing 3（Unit: mm, Tolerance: ±0.2mm）

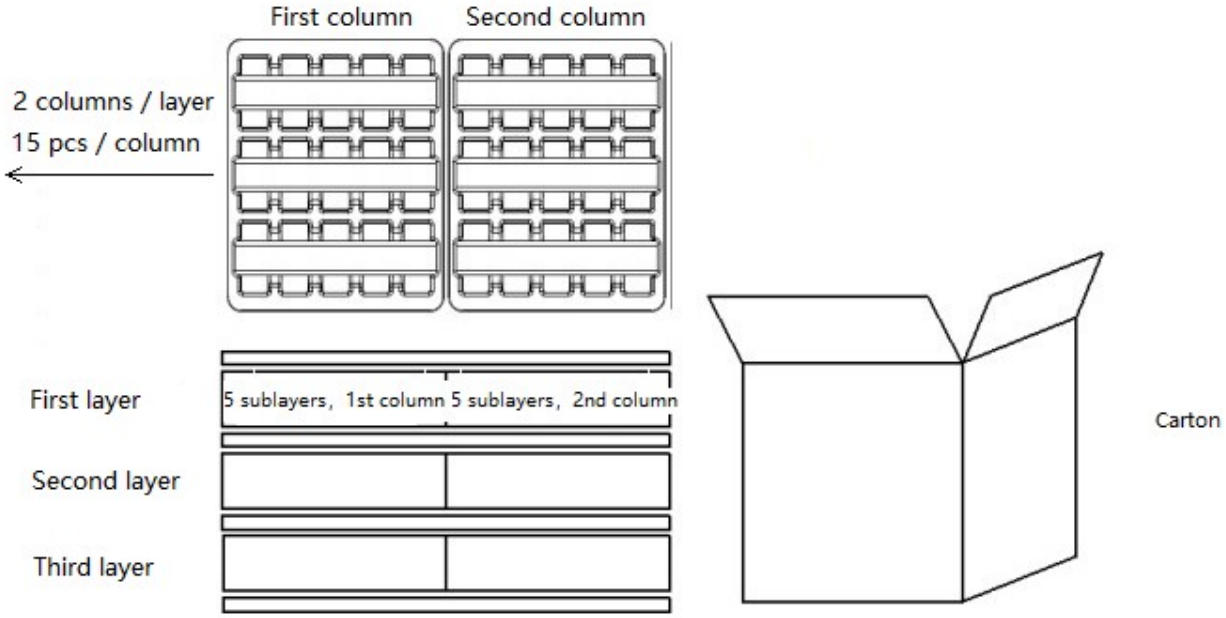
Product Code Instruction



Reliability Testing

Item	Requirement	Criterion	Sample (n) Failed (c)
Flow Performance	Indoor temperature requirement: 25±2℃, 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℃±2℃ 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±2℃, 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℃±2℃ 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±2℃, 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℃ for 60 mins, then switch it to 60℃ 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±2℃,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℃ 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.	n=2 c=0
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 c=0

Packing Information



Qty/Layer	Small Tray Qty	Big Tray Qty	Sensor per Carton	Carton Dimension	Packing Material
30 pcs	5 layers	3 layers	450pcs	W395*L320*H470mm	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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