SPECIFICATION

Product Name: Ultrasonic Oxygen Sensor

Model No. : Gasboard-8500V-RH

Version: V0.2

Date: April 28, 2022

Revision

No.	Version	Content	Date
1	V0.1	First Edition	2020-10-02
2	V0.2	- Changes on accuracy definitions - Replace term “response time” with “data update time” - Change storage temperature condition from “-20~50℃” to “-20~70℃” - Changes on J1 and J2 pin definitions	2022-04-28

Ultrasonic Oxygen Sensor Gasboard-8500V-RH

Applications:

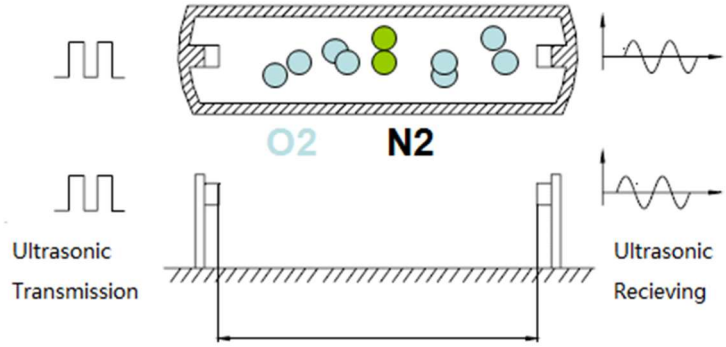
- ✧ Family portable oxygen concentrator, medical concentrator, large oxygen generator.
- ✧ Family ventilator, medical ventilator.
- ✧ The binary gas (include oxygen) detection.

Description

Gasboard-8500V-RH ultrasonic oxygen sensors is an economical gas sensor used to detect oxygen concentration in binary gases. By adopting ultrasonic detecting technology and principle of TOF (time of flight) measurement, Gasboard-8500V-RH sensor has the advantages of very stable, maintenance-free, no drift, no need routine calibration and no-consuming parts and can be used for continuously monitoring with long life span. With full range temperature and humidity compensation, Gasboard-8500V-RH sensor can measure gas concentration more accurately. Gasboard-8500V-RH sensor is small in size and easy to be integrated to medical ventilator and other equipment.

Working Principle

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.



Main Features

- ✧ Ultrasonic measurement technology adopted to oxygen concentration measurement.
- ✧ Based on principle of TOF (time of flight) measurement, continuous monitoring, no drift, no need routine calibration, maintenance-free.
- ✧ No-consuming parts, long life span.
- ✧ Full range temperature and humidity compensation.
- ✧ Excellent stability, high accuracy, fast response.
- ✧ Small size thus easy to be integrated into medical ventilators.
- ✧ High performance-cost-ratio.

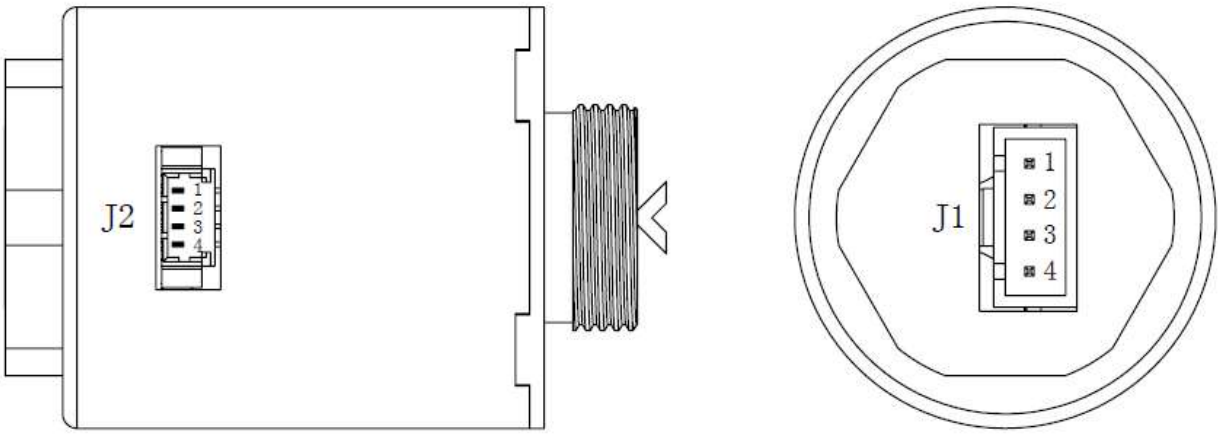
Specifications

Ultrasonic Oxygen Sensor Specifications	
Sensor Type	Gasboard-8500V-RH
Detection Method	Ultrasonic Technology
Detection Range [1)]	0-100%
Accuracy [2)]	Tipical. ±2.5%FS@(10~40)℃;0~40%RH Max. ±3%FS @(5~45)℃;0~95%RH (non-condensing)
Resolution	0.1%
Data Update Time	100ms
Working Condition	0~50℃; 0~95%RH (non-condensing)
Storage Condition	-20~70℃; 0~95%RH (non-condensing)
Working Voltage	DC 4.75-12.6V, Ripple Wave≤50mV
Working Current	Average current ≤40mA; Peak current ≤ 50mA
Communication Interface [3)]	UART_TTL (3.3V); IIC (reserved)
Analog Voltage Output [3)]	200mV-2300mV (0 to 100% O2 concentration)
Size	Ø30X46mm
Life Span	≥15 years

Note:

1) *Concentration measuring range for pure oxygen source is 0 to 100% and for PSA oxygen source is 20.5% to 95.6%. The sensor could withstand flow rate max. 20L/min in mainstream. 8500V-RH is calibrated with pure oxygen source and the concentration output is for pure oxygen. In case of a PSA oxygen source, the concentration should be converted using formula (transfer relationship is: sensor reading = (target concentration*1.142)-3.42%, in which target concentration is for PSA oxygen source).*
2) *The sensor is calibrated at high, middle and low temperature points and compensated with a built-in temperature and a humidity sensor to ensure accuracy typical. ±2.5%FS at (10~40) ℃;0~40%RH condition and max. ±3%FS at (5~45) ℃; 0~95%RH (non-condensing) condition. Typical accuracy of O2 concentration meets ISO 80601-2-55 requirements.*
3) *UART and analog voltage outputs values are all with full temperature and humidity compensation. 8500V-RH sensors' concentration analog output is with 200mV corresponds to concentration 0%, 2300mV corresponds to 100%. In case of a PSA source, first convert the analog output voltage to oxygen concentration in percentage by the linear relationship between the output voltage and concentration, then transfer the concentration to PSA oxygen concentration using formula mentioned in note 1).*

Pin Definition



Drawing 1 Gasboard-8500V-RH Pin Definition Drawing

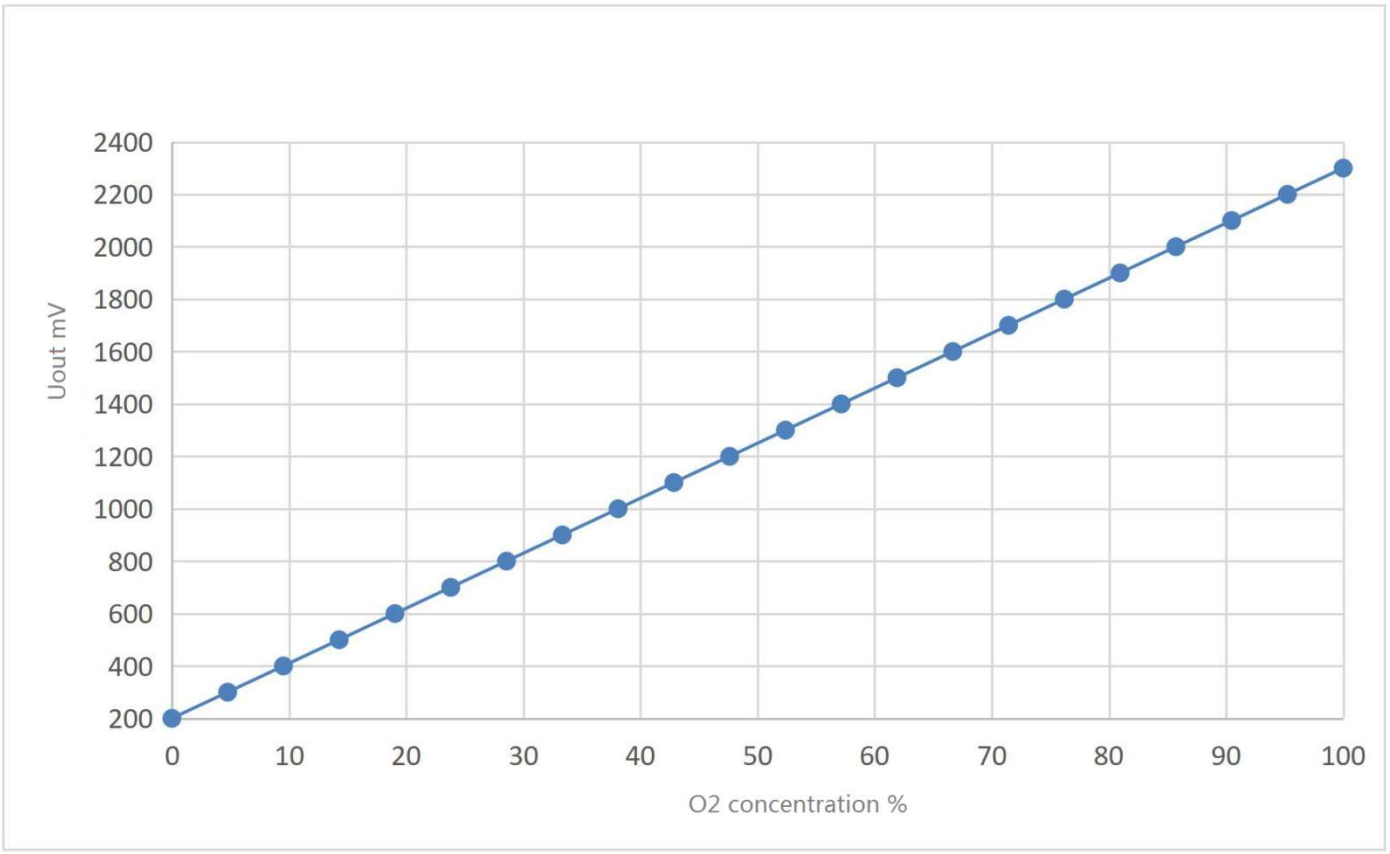
Pin Definition

J1			J2		
No.	**Pin**	**Description**	**No.**	**Pin**	**Description**
1	GND	Power & Signal Ground	1	VIN	Power Supply (4.75-12.6V DC)
2	VIN	Power Supply (4.75-12.6V DC)	2	Rx / SDA	Serial Send / IIC Data (3.3V)
3	NC	Not Connected	3	Tx / SCL	Serial Receive / IIC Clock (3.3V)
4	Vout	Analog Output(200mV~2300mV)	4	GND	Power Ground
			Remark: IIC is reserved		

Connector Description

Port	Terminal	Connector	Pin Pitch
J1	XH-4AW	XH-4Y	2.54mm
J2	A1251WR-S-4P	A1251H-4P	1.25mm

Linearity between Output Signal and Oxygen Concentration



Drawing 2 Linearity between Output Signal and Oxygen Concentration

Linearity Relationship:

O2 and Vout has a linear relationship as below:

O2 = 0% → Vout = 200mV

O2 = 100% → Vout = 2300mV

The corresponding oxygen concentration of the output signal can be calculated by the following formula:

O2(%) = [Vout(mV) -200] /21

Example:

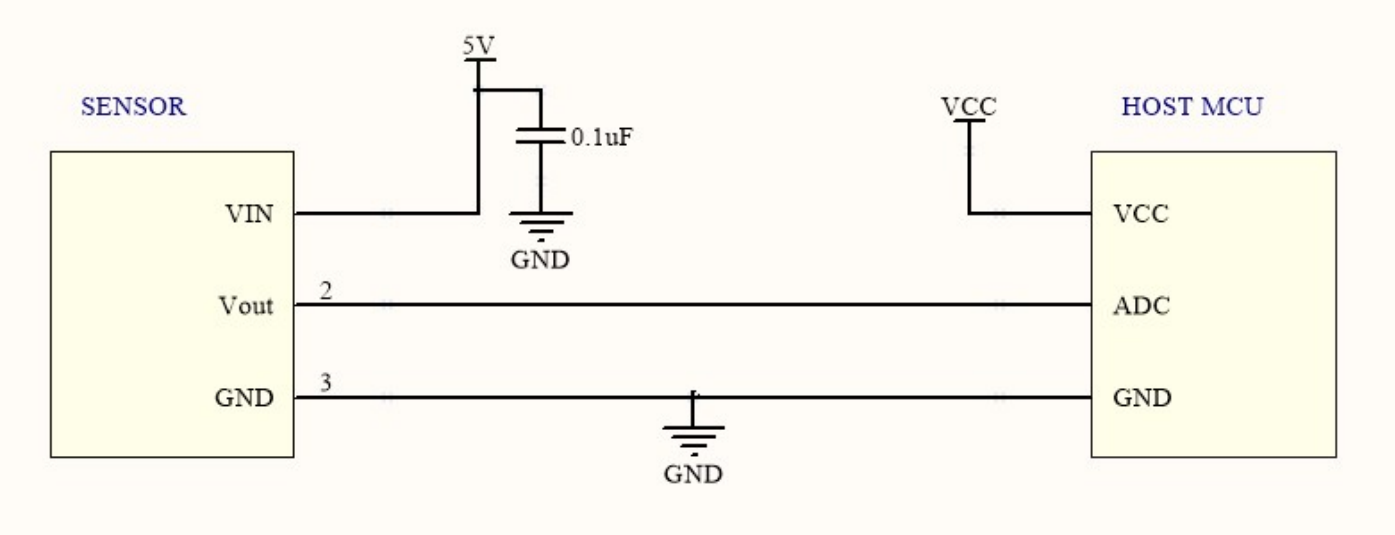
When output Vout(mV) = 800mV, oxygen concentration is calculated as below:

O2(%) = (800-200)/21=28.57

The oxygen concentration is 28.57%.

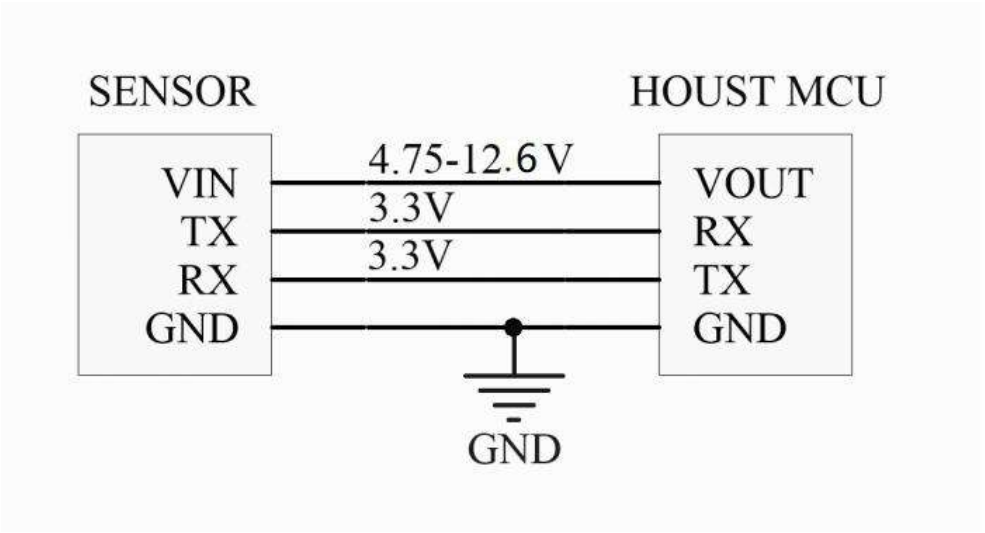
Reference Circuit

Application Scenarios 1: Analog output



Drawing 3 Reference Analog Output Connection Circuit

Application Scenarios 2: UART TTL 3.3V



Drawing 4 Reference 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. The user needs to read more other data, send the corresponding commands directly to the host and the host will respond immediately.

2. Serial Communication Protocol Format

PC Send Format

Start Symbol	Length	Command	Data 1	……	Data n	Checksum
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)
Command	Command number
Data	Read or written data, the length is variable
Checksum	The sum of data accumulation, =256-(HEAD+LEN+CMD+DATA)

3. Serial Protocol Command List

No.	Functions	Command
1	Read the measurement result of O2	0x01
2	Read the firmware version of the sensor	0x1E
3	Read the serial number of the sensor	0x1F
4	Open reading value<20.5%	0x02

4. Detailed Descriptions

4.1 Read the Measurement Result of O2

Send: 11 01 01 ED

Response: 16 09 01 DF1 DF2 DF3 DF4 DF5 DF6 DF7 DF8 [CS]

Function: Read the measurement result of O2

Explanation: O2 concentration = (DF1*256 + DF2)/10 (Vol %)

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

Attention: DF7 DF8 reserved

Remark: The sensor will send data actively and periodically by default. The data can also be requested by sending command to the sensor. Send command 11 01 07 E7 to toggle between active data mode and request mode.

Response example:

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

Explanation:

Hexadecimal convert into decimal: CD is 205; C2 is 194

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

O2 temperature value =0*256+194=194 (19.4℃)

4.2 Read the Software Version Number

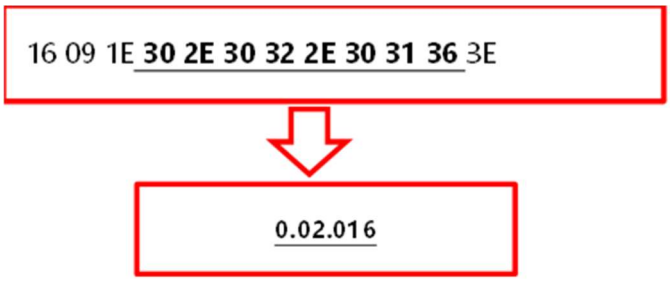
Send: 11 01 1E D0

Response: 16 09 01 DF1-DF8 [CS]

Function: Read the module's firmware version

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

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



Hexadecimal convert into ASCII code

4.3 Read Sensor 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<20.5%

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

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

Example:

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

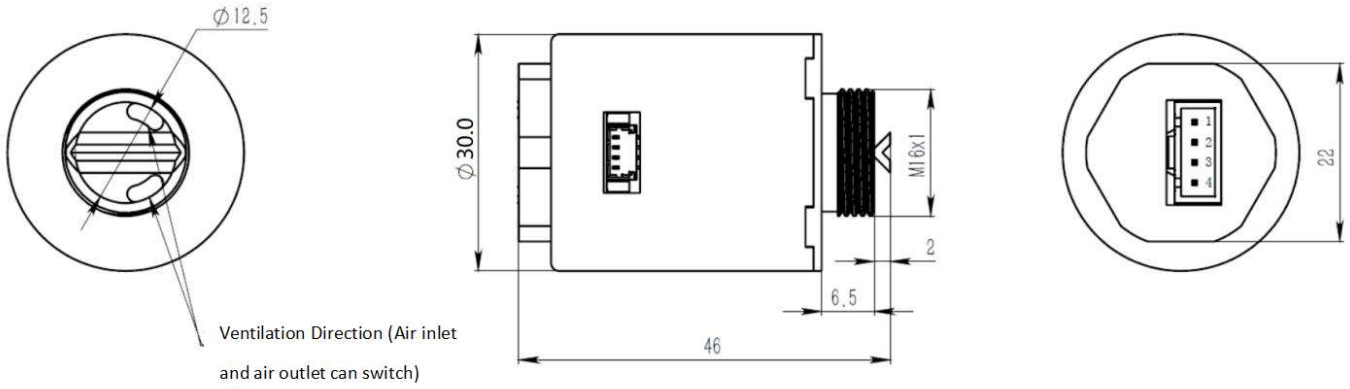
Explanation:

Hexadecimal Convert into Decimal: CD is 205; C2 is194

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

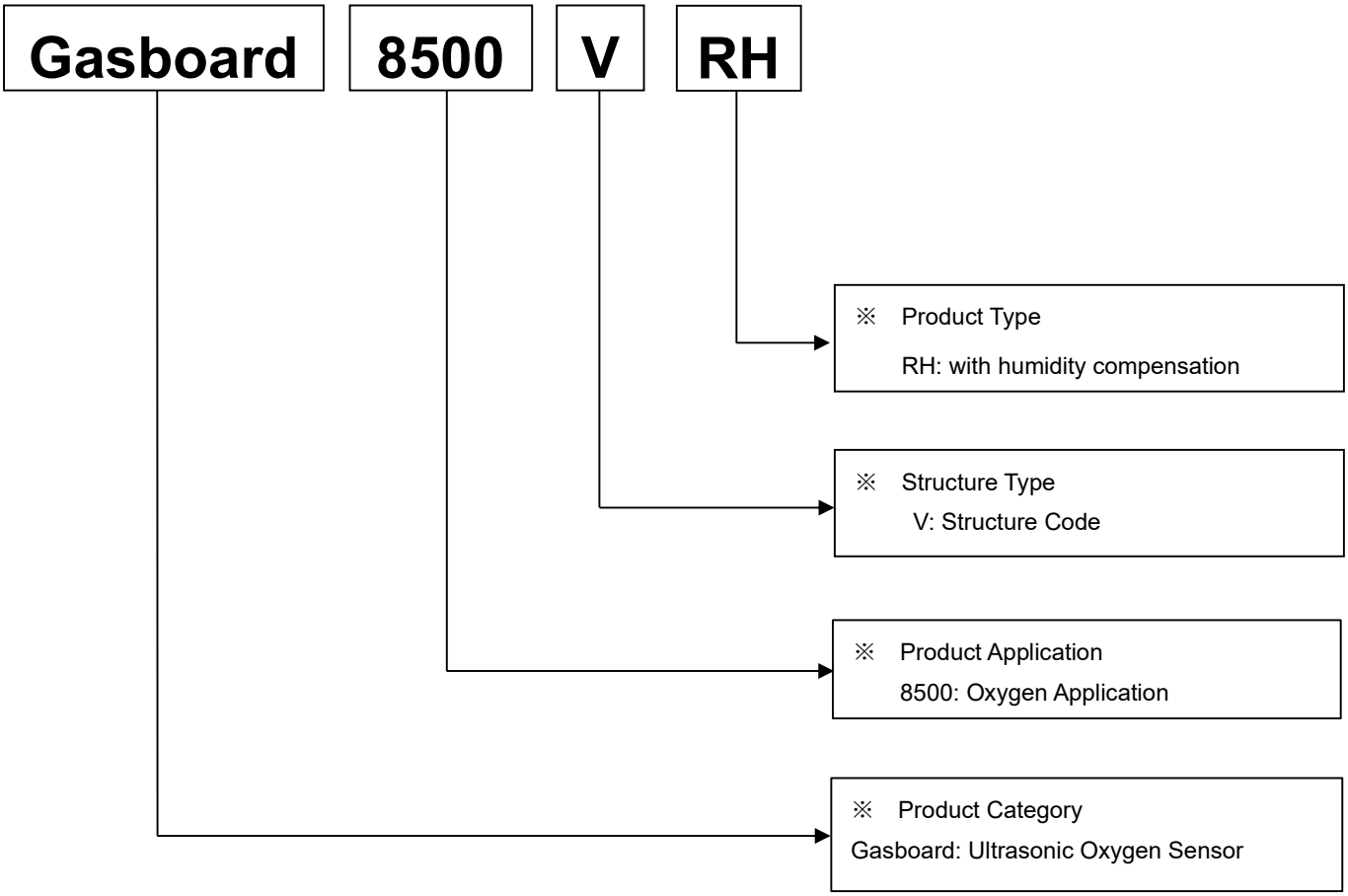
O2 Temperature = 0*256 +194=194 (19.4℃)

Dimension



Drawing 5 External Dimension (Unit: mm, Tolerance: ±0.2mm)

Product Code



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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