

SPECIFICATION

Product Name: Ultrasonic Oxygen Sensor

Model No: Gasboard-8500V-RH

Version: V0.1

Date: October 02, 2020

Revision

No.	Version	Content	Date
1	V0.1	First revision	2020-10-02

Ultrasonic Oxygen Sensor Gasboard-8500V-RH



Applications:

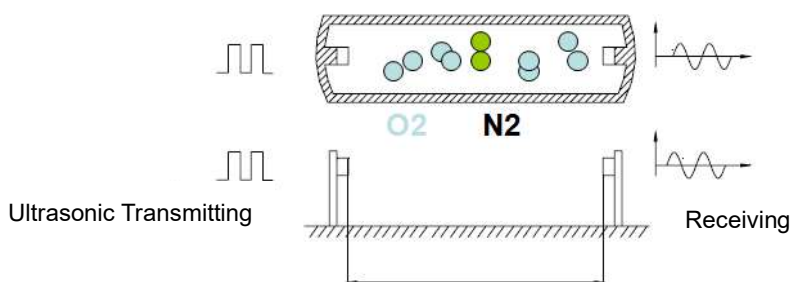
- ✧ Family portable oxygen concentrator, medical concentrator, large oxygen concentrator.
- ✧ Family ventilator, medical ventilator.
- ✧ The binary gas (include oxygen) detection.

Description:

Gasboard-8500V-RH ultrasonic oxygen sensors are 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 sensors are very stable, maintenance-free, no drift, no need routine calibration and no-consuming parts, can continuously monitor with long life span. These products are also with full range temperature and humidity compensation, can measure gas concentration more accurately. Gasboard-8500V-RH sensors are small size and easy to be integrated to medical ventilator and other equipment.

Working Principle:

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



Main Feature:

- ✧ 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.
- ✧ Easy to be integrated to medical ventilator, small size.
- ✧ High performance-cost-ratio.

Specifications

Ultrasonic Oxygen Sensor Specifications	
Sensor Type	Gasboard-8500V-RH
Detection Method	Ultrasonic Technology
Detection Range ^①	0-100%
Accuracy	±3%FS @ (5~45)°C
Resolution	0.1%
Response Time ^②	≤5s (T ₉₀)
Working Temperature	0~50°C; 0~99%RH below (non-condensing)
Storage Temperature	-20~50°C; 0~95%RH below (non-condensing)
Working Voltage	DC 4.75-12.6V, Ripple Wave≤50mV
Average Working Current	≤40mA
Communication Interface ^③	UART_TTL (3.3V), Analog Voltage Output
Analog Voltage Output ^③	200mV-2300mV (0 to 100% O ₂ concentration)
Size	Ø30X46mm
Life Span	≥5 years

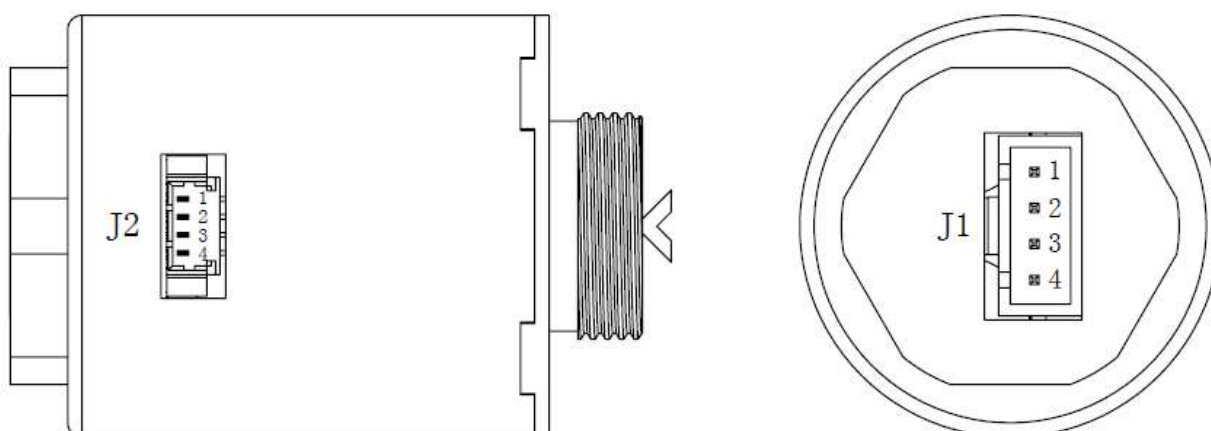
Remark^① PSA oxygen source oxygen concentration detection range 20.5%~95.6%.

The max gas flow is 20L/min when the sensor is in mainstream.

^② T₉₀ is ≤5s at Gas flow 0.5L/min scenarios; T₉₀ is ≤15s at gas flow 0.2L/min.

^③ UART OUTPUT AND ANALOG VOLTAGE OUTPUT values are all with full temperature and humidity compensation.

Pin Definition



Drawing 1 Gasboard-8500V-RH Pin Definition Drawing

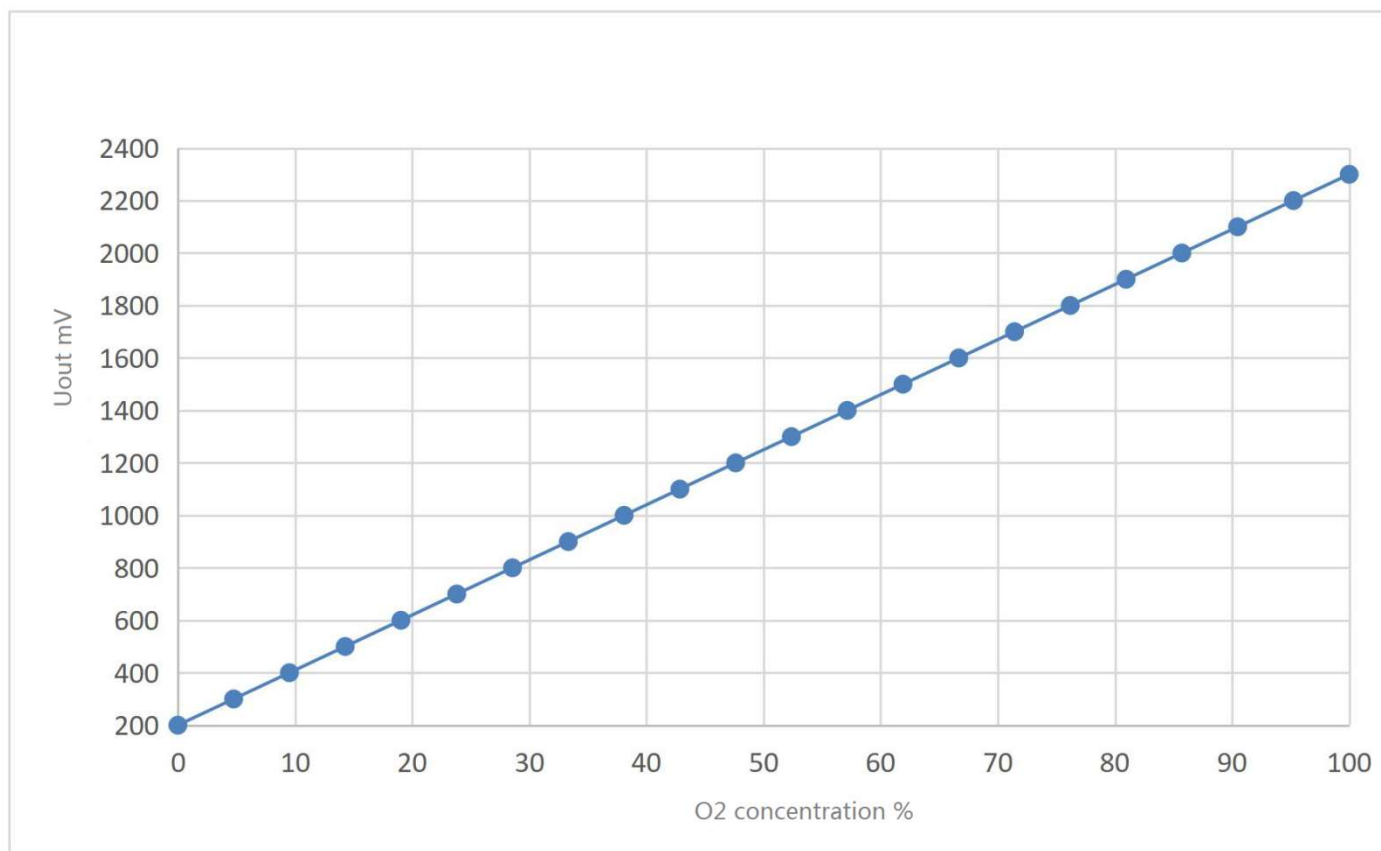
Pin Definition

J1			J2		
NO	Pin	Description	NO	Pin	Description
1	GND	Power supply GND	1	VIN	4.75-12.6V DC power supply input
2	VIN	4.75-12.6V DC power supply input	2	Rx	Serial signal receiving (3.3V)
3	GND	Analog output GND	3	Tx	Serial signal sending (3.3V)
4	Vout	200mV~2300mV correspond 0% ~ 100%	4	GND	GND

Connector Types

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

Correspondence between Output Signal and Oxygen Concentration



Drawing 2 Correspondence between Output Signal and Oxygen Concentration

Corresponding Relations:

O2 and Uout have a linear relationship, and the corresponding relationship is as below:

$$O_2 = 0\% \rightarrow V_{out} = 200\text{mV}$$

$$O_2 = 100\% \rightarrow V_{out} = 2300\text{mV}$$

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

$$O_2(\%) = [V_{out}(\text{mV}) - 200] / 21$$

Example:

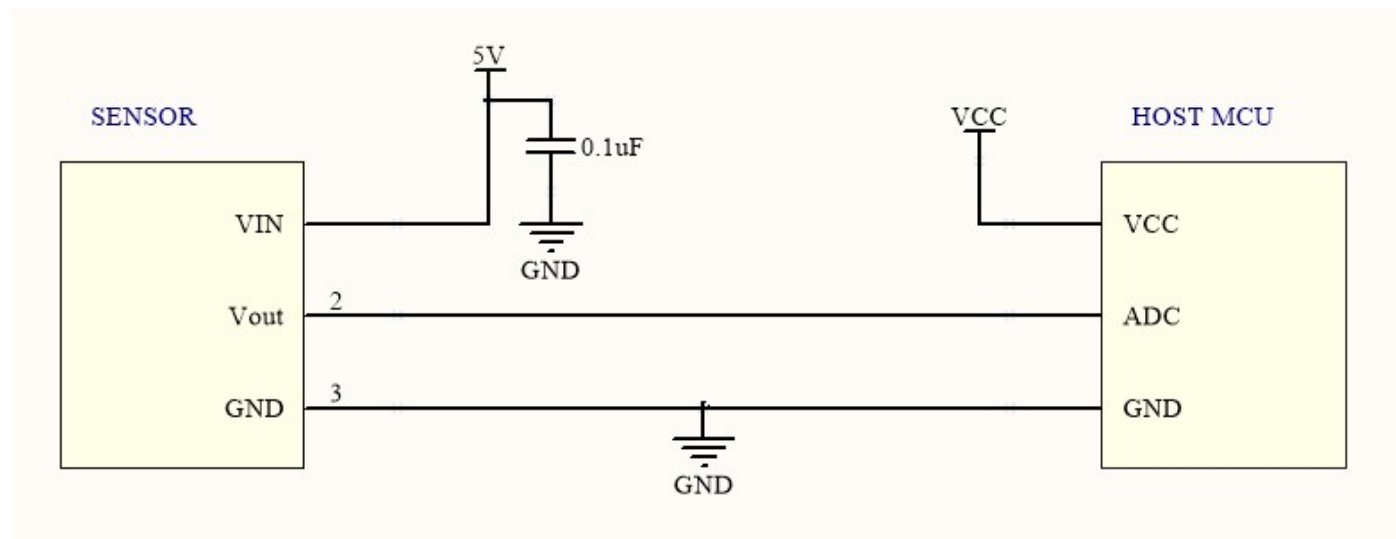
When output $V_{out}(\text{mV})=800\text{mV}$,

$$O_2(\%) = (800-200)/21=28.57$$

The oxygen concentration is 28.57%.

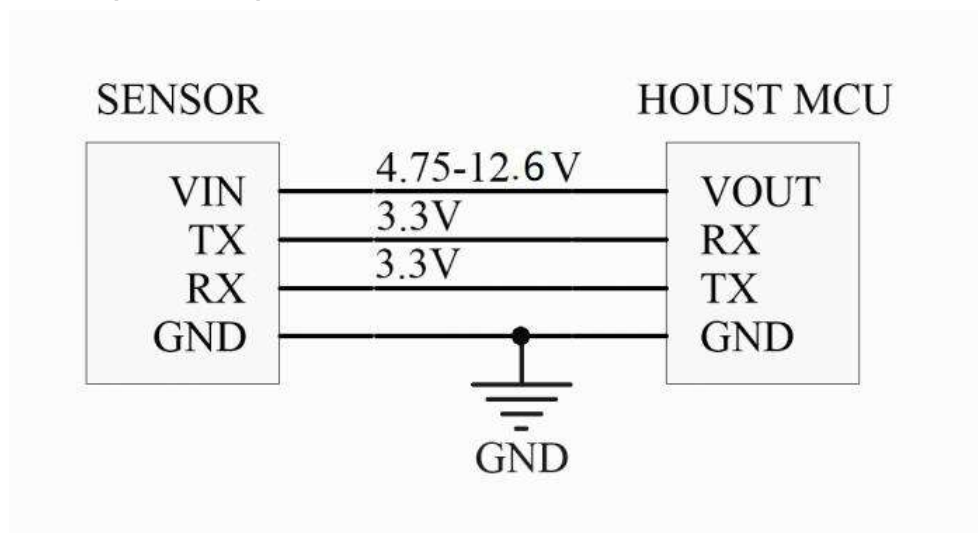
Reference Circuit

Application Scenarios: output



Drawing 3 Application Circuit Diagram

UART : TTL 3.3V Input and Output



Drawing 4 UART Communication Connection Circuit Diagram

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 in front of low byte.
- 4) The default is active sending, and the sending cycle is 0.5 seconds. If you need to read more other data, send the corresponding command directly to the host, and the host responds immediately.

2 Serial communication protocol formats

PC send format

Start symbol	Length	Order No	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)
Order No	Directive number
Data	Read or written data, the length is variable
Checksum	The sum of data accumulation, =256-(HEAD+LEN+CMD+DATA)

3 Serial protocol order number list

No	Function name	Order no
1	Read the measurement result of O2	0x01
2	Read the software version number	0x1E
3	Read sensor serial number	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 pure concentration = (DF3*256 + DF4) /10 (Vol %) This value is for using 99.99% pure oxygen as oxygen source.

O2 temperature value = (DF5*256 + DF6) /10 (°C) Gas temperature in air chamber

Attention: DF7 DF8 reserved

Remark: The default is active 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

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 = $0 \times 256 + 205 = 205$ (20.5%)

O2 temperature value = $0 \times 256 + 194 = 194$ (19.4°C)

4.2 Read the software version number

Send: 11 01 1E D0

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

Function: read version number for module firmware

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

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

16 09 1E 30 2E 30 32 2E 30 31 36 3E



Hexadecimal convert into ASCII code:

0.02.016

4.3 Read sensor serial number

Send: 11 01 1F CF

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

Function: read version number for module firmware

Explanation: instrument serial number of output software. SNn range is 0~9999, 5 integer type constitute 20 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 flow = $(DF9 \times 256 + DF10) / 10$ (L/min)

O2 concentration = $(DF7 \times 256 + DF8) / 10$ (Vol %)

O2 temperature = $(DF5 \times 256 + DF6) / 10$ (°C) (gas temperature in Sensor chamber)

Example:

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

Instruction:

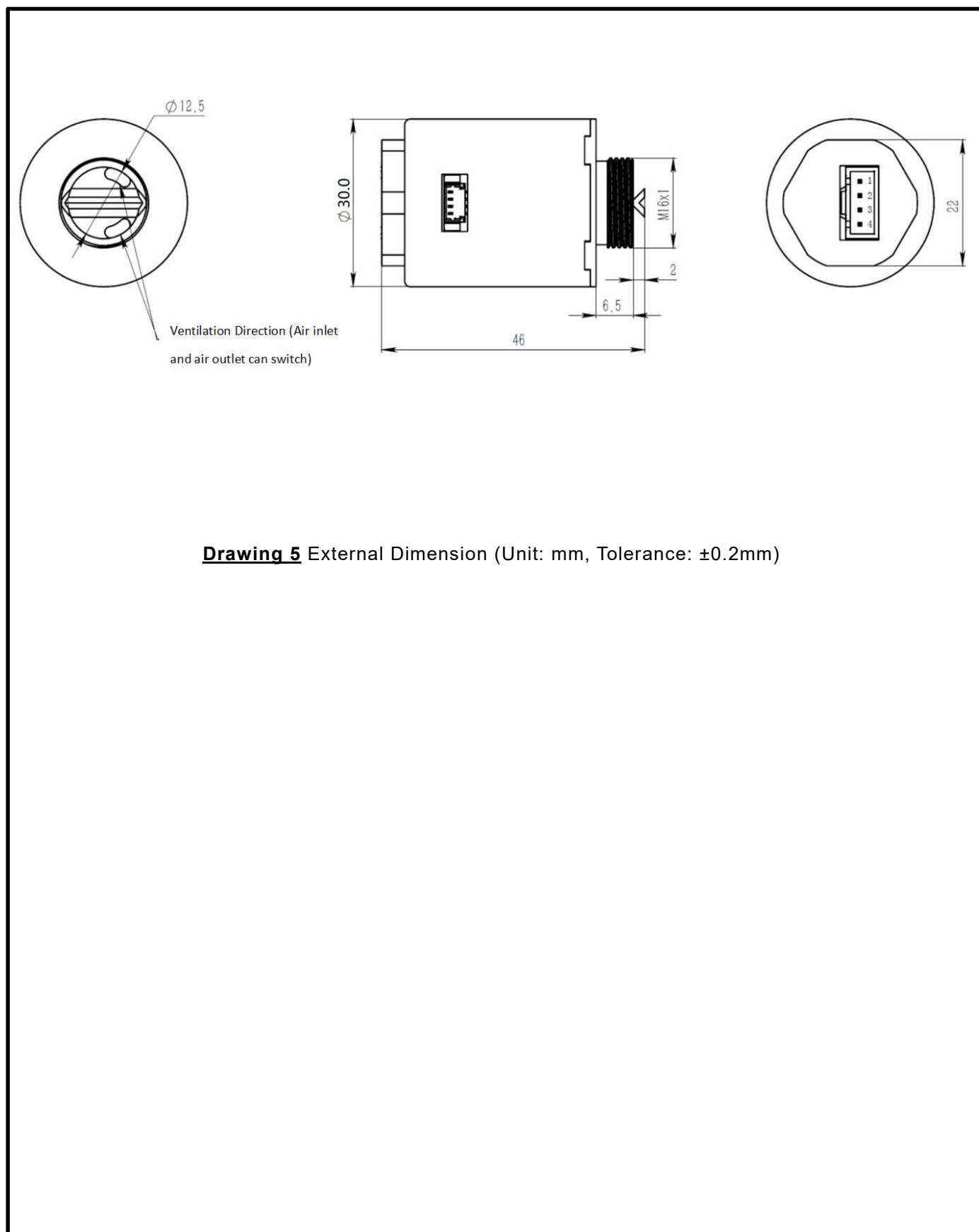
Hexadecimal Convert into Decimal: CD is 205; C2 is 194

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

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

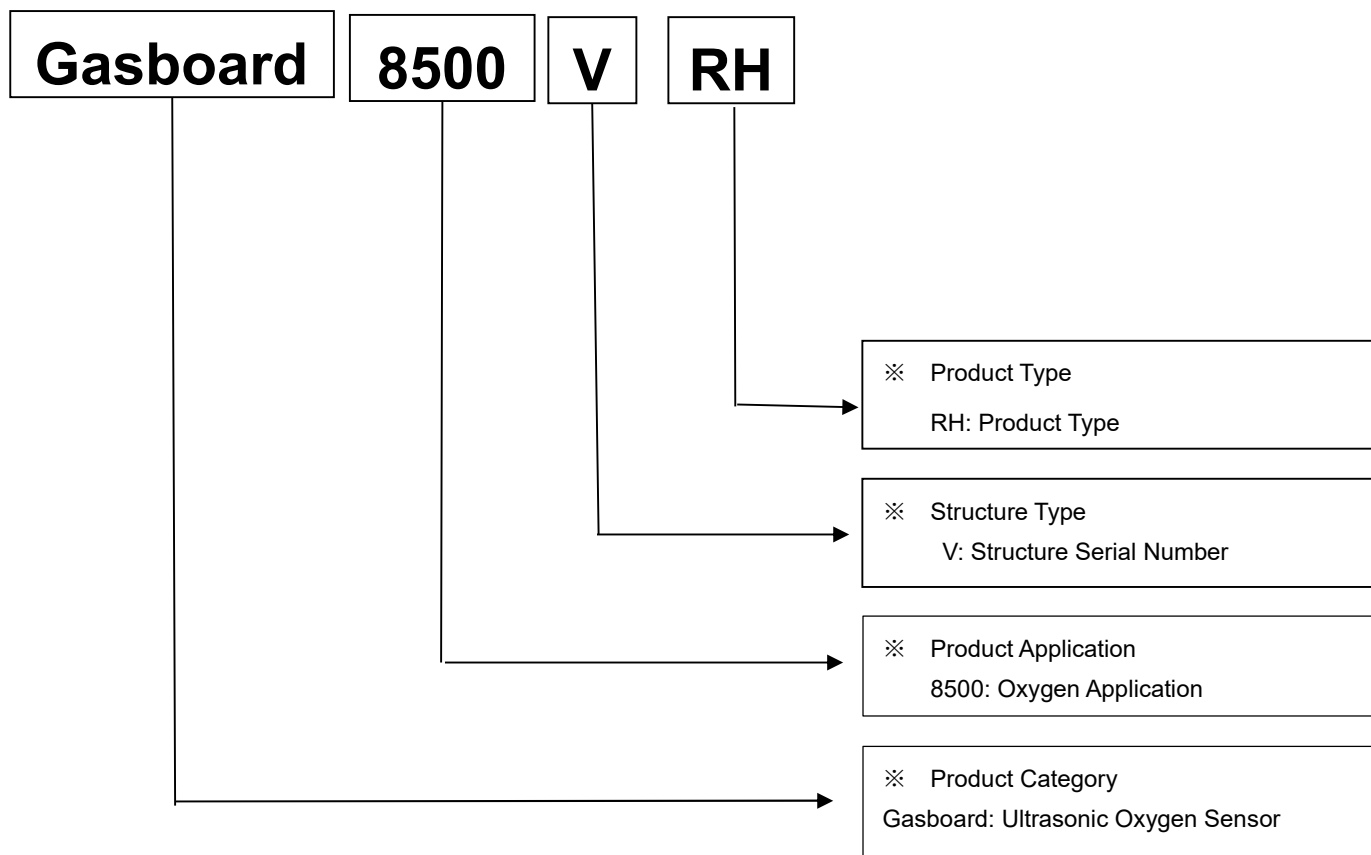
O2 Temperature Value = $0 \times 256 + 194 = 194$ (19.4°C)

Dimension



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

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

Contact number: 86 27-8162 8827

Address: Fenghuang No.3 Road, Fenghuang Industrial Park, Eastlake Hi-tech Development Zone, Wuhan, China

Postal code: 430205

Fax: 86 27-8162 8821

Website: <http://www.gassensor.com.cn>

E-mail: info@gassensor.com.cn