CUBIC

SPECIFICATION

Preliminary Version

Product Name: Wide Band Oxygen Sensor-LSU4.2

Item No.: ZS-WB42-01

Version: V0.1

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Writer	Audit	Approved

Revision

No.	Version	Content	Reviser	Date
1	V0.1	First edition		2021-2-19

Wide Band Oxygen Sensor-LSU4.2

ZS-WB42-01

Application

Engine management

– Gas engines

Measurement and analysis processes

– Flue gas measurement

– Gas analysis

– Wood Incineration

Description

The wide band oxygen sensor LSU is a planar ZrO_2 dual cell limiting current sensor with an integrated heater. It is used to measure the oxygen content and the λ-value of exhaust gases in automotive engines (gasoline and diesel). Its monotonic output signal in the range of λ=0.65 to air makes the LSU capable of being used as an universal sensor for λ=1 measurement as well as for other λ ranges. The connector module contains a trimming resistor, which defines the characteristics of the sensor and is necessary for the sensor function. The wide band sensor LSU operates only in combination with a special LSU control unit (e.g. AWS control box, LA4 or CJ125 IC).

Features

- Short light-off time
- Low heating power
- Low driven cost
- Less dependent on exhaust temperature (conducive to the stability in different operating situations)
- Double protection on the top of tube to confront impact
- Good aging resistance
- Anti-coating and anti-poisoning
- Compact structure (high vibratory level)
- Longer duration
- Independent R&D and production of chips
- Covering multiple series of car models.

Working Principle

Oxygen sensor makes use of the Nernst Principle. The core component of lambda sensor is ZrO_2 **ceramic chip**, which is a kind of solid electrolyte, compressing all functional layers together with screen printing technique into planarity. Porous platinum electrodes are sintered both inside and outside the platelet. Under certain temperature, because of the difference of oxygen concentration on each side, the oxygen molecules of the dense side will be absorbed to the platinum electrode and join with electrons (4e) forming O_2 which makes the electrode positively charged. Through the oxygen ion space, O_2 will move to the side with low oxygen concentration (the side of exhaust), which makes the electrode negatively charged. As a result, voltage is produced.The greater the concentration difference, the greater the voltage difference.

When the air-fuel ratio is low(rich fuel),the oxygen proportion in the exhaust is low, the ceramic chip has less O_2 outside, forming an electromotive force of about 1.0 V. When the air-fuel ratio is 14.7, forming an electromotive force of about 0.4-0.5V, the electromotive force is the basis electromotive force. When the air-fuel ratio is high(low fuel),the oxygen proportion in the exhaust is high, the concentration difference between the two side of the ceramic chip is low, so the electromotive force produced is low and close to 0V.

The LSU4.2 oxygen sensors measure the air-fuel ratio by controlling the oxygen balance between the pump oxygen cell and the reference air cell.

Ceramic Chip

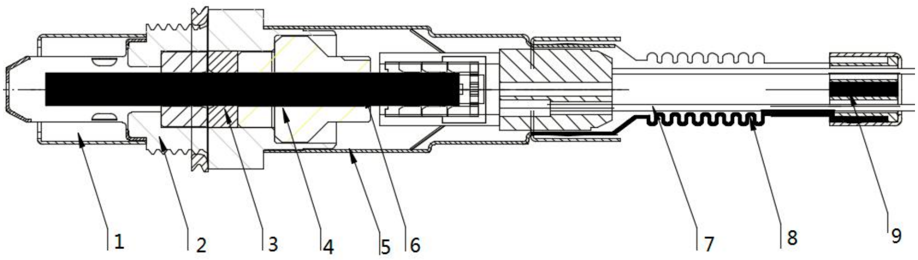
Wide Band oxygen sensor chip is different from ordinary oxygen sensor chip: the engine control has to make the oxygen content on the both side of the sensing room to be consistent, keeping the voltage at 0.45 V, the voltage is computer's reference data,it requires another part of the sensor to complete.

The other key part of sensor is the oxygen pump cell. One side of the oxygen pump cell is exhaust, the other side is connected with the test chamber. Oxygen pump cell using the opposite principle of ZrO_2, the voltage applied to ZrO_2 components (oxygen pump cell) will pump oxygen ions of the exhaust into the test chamber, making the voltage values on both sides of the induction chamber maintained at 0.45 V. The variable pump current Ip applied on the oxygen pump cell is the signal what we just need.

Chip specification

Type	Name	Specification			Resistance Ω	Isolation resistance at 400°C KΩ	Internal Resistance Ω	Remarks
		Length mm	Wide mm	Thickness mm				
ZC-WB42-01	Wide band oxygen sensor chip	59.4±0.5	4.3±0.08	1.2 ±0.05	3.2±0.5	500	80	LSU4.2

Planar Type Sensors (Type Code LSU)



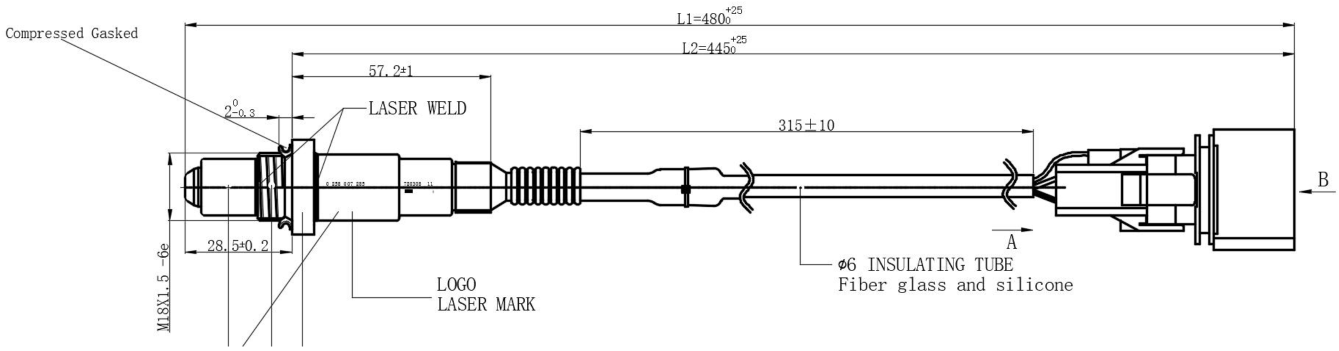
1=Guard Tube
2=Seat Base Hexagon
3=Sealing element
4=Cerarmic assembly
5=Protective cap
6=Sensing element
7=Connection cable
8=corrugated pipe
9=semipermeable membrane

Oxygen Sensor Universal Characteristics

		Note	Parameter
Storage temperature			-40°C+100°C
Working Temperature	Exhaust gas		<930°C
	Minimum exhaust gas temperature recommendation		>150°C
	Sensor seat	T hexagon	<570°C
	Temperature of the wire harness sealing jacket	Close to the side of the connector (bigger jacket)	<250°C
		Close to the side of the connector (small jacket)	<200°C
	The insulation jacket tube and cable		<250°C
	Connector		≤120°C
	Max temperature (In the whole application period limit, it can be used for up to 250Hrs)	Exhaust gas	<1030°C
		Sensor seat with hexagon head (T hexagon)	<650°C
	Temperature of the wire harness sealing jacket(During a internal 10 minutes, the whole application period limit is up to 40 Hrs)	Close to the side of the connector (bigger jacket)	<280°C
		Close to the side of the connector (small jacket)	<230°C
	The insulation jacket tube and cable		<280°C
Rated heating voltage			12V
Insulation resistance between heating machine and sensor		measured with 800VDC	>30MΩ
R & sensor internal resistance		350°C	<500Ω
		850°C	<250Ω
output voltage		λ=0.97 (350°)	800±55mv
		λ=1.10 (350°)	50±30mv
Response time		600mv-300mv	<125ms
		300mv-600mv	<60ms

Dimensions and specifications

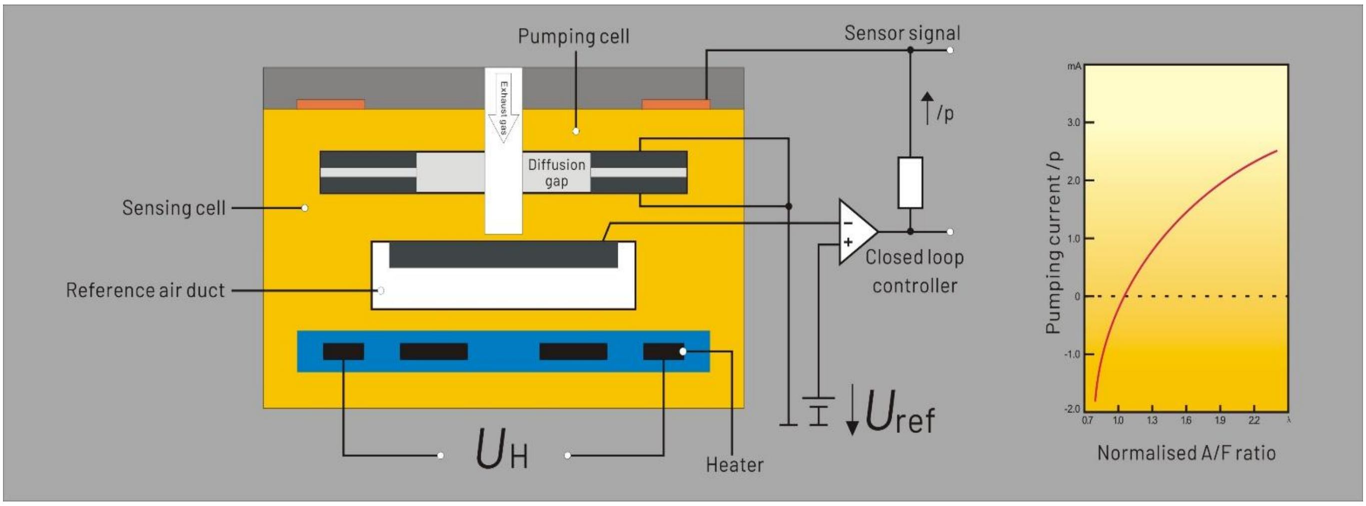
1. Dimensions



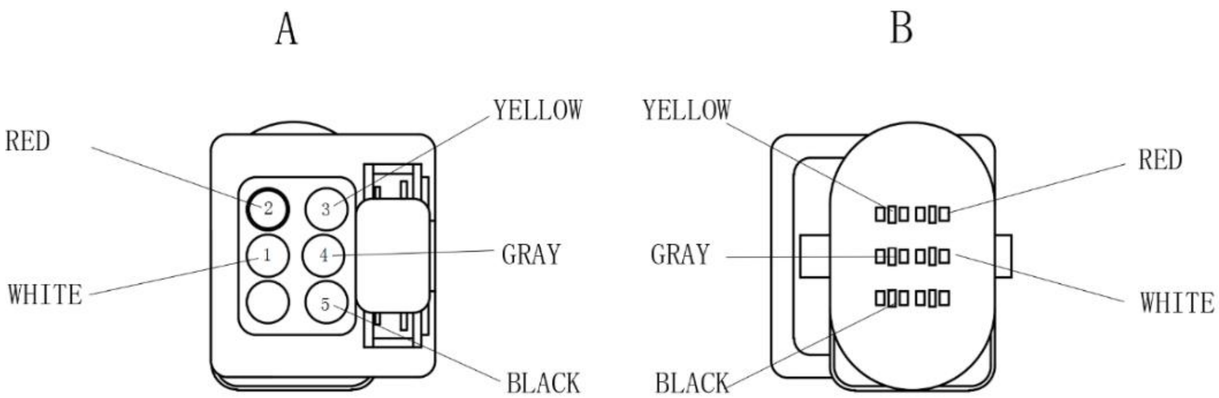
2.Specifications

Heater resistance	3.2±0.5 Ω
Operating voltage	6-8V
Maximum heating current	1.0A
Operating temperature / Exhaust gas temperature	<930°C
Measuring range of oxygen concentration	0~21%
Measuring range of air - fuel ratio	0~+∞
Light-off time	<15S
Accuracy λ=0. 8	0.80 ± 0.01
Accuracy λ=1.0	1.016±0.007
Accuracy λ=1.7	1.7 ± 0.05

Circuit of LSU and control unit



Electrical connection

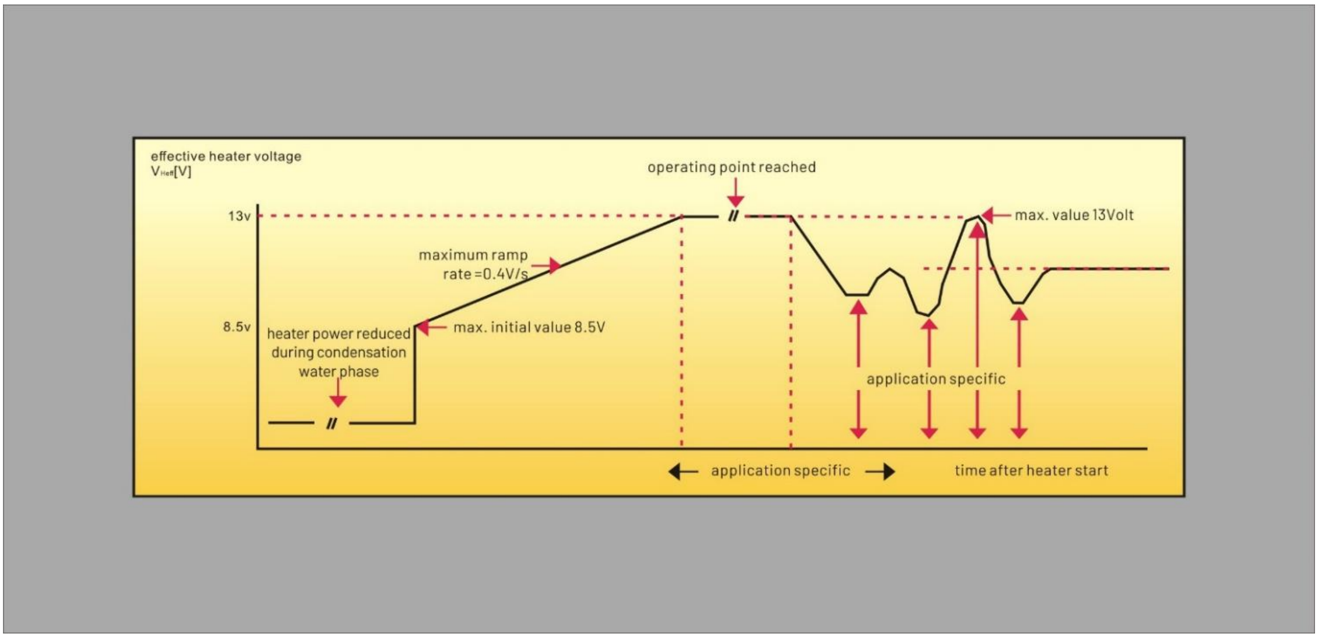


Pin Definitions

Pin	Line color	Description
Pin 1	White	heating negative grounding(0V)
Pin 2	Red	signal output (-9mA~6mA)
Pin 3	Yellow	signal virtual ground (0V)
Pin 4	Grey	heating anode(12V)
Pin 5	Black	Nernst reference Voltage(0~1V)

Performance characteristic

When the heater is switched on, heater power must be limited as follows:



Maximum permissible heat up rate with limited heater power to reduce the thermal stresses in the heat-up phase.

During the condensation water phase the heater power must be limited to rule out thermo shock damage of the sensor ceramic.

Heater voltage during condensation water phase V H, eff ≤ 2 V

Maximum permissible effective heater voltage V H, eff to reach the operating point

- short time ≤ 30sec (200h cumulated time): ≤ 13 V
- continuous: ≤ 12 V

Maximum system supply voltage V batt, max: ≤ 16.5 V

Minimum system supply voltage ≥ 10.8 V

at this system supply voltage the function of the sensor is given in typical applications. This must still be tested in the resp. application.

Minimum frequency of heater voltage control : ≥ 20 Hz

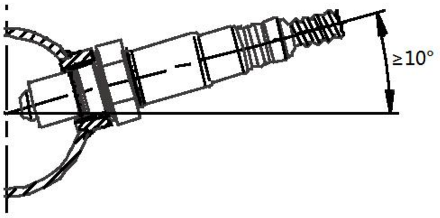
- recommended value: ≥ 100 Hz

Note: the use of the sensor with 24V power systems is not permissible except if a voltage converter system is used.

Note: duty cycle = (V H, eff / V batt) 2

Product Installation

1. Installation angle must be inclined at least 10° towards horizontal (electrical connection upwards). Thus preventing the collection of liquids between sensor housing and sensor element during the cold start phase.
2. The angle against the exhaust gas stream should be aimed as 90°. Maximum inclination should be 90°+15° (protection tube towards gas stream) or90°-30°.
3. Other installation angles must be inspected and tested individually.



General requirements

1. As the sensor receives reference air through the connection cable, the use of cleaning/greasing fluids at the sensor plug connection is not permitted.
2. Assembly with special high temperature resistant grease on the screw-in thread is recommended
3. Tightening torque = 40 – 60 Nm, material characteristics and strength must be appropriate.
4. Recommended material for the thread boss in the exhaust pipe: Temperature resistant stainless steel to following standards; DIN 17440 1.4301 or 1.4303, SAE 30304 or 30305 (US). Thread boss dimensions should be as in sketch, note that sensor thread must be covered completely.
5. The sensor must be covered when under seal (wax, tar etc.) or spray oil is applied to the vehicle.
6. The sensor must not be exposed to strong mechanical shocks (e.g. while the sensor is installed). Otherwise the sensor element may crack without visible damage at the sensor housing.
7. Underfloor installation of the sensor remote from the engine requires an additional check of the following points; positioning of the sensor with respect to stone impact hazard; positioning and fixing of cable and connector with respect to mechanical damage, cable bending stress and thermal stress.
8. The sensor should not be exposed to continuous, one sided dripping of water, e.g. by the air-conditioning condensation water outlet. The thermal stress could lead to mechanical damage of the sensor.

After-Sales Services and Consultancy

Cubic Sensor and Instrument Co.,Ltd.
Tel: +86 (0)27 81628827   Fax: +86 (0)27 81628821
Add: Fenghuang No.3 Road, Fenghuang Industrial Park, Eastlake Hi-tech Development Zone, Wuhan 430205, China
E-mail: info@gassensor.com.cn