Limiting Current Type Oxygen Sensor

operational principle：

In zirconia electrolytes, where oxygen ions serve as the current carriers, oxygen is drawn through the zirconia disk to the anode when voltage is applied. When a porous cover is installed on the electrolytic cell's cathode, the oxygen flow rate becomes restricted. This limitation means that as the applied voltage increases, the current within the electrolytic cell reaches saturation. This saturated current, known as the limiting current, is proportional to the oxygen concentration in the surrounding environment.

apply：

medical treatment

Oxygen concentrator

- incubator

laboratory

Inert gas treatment cabinet (glove box)

- bacteriological incubator

Food industry

- pack
- food test

Monitoring of fruit ripening process (storage/transportation)

Household/cooking

Automated baking/baking (high temperature> 100℃)

Advantages of oxygen sensor:

. Wide measurement range, 10 ppm to 96% oxygen

- high-accuracy

. Many models show linear characteristics

The sensor signal is less dependent on temperature

Low cross sensitivity

Long service life

In most cases, only a single "single point calibration" is required

measuring technique

Fixed/Portable oxygen meter

The measurement is carried out under controlled oxygen content.

Air conditioning and circulation

Safety technology/monitoring

Fire protection (increase in nitrogen, e.g. server room)

Greenhouses, wine cellars

Gas storage, refineries

- go under water
- Fermentation unit

electrical industry

Inert gas processors and cabinets

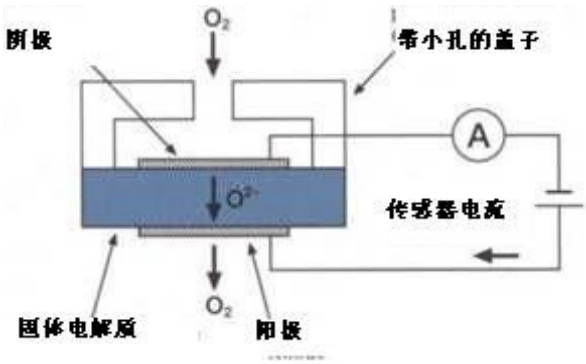
Inert gas welding monitoring

Storage in the presence of increased nitrogen (anti-oxidation)

- drier

Nitrogen concentrator

Exhaust measurement



Schematic diagram of sensor element




Several types of shell

Limiting current type oxygen sensor

performance data：

Measuring Gas

oxygen concentration

Measuring Medium

gas

Measuring Principle

Current type limit sensor

Measuring Range

Type SO-xx-001	10 ppm – 1000 ppm O_2
Type SO-xx-010	0,01 – 1,0 vol.% O_2
Type SO-xx-020	0,01 – 2,0 vol.% O_2
Type SO-xx-050	0,05 – 5,0 vol.% O_2 0,10 –
Type SO-xx-250	25,0 vol.% O_2
Txpe SO-xx-960	1,00 – 96,0 vol.% O_2

For more details, please refer to the specifications section.

output characteristic：

$$Is(O_2) = -k \cdot \ln\left(1 - \frac{[O_2]}{100}\right)$$

Is (O2) [O 2]	Sensor current, in μA oxy- gen concentration, in%
k	Sensor specific constants

Response time (t90)

2 ~25 seconds (depending on sensor type, air flow, measurement chamber) ***Sensor voltage/heating voltage/power consumption/ Heater cold resistance***

Sensor voltage:	0,7 ~ 1,6 volts
heater voltage：	3.6 ~ 4.4 volts
power dissipation：	1.3 ~ 1.8 watts (depending on application
cold resistance：	and packaging) R(25°C) = 3.25 Ω ± 0.20 Ω

Preheating Time

At least 30s

Maximum Working Temperature

350 °C (*)

** Takes place in the cable and filter assembly (see specifications and cable assembly section)*

Allowing volume flow rate (sensor purge)

For all sensor types, the maximum flow rate depends on the sensor purge method (DC, airflow configuration, etc.) and measurement chamber size, except for SO-E1-xxx (TO8 + hose interface, direct ventilation). Allowable flow rate [ml/min]: 100-500 (250 optimal)

Life (MTTF)

~ 20.000 hours (*)

* *This depends on the measuring medium. The specified life refers to SO - xx - 250 and SO - xx - 960 sensors. Failure to reach or exceed the service life means slight deviations in specification parameters.*

Vibration Resistance

The TO8 and TO39 tube and shell packaged sensors (SO-Bx-xxx, SO-Ex-xxx, SO-Ax-xxx) meet the European standard **EN60068-2-6** (sinusoidal vibration test).

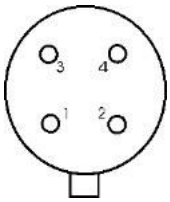
Limiting current type oxygen sensor

Pin Connections for Different Types of Sensors

Standard enclosure TO39 (SO-A0-xxx), TO8 (SO-Bx-xxx)

1 H+ (HS+)
2 H- (HS-)
3 Sen+
4 Sen-

(**pin side view**)



4-wire sensor (SO-Bx-xxx-AxxxC, SO-Dx-xxx-AxxxC)

Polytetrafluoroethylene insulated connection line can withstand temperature up to 250 °C:

cable color	pin connection	Port number
Violet 1 Violet 2	H+ HS+	1
White 1	H-	2
White 2	HS	
	Sen+	3
Red Black	Sen-	4

Schematic diagram of sensor wiring cable and connector

Limiting current type oxygen sensor

specifications
:

Enclosure Type

type	hull	Size, Remarks
SO-A0-xxx	TO39	⑦ 9.2 mm; H= 6.4 mm; pin distance 3.59 mm
SO-B0-xxx SO-E2-xxx	TO8	⑦ 15.3 mm; H= 13.7 mm; pin distance 7.18 mm
SO-B1-xxx	TO8 + installation flange	⑦ 15.3 mm; H= 13.7 mm; Pin distance 7.18 mm; installation hole (flange): ⑦ 3.4 mm, distance 36 mm
SO-D0-xxx- xxxxx	Screw is installed in housing with sintered metal top	M 16 * 1.5 mm L tot.= 49 mm; with wiring cable sintered metal top ⑦ 12 mm, L= 20 mm, SW22
SO-D1-xxx- xxxxx	Screw is installed in housing with sintered metal top	M 10 * 1 mm L tot.= 43 mm; with wiring cable sintered metal top ⑦ 12 mm, L= 20 mm SW10
SO-D2-xxx- xxxxx	Aluminum housing with threaded installation, featuring sintered metal filter M 16 * 1.5 mm L tot.= 47.4 mm; Sintered metal filter ⑦ 12.5 mm with wiring cable, SW 22	
SO-E1-xxx	TO8, with hose interface	⑦ 15,3 mm; H= 23,9 mm; pin distance 7,18 mm; Fitting hose 4,8 mm

Cable Components

type	Cable length [cm]	Working temperature [°C]	plug connector
SO-xx-xxx	not have	350	not have
SO-E1-xxx excluded	not have	250 (*)	No
SO-xx-xxx-A100C	100	200 (*)	Rast 2,5
SO-xx-xxx-A300C	300	200 (*)	Rast 2,5

** The operating temperature of the transducer is limited by the temperature tolerance of the cable assembly or the polytetrafluoroethylene insulation layer that can be selected for use.*

Measuring Range

Sensor type	measuring range	output	gas componant	sensor voltage	encoding
SO-xx-001	10 ppm O_2 – 1000 ppm O_2	70 µA – 140 µA	400 ppm O 2, remaining N 2	0.70V	A
SO-xx-010	0.01 % O_2 – 1.0 % O_2	150 µA – 250 µA	1.0 % O 2, remaining N 2	0.75V	H
SO-xx-020	0.01 % O_2 – 2.0 % O_2	150 µA – 250 µA	2.0 % O 2, remaining N 2	0.75V	B
SO-xx-050	0.05 % O_2 – 5.0 % O_2	150 µA – 250 µA	5.0 % O 2, remaining N 2	0.80V	C
SO-xx-250	0.10 % O_2 – 25.0 % O_2	100 µA – 200 µA	20.9 % O 2, remaining N 2 (air)	0.85V 1.60V	D
SO-xx-960	1.00 % O_2 – 96.0 % O_2	15 µA – 30 µA	20.9 % O 2, remaining N 2 (air)		E

Working outside the specified measurement range will cause permanent damage to the sensor.

Accuracy, repeatability and response time

Sensor type	accuracy	repetitiveness
SO-xx-001 (*)	± 20 ppm O_2	< 10 ppm O_2
SO-xx-010	± 100 ppm O_2	< 100 ppm O_2
SO-xx-020	± 200 ppm O_2	< 100 ppm O_2
SO-xx-050	± 500 ppm O_2	< 250 ppm O_2 <
SO-xx-250	± 0.25 % O_2	0.1 % O_2
SO-xx-960	± 1.00 % O_2	< 0.2 % O22

** Currently not available SO-D2-001*

The Temperature of the Shell During Work

type	hull	maximum temperature
SO-Ax-xxx	TO39	250 °C
SO-Bx-xxx	TO8	70 °C
SO-Dx-xxx-xxxxx	Screw mounting housing	70 °C

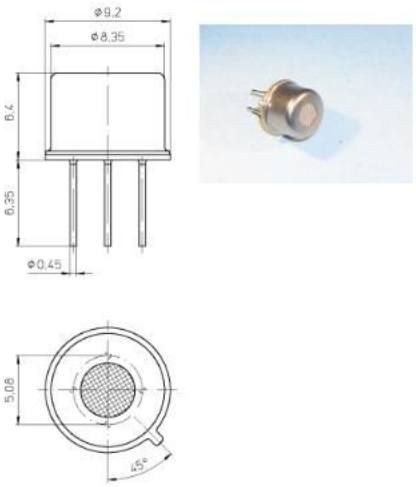
(Measured at ambient temperature 25°C)

Limiting current type oxygen sensor

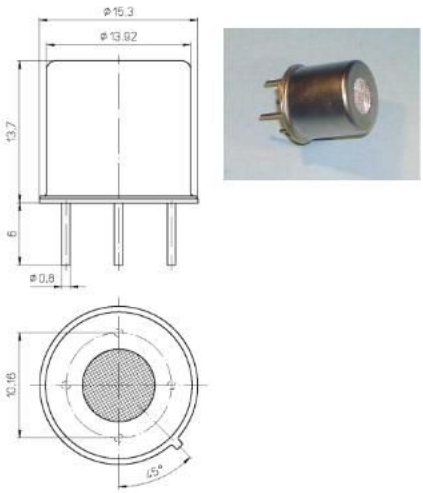
Appendix: Enclosure Types

Standard housing:

TO39 (SO-A0-xxx)

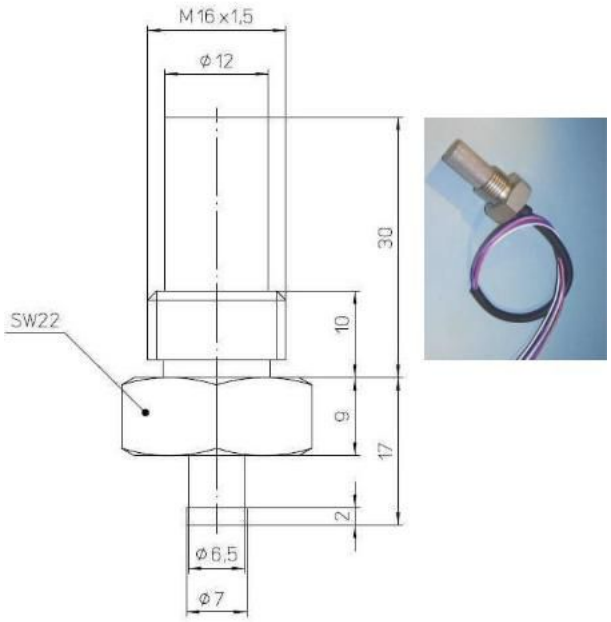


TO8 (SO-B0-xxx)

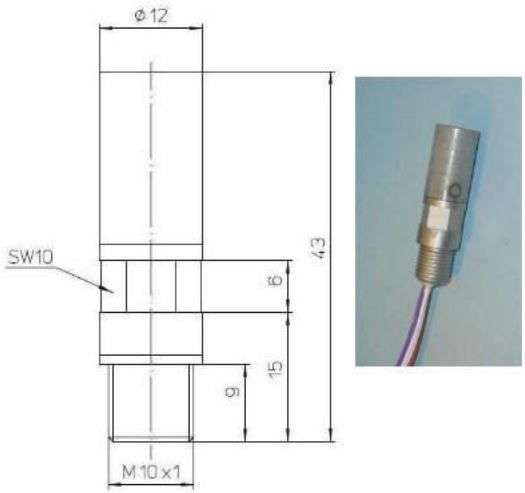


Screw is installed in housing with sintered metal top

SO-D0-xxx- xxxxx



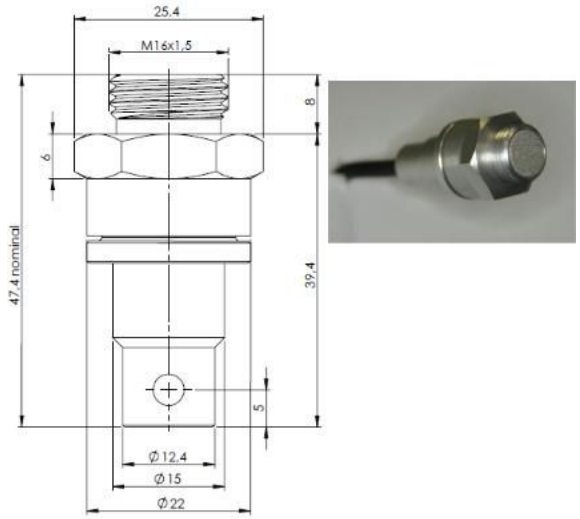
SO-D1-xxx- xxxxx



Limiting current type oxygen sensor

Aluminium housing with sintered metal filter for screw installation

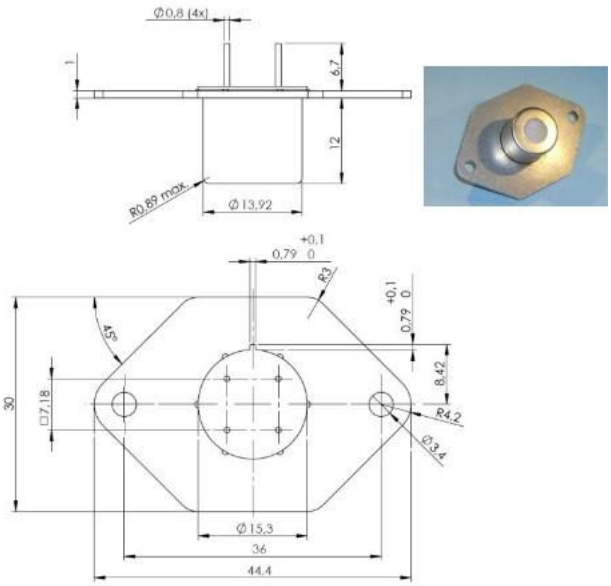
SO-D2-xxx- xxxxx (SW22)



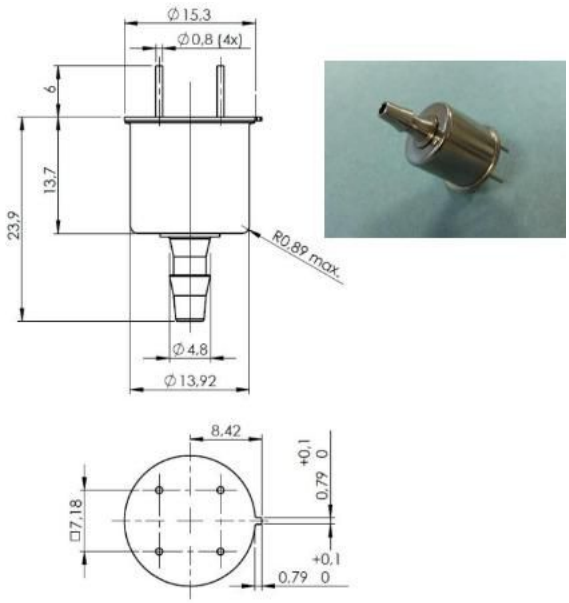
TO8 housing, with installation flange

TO8 housing, with hose fitting (direct contact with gas)

SO-B1-xxx- xxxxx



SO-E1-xxx



深圳市杰晟兴电子有限公司 JM Components Limited

地址：深圳市福田区中航路7号鼎诚国际大厦南座2007室 邮编：518031

手机：13662266995 马少良 电话：0755-83951311 传真：0755-83952401

官网：cn-sensor.com 电邮：jackson@jmcomponents.com