

ZR500 MINI-ZIRCONIUM OXIDE SENSOR

TECHNICAL BULLETIN 021

Percent oxygen measurement, 0 to 100%
For high purity applications

Introduction

The Neutronics ZR500 sensor is a rapid-response mini-zirconium oxide sensor with a measurement range of 0 to 100% oxygen. The sensor contains a zirconia ceramic solid-electrolyte, and it is designed to be compact with a small profile, built-in platinum thick film heater, and low electrical consumption. Unlike many solid-state oxygen sensors, the ZR500 does not require the use of a standard reference gas for normal operation. Instead, it uses a limiting current type measuring mechanism. The use of this sensor eliminates the need for space consuming equipment necessary when using standard comparison gas.

Along with an expected service life of more than 2 years, the ZR500 sensor is not affected by position and has an unlimited storage life. It can be exposed to high atmospheric pressure with no impact on performance, and it is unaffected by dry atmospheres or by extremely cold storage temperatures. For the most accurate readings, a flexible two-point calibration is recommended at system commissioning. During the normal service life of the sensor, no additional calibration is required.

Description

The sensor is mounted directly onto a printed circuit board that supplies bias and heater voltages to the sensor element. A small capillary on the sensor surface controls diffusion of oxygen into the sensor. At operational temperature, oxygen is electrochemically reduced, causing current flow through the solid electrolyte. Oxygen concentration in the sample gas is determined by measuring the current flowing through the sensor's two electrodes. Since the sensor is a heated device, the sensor body is positioned a few millimeters above the surface of the PCB to promote gas circulation.

The concentration of oxygen is proportional to the measured current through the sensor. The change in current signal follows a non-linear function. A constant flow of gas to the



Features

- Rapid response time – $T_{90} < 15$ seconds
- High accuracy – within $\pm 0.5\%$ of range at calibrated temperature and pressure
- Long service life – expected sensor service life > 2 years
- Not affected by position – allows for mounting close to the sampling point
- Small robust design – compact sensor with built-in heater and low electrical consumption

Applications

Air separation

Biochemical processing/fermentation

Contact lens manufacturing

Cryogenic gas generation

Food and beverage packaging

Glass and fiber optics manufacturing

Glove box systems

Inert gas purity/nitrogen purity systems

Semiconductor manufacturing

Welding

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sensor is required to ensure the highest accuracy and fast response time. A minimum of 1 slm is recommended, and a maximum of 5 slm may be used for a faster response time.

The sensor includes four pins for mounting to the printed circuit board (see Figure 1). Power is supplied to the built-in heater and to the sensor pins (see Figure 2). No external temperature sensor is required to control the heater temperature.

Operation

The sensor selects 100% oxygen. If other gases exist, preliminary reactions may occur where additional oxygen may result or oxygen may be consumed.

- The sensor should not be used near any flammable gases
- Measuring errors may occur or the sensor performance may be impeded in atmospheres containing flammable gases, sulfur oxides, hydrogen sulfide, water droplets, or other organic compounds
- Dust, oil mists, and other contaminants should be filtered to prevent the sensor from clogging
- The sensor may be damaged by silicon gas or silicon vapor
- Do not subject the sensor to excessive shock or vibration

Sensor Storage

The sensor is unaffected by temperature changes in its unheated state. Storage temperatures may range from -10°C to 85°C (14°F to 185°F). Non-condensed humidity has no effect on the unheated sensor. Condensed humidity within the packaging may damage the electrode when it is started up.

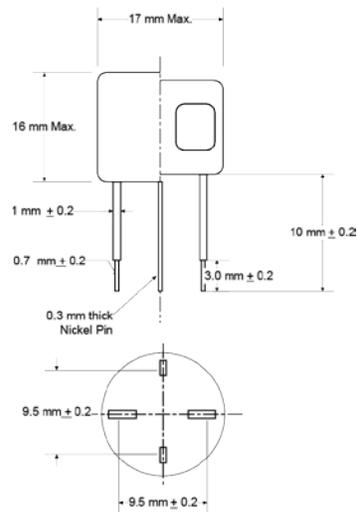


Fig. 1

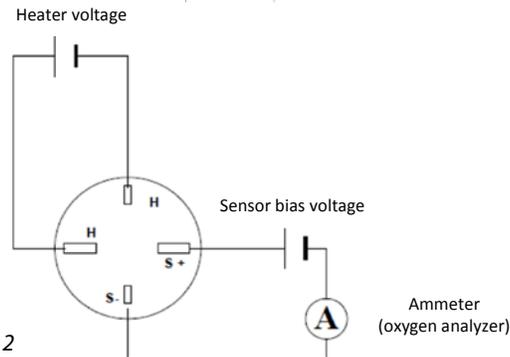


Fig. 2

Technical specifications

Measurement technology	Mini-zirconia oxide, limiting current type
Measured gas	Oxygen
Measurement range	0 to 100% O ₂
Accuracy	Within $\pm 0.5\%$ of range @ calibrated temperature and pressure
Response time (T_{90})	< 15 seconds
Sample flow	0.5 to 1.5 slm (1 slm nominal)
Warm up time	60 seconds
Operating temperature	0°C to 50°C (32°F to 122°F)
Relative humidity	0-95%, non-condensing
Storage temperature	-5°C to 50°C (23°F to 122°F)
Service life	2 years
Warranty	12 months from date of shipment

