

Vaisala SPECTRACAP® Sensor Technology for Oxygen Measurements

The Vaisala SPECTRACAP® Sensor challenges the conventional oxygen measurement technologies by a laser based oxygen measurement. It offers reliable and accurate oxygen measurements to the most demanding applications.

Operating principle

The Vaisala SPECTRACAP® Sensor is based on Tunable Diode Laser (TDL) technology. The laser light travels through the gas sample and the amount of light passing through the gas sample is measured.

The laser light source is tuned to a characteristic and unique wavelength of the oxygen molecule in the near infrared (NIR) region, see Figure 1 below. Consequently, there are no direct cross sensitivities with other gases, and the measured absorption is proportional to the oxygen concentration in the gas sample.

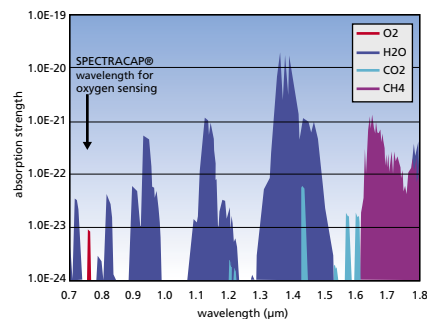


Figure 1: Absorption wavelengths of some common gases. Note how the oxygen absorption does not overlap with other atmospheric gases.

Optimum optical and mechanical design

The Vaisala SPECTRACAP® Sensor introduces a novel optical path arrangement where the laser light source, optical components, and the light detector are mounted within the same rigid structure. This removes the need for optical beam alignment. See Figure 2 below.



Figure 2: The passage of light in the SPECTRACAP® sensor probe used in the OMT355.

Interferences and optical feedback to the laser have been eliminated by optimal design of tilt angles, reflected light analysis, stray light control, and apertures. This enables stable and accurate oxygen measurements.

The SPECTRACAP® Sensor has a design where the laser light source and the detector are placed behind a protective window. The sensor contains neither moving parts nor sensitive components. The wetted parts are made of stainless steel and optical glass, which ensures good tolerance against aggressive chemicals in a variety of process environments.

The SPECTRACAP® Sensor is ideal for direct insertion into the measurement location.

Long-term stability

The extreme stability of the Vaisala SPECTRACAP® Sensor is based on the combination of the optical absorption principle and the highly optimized sensing algorithms, including a built-in

Features/Benefits

- Vaisala SPECTRACAP® is sensor technology based on TDL
- Stable and accurate O₂ measurement
- Linear response to O₂ concentration
- Excellent durability with no moving parts

reference measurement. See Figure 3 below for outdoor test data.

The employed semiconductor lasers show a lifetime of more than 10 years in continuous operation. Such a long lifetime enables considerable savings during the product life cycle as maintenance is seldom needed.

Compensation of environmental parameters

Since the oxygen measurement in the SPECTRACAP® Sensor is to some extent affected by environmental conditions, there are built-in compensations for temperature and pressure as well as for water and carbon dioxide content of the background gas.

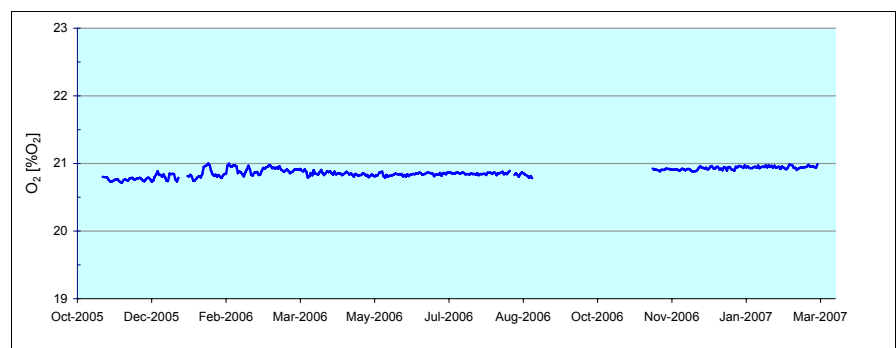


Figure 3: 16-month outdoor test data for the OMT355. An ideal gas correction has been applied to the data.

These compensations aid in achieving the most accurate measurement in varying environmental conditions. The automatic temperature compensation is based on integrated temperature sensor, whereas the pressure, temperature, and carbon dioxide compensations require parameter values set by users.

Applications

The Vaisala SPECTRACAP® Sensor is designed for demanding process applications. Typical applications include inert gas blanketing, monitoring of chemical and pharmaceutical process, of biogas and landfill oxygen, and of various oxygen-rich processes like pulp bleaching and medical air.

Other applications include fermentation and bioreactor monitoring, gas generation, and composting.

The excellent long-term stability of the Vaisala SPECTRACAP® Oxygen Transmitters is clearly an advantage also in oxygen deficiency applications.



Fuel tankers are required an oxygen measurement in their on-board inerting system before they are allowed to empty their tanks at the port.



Oxygen measurement is used in ensuring process safety in chemical plants.