

Comparison of Oxygen Sensors

Electrochemical (lead-free) vs. Zirconium Dioxide vs. EC Partial Pressure Sensor (Helium Tolerant):
Sensor selection criteria for portable and fixed gas detection systems

Technology Comparison Overview



Criterion	Electrochemical (lead-free)	Zirconium Dioxide (for fixed)	EC Partial Pressure Sensor (Helium Tolerant) (for fixed)
Operating Principle	Reading influenced by displacement gas	Reading influenced by displacement gas ¹	Galvanic cell, lead-based, largely unaffected by displacement gas ²
Measuring Range	0–25% vol, 0–30 % vol	0–25% vol, 1–96% vol, 0–1000 ppm, 0–2% vol, 0–30% vol ³	0–25% vol, up to 0–35% vol ⁴
Response Time	Sensor dependent, approx. 15–20 seconds	Sensor dependent, approx. 5–10 seconds ⁵	Sensor dependent, approx. 15–20 seconds
Power Consumption	Low	High (requires internal heating)	Very low
Typical Service Life	2–5 years (sensor dependant)	4–5 years	4–5 years
Cross Sensitivity	Elevated (e.g., CO ₂ , H ₂ S)	Very low	Resistant to CO ₂
Maintenance	Regular calibration required	Less frequent calibration in stable conditions	Regular calibration required
Temperature Range	-20° C to +50° C 68° F to 122° F	-20° C to +50° C 68° F to 122° F	0° C to +50 C 32° F to 122° F
Cost	Low to moderate investment (sensor dependent)	Higher investment	Moderate investment

¹ ZrO₂ sensors generate a Nernst voltage depending on the O₂ concentration gradient.

² Helium tolerance through modified gas diffusion or signal processing

³ ZrO₂ sensors are preconfigured for specific application ranges.

⁴ GfG offers versions up to 35% vol on request.

⁵ Response time depends on sensor; up to 30 seconds for 0–30 % vol.

Technical Note

Zirconium dioxide sensors are largely unaffected by humidity (0–99 % rH) and pressure fluctuations (15–500 kPa), but they are highly sensitive to liquid water and condensation, which can permanently damage the sensing element. Corrosive gases (e.g., HCl, HF, Cl₂), silicone vapors, oily aerosols, hot gases, and rapid temperature changes may also reduce the service life. Always operate sensors in dry, non-condensing, silicone-free gas atmospheres.

Technical Specifications and Applications

Electrochemical (lead-free)



- » For portable and fixed gas detectors
- » Compact design, energy efficient
- » Suitable for standard applications
- » Sensitive to interfering gases
- » Regular calibration required
- » **Ambient and breathing air monitoring (e.g., confined spaces, storage rooms or areas with risk of oxygen displacement)**



EC22 D and G888 with electrochemical sensors

Zirconium Dioxide



- » For fixed gas detection in challenging environments such as fluctuating temperatures, high-humidity, or inert atmospheres
- » Various measuring ranges from ppm to high volume percent concentrations possible
- » Excellent long-term stability
- » Insensitive to many interfering gases
- » Requires continuous power for internal heating, higher investment
- » **Long-term monitoring in harsh industrial environments (e.g., inerting, packaging, or metal processing applications)**



ZD22 D and ZD21 (ZD21 type tested acc. to EN 50104) with zirconium dioxide sensor

EC Partial Pressure Sensor (Helium Tolerant)



- » For fixed use in environments where helium may be present
- » Stable % vol readings with reduced impact from helium
- » Reliable alternative where standard EC sensors might misread due to gas displacement
- » Regular calibration required
- » **Helium-containing atmospheres (e.g., laboratories, semiconductor manufacturing, or leak detection systems)**



EC22 O with electrochemical partial pressure sensor

Not sure which sensor or gas detector fits your application?

We're happy to assist you!

You can also reach us by phone **800-959-0329** or by email: **info@goodforgas.com**

We look forward to hearing from you.

GfG Instrumentation, Inc. (Gesellschaft für Gerätebau mbH)

Headquartered in Dortmund, Germany, GfG is among the world's leading manufacturers of both portable gas detectors and fixed gas detection systems. With its solutions, the company makes a key contribution to occupational safety and environmental protection across the globe. Drawing on more than 60 years of expertise in the development, production, and marketing of equipment for detecting hazardous gases, explosive gas-air mixtures, and oxygen-deficient atmospheres, GfG combines experience with innovation. Recognized as one of the "hidden champions," GfG operates worldwide through 11 subsidiaries and a network of local sales partners.

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