

HIGH PERFORMANCE GAS SENSORS FOR AMBIENT AIR QUALITY APPLICATIONS

Application Note

AQ Series for sensing ozone (O_3), carbon monoxide (CO), sulfur dioxide (SO_2) and nitrogen dioxide (NO_2).

Honeywell AQ Series Gas Sensors offer high resolution and low detection limits as well as high correlation with control stations for ambient air quality (AAQ) applications. The 4-electrode electrochemical technology is highly sensitive to low gas concentrations in the range of parts per billion (ppb). These sensors provide accurate measurements and have excellent gas specificity.

BACKGROUND

Advances in technology have led to exciting and rewarding improvements in living standards but have also contributed significantly to a variety of serious environmental issues. Among these are the release of many types of chemical pollutants into the atmosphere that contribute to global and local environmental issues such as the greenhouse effect, sick-house syndrome, and ozone depletion. In addition to meeting increasing market demand for environmentally conscientious solutions, the hazards of environmental pollution can be capable of causing severe injury within a short time period.

Developers are addressing this challenge as they concentrate on outdoor air pollution, including emissions caused by combustion from motor vehicles, solid fuel burning, smoke from brush fires, windblown dust, pollen and mold spores. To meet these new gas-sensing challenges, Honeywell is committed to providing high-resolution, compact, robust, accurate, and reliable gas sensors for use in non-industrial environmental applications.

SOURCES OF AIR POLLUTION

- 60 % of sulfur oxides come from energy production and distribution
- Many natural phenomena, including volcanic eruptions and sandstorms, release air pollutants into the atmosphere
- More than 40 % of emissions of nitrogen oxides come from road transport
- Almost 40 % of primary PM2.5 emissions come from road transport
- Fuel combustion is a key contributor to air pollution - from road transport, household to energy use and production. Businesses, public buildings and households contribute to around half of the PM2.5 and carbon monoxide emissions
- Waste (landfills), coal, mining and long-distance gas transmission are source of methane
- Around 90 % of ammonia emissions and 80 % of methane emissions come from agricultural activities

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SOLUTION

According to the Environmental Protection Agency (EPA), ambient air quality monitoring is the systematic long-term assessment of pollutant levels through detection and measurement of the quantity and types of certain pollutants in the surrounding air. It is an integral part of an effective air quality management system to accomplish any or all of the following:

- assess the extent of pollution;
- provide air pollution data to the general public in a timely manner;
- support implementation of air quality goals or standards;
- evaluate the effectiveness of emissions control strategies;
- provide information on air quality trends;
- provide data for the evaluation of air quality models; and
- support research (e.g., long-term studies of the health effects of air pollution).

The demand for lower-cost, easily transportable solutions for these applications has grown substantially as public awareness and demand for healthier breathing conditions has increased, leading to a growing need for monitoring air quality across cities, offices, and residential areas with mobile, smaller and low-cost stations/systems.

Multiple AAQ mini stations can be used to expand the monitoring coverage of a station or they can be used individually as a lower cost option for smaller areas. These applications typically utilize electrochemical sensors rather than optical sensors that are more appropriate for applications where high maintenance and higher cost are not barriers to use.

The response of an electrochemical sensor like the AQ7 Series (AQ7CO, AQ7ND, AQ7OZ and AQ7SO₂) greatly depends on the environmental conditions, including changes in relative humidity and temperature. This continuous environmental fluctuation can cause short-term effects on the



sensor's reliability (like impacting its sensitivity and baseline offset) as well as long-term effects (such as an inherent variation in the electrolyte concentration).

In order to monitor extremely low gas concentrations in the ppb range for ambient air applications, Honeywell has designed the AQ Series with algorithmic compensation that gives users very high resolution, maximum accuracy, and long-term stability. The algorithmic compensation will account for the humidity, temperature and baseline offset.

To ensure high resolution, Honeywell provides sensor parameters which can be customized to each sensor.

For example, two ozone sensors are likely to have different parameters, even when the target gas is the same. Users can input each sensor's parameters into their sensing system to establish proper environmental compensation for that specific sensor, which can then be correlated with the output of other sensors to provide the maximum accuracy possible for the overall sensed environment.

The AQ7 Series has the lowest sensor sensitivity decay over its full lifespan, which translates into the most stable and reliable sensors for environmental applications in the current market. Because the sensor is provided with **individual sensor parameters**, users are able to compensate for environmental effects.



AAQ DEVICES

- AAQ Mini System
- Portable AAQ System
- AAQ Unmanned Aerial Vehicle (UAV)
- Mobile Air Quality Monitoring System (AQMS)

AAQ APPLICATIONS

- Urban air monitoring networks
- National air monitoring networks
- Roadside air monitoring
- Industrial perimeter monitoring
- Environmental impact assessments
- Research and consultancy projects
- Short term hot spot monitoring

In summary, the compact design of Honeywell AQ Series Gas Sensors sizes them well for portable AAQ applications. They can be used over an extensive range of gases and their ability to monitor extremely low gas concentrations, provide signal-to-noise ratio at lower detection limits, and offer full compensation for temperature and humidity using baseline offset, which combined with their high correlation with control station parameters makes them ideal for AAQ applications.



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