AerNos
AerIoT™

OZONE (O_3)
Data Sheet
Product Code: ANOZ210A1 (P/E)

Overview

AerNos® AerIoT™ for Ozone is a nano gas sensor product that detects ozone at the parts-per-billion level. It is designed to be integrated into third party IoT connected devices.

AerIoT is a standard and configurable product based on specific application requirements of integration partners. AerIoT application specific systems deliver complete processing and results for plug-and-play integration into IoT devices.

AerNos AerIoT is a sensor module that includes a microprocessor, memory, integrated algorithms, self-calibration technology and communication ports.

Configured for one or more gas sensing capability, AerIoT can be configured to detect:

- One Gas | Multi-Gas
- One Gas with Multi-Gas Activation Option

This product data sheet is configured for One Gas – Ozone (O_3) detection and reporting of concentration to the low parts per billion for standard use.

AerN²S™ Technology
AerNos AerIoT is based on breakthrough AerNos AerN²S Technology. AerNos AerN²S Technology represents a significant evolution in the MEMS circuitry, hybrid-nanostructures, nanoelectronics, machine learning, algorithms and nanofabrication for high volume manufacturing of its gas sensor modules. These advances, which include specific techniques and processes to manipulate hybrid nanostructures at the atomic level, increase the selectivity and sensitivity of AerNos sensors at ambient temperatures.

AerNos AerIoT nano gas sensors use doped and manipulated nanomaterials to target specific gases and its unique sensor array design allows for simultaneous detection of multiple gases to parts-per-billion (ppb) levels.

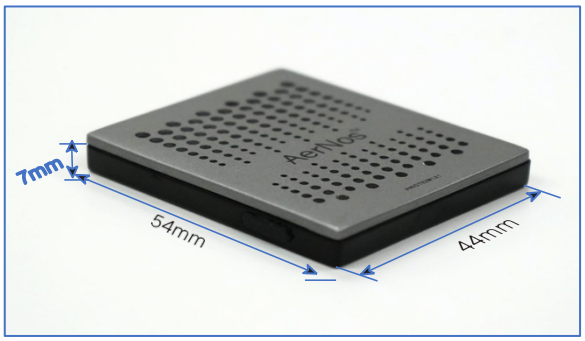
Key Features

• Detects multiple gases simultaneously
• Sensitive to parts-per-billion (ppb) levels
• Low Power
• Self-Calibrating
• Real-Time & Quick Response
• Tiny Sensor Arrays
• Complete Plug and Play Sensor Module

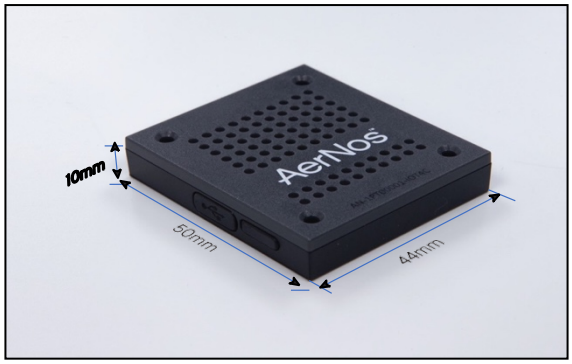
Configurations

AerNos AerIoT for Ozone (O_3) comes in two product enclosure configurations:

- **ANOZ210A1SP** (*Standard Production Version*)
  This version is for deployment and does not include micro USB and UART communication ports. Also, the dimensions of this product are smaller allowing to be easily embedded into your product lines.



- **ANOZ210AS1E** (*Standard Engineering Version*)
  This is an engineering version and includes two additional ports (micro USB and UART) for the purpose of testing and validation.



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Recommended Applications

- Smart Home
- Smart Building
- Indoor/Outdoor Air Quality
- Indoor Cabin – Transportation
- Gas & Oil Industry
- Smart City
- Automation & Control
- Industrial Health & Safety

Performance Specifications

Gas			
Detection Capabilities	Ozone (O_3)		
Low Detection Range	0 ppb		
High Detection Range	2 ppm		
Resolution	1-5 ppb		
Power	**Min**	**Typical**	**Max**
Supply Voltage		3.3V	
Operating Current	5mA	25mA	45mA
Humidity	**Min**	**Typical**	**Max**
Operating Humidity	5% RH	40% RH	99% RH
Storage Humidity	0% RH	60% RH	80% RH
Temperature	**Min**	**Typical**	**Max**
Operating Temperature	5 ℃	20 ℃	65 ℃
Storage Temperature	0 ℃	20 ℃	50 ℃
Performance			
Startup - From Off	30 Seconds		
Startup – From Sleep	< 10 seconds		
Reading Frequency	10 seconds		
Sensing Period for high accuracy ppb detection	Configurable: 30 seconds to 300 seconds cycle		
Accuracy	**Low-Level Detection Capabilities**		
Indoor/Outdoor	0-5ppb	6-25 ppb	26-70 ppb
Variance	± 50%	± 20%	± 15%
Accuracy	**Detection Capabilities**		
Indoor/Outdoor	71-200 ppb	201-500 ppb	> 501 ppb
Variance	± 10%	± 5%	± 3%

Technical Specification

Electronics	Microprocessor, Memory, MEMS Sensor Array, Humidity & Temperature Sensor
Communication	Production Version: I2C Engineering Version: UART, Micro USB
Weight	Production Version: Engineering Version: 15.2g
Dimensions	Production Version: 54 x 45 x 7 mm^3 Engineering Version: 50 x 45 x 10 mm^3
Mounting/Attachment *Engineering Version Only*	Mounting holes on four corners for attaching sensor system onto integration platforms using screw
Size of Mounting Screw *Engineering Version Only*	M2 - Part Number: 91801A530_316

AerNos Cloud Data Platform

Unlike traditional gas sensor that are "dumb" sensing elements that do not communicate to a command center. AerNos Nano Gas Sensors are "smart" sensors designed to communicate in real-time to the AerNos Cloud Data Platform. This feature enables product companies to manage all their end-user data in a consolidated or individual fashion and take real-time action to provide the best user experience. From real-time monitoring to alerts, to firmware upgrades, system administrators will easily be able to monitor and take action when necessary.

Features include:

- Real-Time Access to All Sensor Data – 24/7
- Turn On/Off or limit access to certain functions for End-Users
- Enable Additional Gas detection capabilities based on pre-defined conditions
- Download .csv data files with filtering options
- Normalized data option based
- Detect Sensor issues and correct via pushing new firmware
- Upgrade to new capabilities by pushing out new firmware upgrades
- Sensor End of Life Alerts
- Sensor Degradation Alerts based on un-common environmental conditions
- Reporting – Ability to set automated reporting based on pre-defined filters and settings
- Administrative function for Support Teams

Tested & Validated

The AerNos AerIoT has been tested in the real world for both indoor and outdoor use. Sensors get exposed to potential cross-sensitive gases at multiple temperature and humidity in the environment during use. All product accuracy testing takes into account the thousands of gases present in the environment. Although it is impossible to test cross-sensitivity across all gases in the environment, our tests are meant to ensure our sensors perform based on the Performance Specifications under standard usage.

Ozone Decay – Hal-Life Test

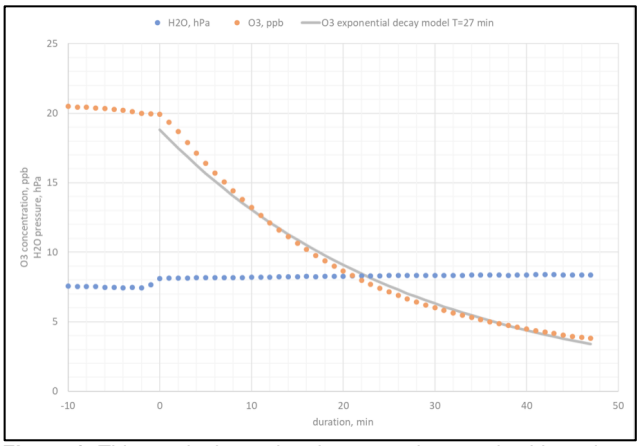

Figure 1: This graph shows that the sensor is not only able to detect O_3 with high precision but is able to provide accurate real-time readings as O_3 breaks down. This is important to demonstrate the speed and accuracy of the AerNos sensor sensing capabilities.

Designed versus Measure Tests – Accuracy Tests

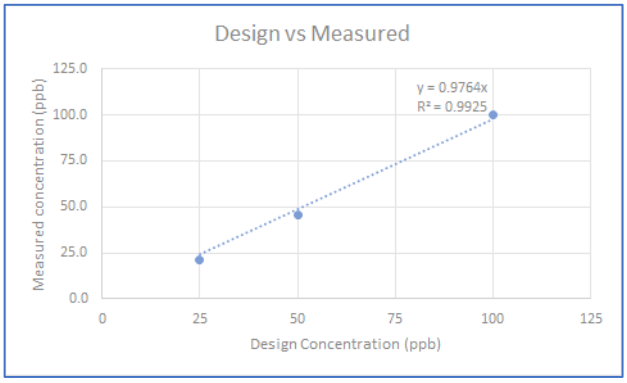

Figure 2: Percent error for Design versus Measured in laboratory environments show a 14.9% variance at 25 ppb; 8.5% variance at 50 ppb and 0.1% variance at 100 ppb exposure.

Cross Sensitive Test

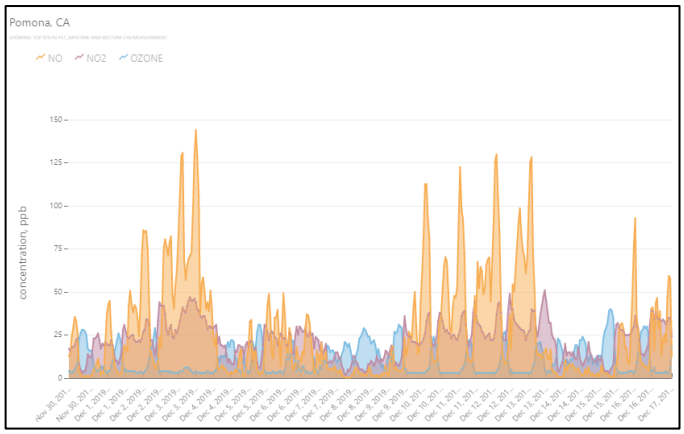

Figure 3: Cross-sensitive testing sensors with NO and NO_2. Above graph shows clear signal distinction.

Sensor Repeatability Test in Real World Environment

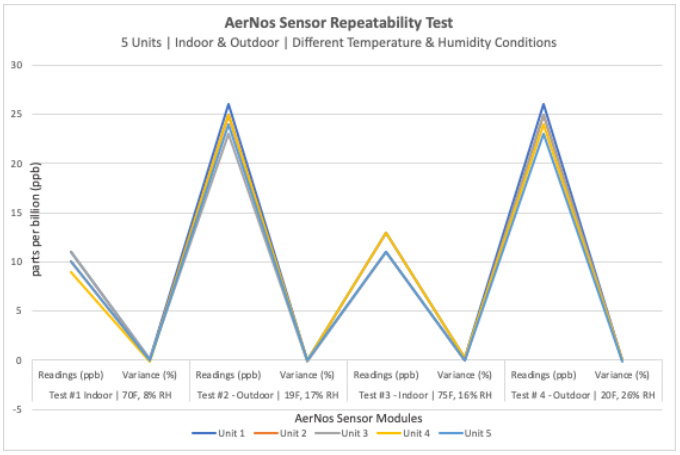

Figure 4: Repeatability test conducted in real world environment for indoor and outdoor environments. Tests were done with varying temperature and humidity settings. Variance For Test #1 was 10%; Variance for Test #2 was 8%; Variance for test #3 was 18% and variance for test $3 was 8%.

Configured for Specific Use
Based on Application, Environment & Use Case

AerNos AerIoT is available to be configured for specific conditions and/or environments that are harsh or that cater to your specific end product. We take into consideration the use case and more specifically the environment that the sensor is going to deploy to minimize any noise that may result in inaccurate readings.

For example, if your consumer end product is an Air Purifier that has a specific air flow requirement and is going to be used in a specific manufacturing environment where high levels of toxic gases exists, AerNos AerIoT can be configured for that specific environment to ensure the highest level of end-user satisfaction.

To learn more about our AerIoT configured for your specifications, please contact your AerNos Sales Representative.

Air Quality Index for Ozone
Based on EPA.gov/AirNow.gov

AerNos utilizes the standards used by United States Environmental Protection Agency (EPA), Center for Disease Control (CDC) and World Health Organization (WHO) standards in determining the level of health concerns (concentrations) when exposed to Ozone. This information is provided below for reference only. For more detail information, please visit EPA.gov or AirNow.gov websites.

Ground-level ozone is one of our nation's most common air pollutants. Use the chart below to help reduce your exposure and protect your health. For your local air quality, visit www.airnow.gov

Air Quality Index	Who Needs to be Concerned?	What Should I Do?
Good (0-50)	It's a great day to be active outside.	
Moderate (51-100)	Some people who may be unusually sensitive to ozone.	**Unusually sensitive people:** *Consider reducing* prolonged or heavy outdoor exertion. Watch for symptoms such as coughing or shortness of breath. These are signs to take it easier. **Everyone else:** It's a good day to be active outside.
Unhealthy for Sensitive Groups (101-150)	Sensitive groups include **people with lung disease such as asthma, older adults, children and teenagers, and people who are active outdoors.**	**Sensitive groups:** *Reduce* prolonged or heavy outdoor exertion. Take more breaks, do less intense activities. Watch for symptoms such as coughing or shortness of breath. Schedule outdoor activities in the morning when ozone is lower. **People with asthma** should follow their asthma action plans and keep quick- relief medicine handy.
Unhealthy (151-200)	**Everyone**	**Sensitive groups:** *Avoid* prolonged or heavy outdoor exertion. Schedule outdoor activities in the morning when ozone is lower. Consider moving activities indoors. **People with asthma**, keep quick-relief medicine handy. **Everyone else:** *Reduce* prolonged or heavy outdoor exertion. Take more breaks, do less intense activities. Schedule outdoor activities in the morning when ozone is lower.
Very Unhealthy (201-300)	**Everyone**	**Sensitive groups:** *Avoid all* physical activity outdoors. Move activities indoors or reschedule to a time when air quality is better. **People with asthma**, keep quick-relief medicine handy. **Everyone else:** *Avoid* prolonged or heavy outdoor exertion. Schedule outdoor activities in the morning when ozone is lower. Consider moving activities indoors.
Hazardous (301-500)	**Everyone**	**Everyone:** *Avoid all* physical activity outdoors.

Note: If you don't have an air conditioner, staying inside with the windows closed may be dangerous in extremely hot weather. In these cases, seek alternative shelter.

* Information contained in this Datasheet is subject to change without notice. Sensor resolution depends on lower detection levels (LDL) or higher detection levels (HDL). Depending on use case, lower detection range variances may vary more than specifications. We strongly suggest thoroughly validating our sensor performance in your products and use case environment to review and adjust readings on your end as necessary. Product requires internet connection. Product may not function as specified in certain environmental and/or usage conditions. Sensor life depends on configuration, usage and environment and may impact dimensions for longer sensor life. Product dimensions are based on standard configurations. Warranty void when product is not used as specified.

Specifications herein are current as of document publication date.

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