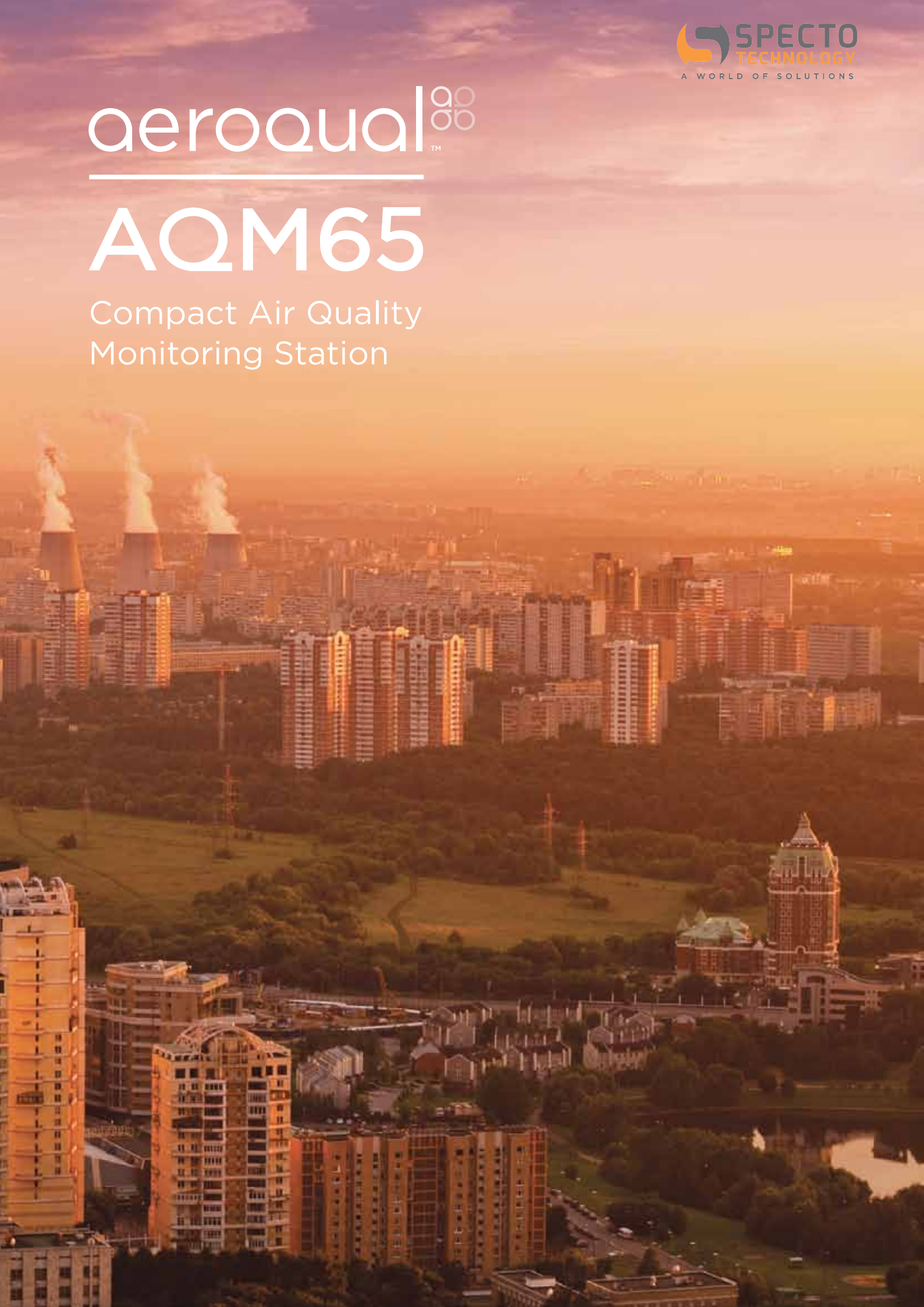
SPECTO TECHNOLOGY
A WORLD OF SOLUTIONS

aeroqual™

# AQM65

## Compact Air Quality Monitoring Station



# Contents

# Accurate air quality information, made affordable

The AQM 65 system balances the need for lower cost, distributed air quality measurement with the need for data that is robust, reliable and defensible ('near reference').

In head-to-head field trials the AQM 65 demonstrates strong statistical correlation to US EPA and EU approved reference analyzers. Yet the complete AQM 65 – weighing just 30kg – costs three to five times less than an equivalent reference station.

## What is it?

- A continuous ambient air quality monitoring system
- Simultaneous gas, particulate and environmental data
- View data remotely in real-time on PC, tablet, or phone
- Fully integrated system installed and supported by a global service network

## Who needs it?

- National and local government
- Environmental agencies
- Transport authorities
- Industrial operators
- Air quality consultants
- Air quality researchers
- Public facilities (schools, hospitals, parks)

# Air quality data – anywhere, anytime

The AQM 65's compact size opens up new monitoring locations and applications. Now you can measure with confidence at both macro level and in the micro-environment. And it's easy to move from one location to another; you can be set up and collecting data in under an hour. With secure wireless communications and a cloud based user interface, your data is protected and available wherever and whenever you need it.


# A customized, fully integrated monitoring system

You choose the parameters you wish to measure. The modular design makes any combination possible and means you can add parameters in the future. We integrate and test the modules and environmental sensors here at our factory and ship the fully integrated system to you for installation and commissioning (courtesy of one of our sales and service agents).

Here are some typical configurations and applications:

| | |
|---|---|
| URBAN AND NATIONAL AIR POLLUTION MONITORING | CO, $NO_2$, $O_3$, $SO_2$, $PM_{2.5}$, wind speed and direction, temp/RH, pressure, rain |
| INDUSTRIAL PERIMETER MONITORING | $SO_2$, $H_2S$, VOC, $PM_{10}$ / $PM_{2.5}$, wind speed and direction |
| TRANSPORTATION MONITORING | $NO_2$, $SO_2$, VOC, $PM_{2.5}$, wind speed and direction |
| PUBLIC NUISANCE MONITORING | $H_2S$, TSP, noise, wind speed and direction |
| RESEARCH / CONSULTING | CO, $CO_2$, $NO_2$, NOx, $O_3$, $SO_2$, $H_2S$, VOC, TSP, $PM_{10}$, $PM_{2.5}$, $PM_1$, noise, solar radiation, wind speed and direction, temp/RH, pressure, rain |
| PARKS / OPEN SPACES | $O_3$, CO, $CO_2$, $NO_2$, $PM_{10}$, $PM_{2.5}$, solar radiation, wind speed and direction, temp/RH, pressure, rain |

## The AQM 65 system is modular

Each sensor is housed in a module, and the system is built with only the modules you require.

Each module is connected with the control system for air sampling, data and power.

All module data is available on the same software interface.

During servicing, modules can be easily removed and replaced without affecting the rest of the system.

CO

# Carbon Monoxide

## Why measure it?

Carbon monoxide (CO) is a criteria pollutant. Short-term exposure to carbon monoxide can reduce the oxygen-carrying capacity of the blood, leading to shortness of breath, dizziness and even death. This is especially dangerous for people with heart disease who already have a reduced capacity for carrying oxygenated blood to the heart.

## Where does it come from?

The majority of CO emissions in urban environments come from mobile sources e.g. cars, trucks, ships and off-road vehicles. Fossil fuel power stations are another major contributor, as well as fires and biogenic sources in rural areas.

## How do we measure it?

The CO analyzer module continuously measures carbon monoxide in ambient air. Air is actively sampled by pump and travels through a glass and Teflon coated inlet system to the analyzer module. The CO analyzer module uses gas sensitive electrochemical (GSE) sensors which incorporate next generation electrochemical cells with nano-catalyst coated working electrodes that provide higher sensitivities. The lowest possible detection limits are achieved by proprietary signal processing and maintaining the AQM 65 enclosure at a constant temperature that can be adjusted to local conditions.

## Near reference performance

The CO module is factory calibrated and traceable to NIST Standard Reference Materials. It can be field calibrated against US EPA protocol gas standards if required. In head to head field trials with an infrared absorption gas analyzer the CO module demonstrates strong linear correlation. The CO module is suitable for use in ambient, fenceline, and point source emission monitoring.

| RANGE (PPM) | RESOLUTION (PPM) | NOISE ZERO / PPM; SPAN % OF READING | LOWER DETECTABLE LIMIT / PPM | PRECISION | LINEARITY (% OF FS) | DRIFT 24 HOUR ZERO / PPM; SPAN % OF FS |
|---|---|---|---|---|---|---|
| 0-25 | 0.001 | <0.020; <1% | 0.040 | <3% of reading or 0.050 ppm | <1% | 0.02; 0.2% |

# Ozone

## Why measure it?

In the upper atmosphere 'good' ozone ($O_3$) protects life on Earth from the sun's ultraviolet rays. At ground level 'bad' ozone is a criteria pollutant that is a significant health risk, especially for people with asthma. It also damages crops, trees and other vegetation and a main component of smog.

## Where does it come from?

Ground level ozone is not emitted directly; it is created by chemical reactions between oxides of nitrogen (NOx) and volatile organic compounds (VOC) in the presence of sunlight. Emissions from industrial facilities and electric utilities, vehicle exhaust, gasoline vapors, and chemical solvents are some of the major sources of NOx and VOC.

## How do we measure it?

The $O_3$ analyzer module continuously measures ozone in ambient air. Air is actively sampled by pump and travels through a glass and Teflon coated inlet system to the analyzer module. The ozone analyzer module incorporates an Aeroqual gas sensitive semiconductor (GSS) sensor. This sensor is a tungsten oxide ($WO_3$) formulation that is particularly sensitive to $O_3$ when operated at elevated temperatures. By subjecting the sensor to periodic zero flow conditions and temperature cycling, the analyzer module compensates for drift and cancels interferences from $NO_2$ and VOCs.

## Near reference performance

The $O_3$ module is factory calibrated and traceable to NIST Standard Reference Materials. It can be field calibrated against US EPA protocol gas standards if required. In head to head field trials with an ultraviolet photometric analyzer the $O_3$ module demonstrates very strong linear correlation. The $O_3$ module is suitable for use in ambient air monitoring in urban and rural areas.

| RANGE (PPM) | RESOLUTION (PPM) | NOISE ZERO / PPM; SPAN % OF READING | LOWER DETECTABLE LIMIT / PPM | PRECISION | LINEARITY (% OF FS) | DRIFT 24 HOUR ZERO / PPM; SPAN % OF FS |
|---|---|---|---|---|---|---|
| 0-0.5 | 0.001 | <0.001; <1% | 0.001 | <2% of reading or 0.002 ppm | <1% | 0.001; 0.2% |

$NO_2$

# Nitrogen Dioxide

## Why measure it?

Nitrogen dioxide ($NO_2$) is a criteria pollutant and contributes to the formation of photochemical smog, with significant impact on human health. Breathing raised levels of $NO_2$ inflames the lining of the lungs and reduces immunity to lung infections. The result is wheezing, coughing, colds, flu and bronchitis, and more frequent and intense asthma attacks.

## Where does it come from?

The major source of $NO_2$ is from combustion of fossil fuels: coal, oil and gas. Most of the $NO_2$ in cities is derived from motor vehicle exhaust. Other sources of $NO_2$ are petrol and metal refining, electricity generation from coal-fired power stations, other manufacturing industries and food processing.

## How do we measure it?

The $NO_2$ analyzer module continuously measures nitrogen dioxide in ambient air. The air is actively sampled by pump and travels through a glass and Teflon coated inlet system to the analyzer module. The module incorporates an Aeroqual gas sensitive semiconductor (GSS) sensor with a tuned microstructure for $NO_2$ detection. A thermal scrubber removes the effect of ambient ozone and a zero cycle compensates for sensor drift and interference effects from humidity and VOCs.

## Near reference performance

The $NO_2$ module is factory calibrated and traceable to NIST Standard Reference Materials (SRM). It can be field calibrated against US EPA protocol gas standards if required. In a head to head field trials with a chemiluminescent analyzer the $NO_2$ module demonstrated strong linear correlation. The $NO_2$ module is suitable for use in ambient, fenceline, and near roadside monitoring applications.

| RANGE (PPM) | RESOLUTION (PPM) | NOISE ZERO / PPM; SPAN % OF READING | LOWER DETECTABLE LIMIT / PPM | PRECISION | LINEARITY (% OF FS) | DRIFT 24 HOUR ZERO / PPM; SPAN % OF FS |
|---|---|---|---|---|---|---|
| 0-0.2 | 0.001 | <0.001; <1% | 0.001 | <3% of reading or 0.003 ppm | 1% | 0.001; 0.5% |

$SO_2$

# Sulfur Dioxide

## Why measure it?

Sulfur dioxide ($SO_2$) is a criteria pollutant. Short-term exposure to $SO_2$, ranging from 5 minutes to 24 hours, is linked with adverse respiratory effects including bronchoconstriction and increased asthma symptoms. $SO_2$ is also a major precursor to acid rain.

## Where does it come from?

Primary sources include fossil fuel combustion at power plants and other industrial facilities. Secondary sources include industrial processes such as extracting metal from ore, and the burning of high sulfur-containing fuels by locomotives, large ships, and off-road equipment.

## How do we measure it?

The $SO_2$ analyzer module continuously measures sulfur dioxide in ambient air. The air is actively sampled by pump and travels through a glass and Teflon coated inlet system to the analyzer module. The $SO_2$ analyzer module uses gas sensitive electrochemical (GSE) sensors which incorporate next generation electrochemical cells with nano-catalyst coated working electrodes that provide higher sensitivities. The lowest possible detection limits are achieved by proprietary signal processing, integration of a zero cycle scrubber, and maintaining the AQM 65 enclosure at a constant temperature that can be adjusted to local conditions.

## Near reference performance

The $SO_2$ module is factory calibrated and traceable to NIST Standard Reference Materials. It can be field calibrated against US EPA protocol gas standards if required. The $SO_2$ module is suitable for use in ambient, fenceline, and point source emission monitoring.

| RANGE (PPM) | RESOLUTION (PPM) | NOISE — ZERO / PPM; SPAN % OF READING | LOWER DETECTABLE LIMIT / PPM | PRECISION | LINEARITY (% OF FS) | DRIFT 24 HOUR — ZERO / PPM; SPAN % OF FS |
|---|---|---|---|---|---|---|
| 0-10 | 0.001 | 0.004; <2% | 0.009 | <3% of reading or 0.009 ppm | 1% | 0.001; 0.2% |

NOx

# Nitrogen Oxide

## Why measure it?

Nitrogen Oxide (NOx) is a group of gases (predominantly NO+$NO_2$) that contribute to air pollution processes such as smog formation and ground level ozone production. $NO_2$ is linked to respiratory effects including airway inflammation and increased asthma symptoms.

## Where does it come from?

NO and $NO_2$ are produced by combustion processes: mobile sources e.g. cars, trucks and buses; and from fossil fuelled generators and power stations. $NO_2$ is also formed through oxidation of NO in the atmosphere. Biogenic sources contribute to atmospheric NOx through the nitrogen cycle.

## How do we measure it?

The NOx analyzer module continuously measures nitrogen oxides (NO and $NO_2$) in ambient air. The air is actively sampled by pump and travels through a glass and Teflon coated inlet system to the analyzer module. The analyzer incorporates an Aeroqual gas sensitive semiconductor (GSS) sensor with a tuned microstructure for $NO_2$ detection. The module has an integrated >95% efficient convertor to convert NO to $NO_2$ and provide a quantitative NOx measurement. A thermal scrubber removes the effect of ambient ozone and a zero cycle compensates for sensor drift and interference effects from humidity and VOCs.

## Near reference performance

The NOx module is factory calibrated and traceable to NIST Standard Reference Materials. It can be field calibrated against US EPA protocol gas standards if required. In head to head field trials with NOx chemiluminescent analyzers the NOx module demonstrates very strong linear correlation. The NOx module is suitable for use in ambient, fenceline, and near roadside monitoring applications.

| RANGE (PPM) | RESOLUTION (PPM) | NOISE ZERO / PPM; SPAN % OF READING | LOWER DETECTABLE LIMIT / PPM | PRECISION | LINEARITY (% OF FS) | DRIFT 24 HOUR ZERO / PPM; SPAN % OF FS |
|---|---|---|---|---|---|---|
| 0-0.5 | 0.001 | <0.001; <1% | 0.001 | <3% of reading or 0.003 ppm | 1% | 0.001; 0.2% |

VOC

# Volatile Organic Compounds

## Why measure it?

Volatile organic compounds (VOCs) are carbon-containing gases and vapors such as gasoline fumes and solvents. Many VOCs such as benzene and formaldehyde are toxic air pollutants that can cause cancer and other serious health problems. VOCs such as 1,3 butadiene are also involved in the formation of ground level ozone.

## Where does it come from?

VOCs are emitted to air by natural sources (vegetation, forest fires) and anthropogenic sources (resulting from human activity) such as emissions from the oil and gas industry, solvent usage and transportation. Although natural sources of VOC emissions are larger overall, anthropogenic sources are the main contributors of VOCs in urban areas.

## How do we measure it?

The VOC analyzer module continuously measures carbon-containing gases and vapors in ambient air. Air is actively sampled by pump and travels through a glass and Teflon coated inlet system to the analyzer module. This module incorporates photo-ionisation detector (PID) sensor technology. A long-life 10.6 eV deep UV lamp breaks VOCs down into positive and negative ions. The detector measures the current of the ionised gas, which is proportional to detectable VOCs. The highly stable AQM 65 internal environment minimizes humidity effects. The VOC module is sensitive to a wide range of VOCs, including benzene and toluene.

## Near reference performance

The VOC module is factory calibrated and traceable to NIST Standard Reference Materials. It can be field calibrated against US EPA protocol gas standards if required. The VOC module is suitable for use in ambient air monitoring in urban and rural areas.

| RANGE (PPM) | RESOLUTION (PPM) | NOISE ZERO / PPM; SPAN % OF READING | LOWER DETECTABLE LIMIT / PPM | PRECISION | LINEARITY (% OF FS) | DRIFT 24 HOUR ZERO / PPM; SPAN % OF FS |
|---|---|---|---|---|---|---|
| 0-20 | 0.001 | <0.005; <1% | 0.010 | <2% of reading or 0.010 ppm | <1% | 0.005; 0.2% |

# Hydrogen Sulfide

## Why measure it?

Hydrogen sulfide ($H_2S$) is highly odorous and detectable by the human nose at levels as low as 0.008 ppm. Health impacts start to be evident in the general population above 0.1 ppm. $H_2S$ is also measured because its presence may indicate an industrial process issue.

## Where does it come from?

$H_2S$ is formed during bacterial decomposition of sulfur-containing organic substances. Typical sources include landfills, waste handling facilities, and waste water treatment plants. Also, it can be present in sewer gas and some natural gas, and can be emitted as the result of geothermal energy exploitation.

## How do we measure it?

The $H_2S$ analyzer module continuously measures hydrogen sulfide in ambient air. Air is actively sampled by pump and travels through a glass and Teflon coated inlet system to the analyzer module. The $H_2S$ analyzer module uses a gas sensitive electrochemical (GSE) sensor which incorporates next generation electrochemical cells with nano-catalyst coated working electrodes that provide higher sensitivities. The lowest possible detection limits are achieved by proprietary signal processing, integration of a zero cycle scrubber, and maintaining the AQM 65 enclosure at a constant temperature that can be adjusted to local conditions.

## Near reference performance

The $H_2S$ module is factory calibrated and traceable to NIST Standard Reference Materials. It can be field calibrated against US EPA protocol gas standards if required. The $H_2S$ module is suitable for use in ambient, fenceline, and point source emission monitoring.

| RANGE (PPM) | RESOLUTION (PPM) | NOISE ZERO / PPM; SPAN % OF READING | LOWER DETECTABLE LIMIT / PPM | PRECISION | LINEARITY (% OF FS) | DRIFT 24 HOUR ZERO / PPM; SPAN % OF FS |
|---|---|---|---|---|---|---|
| 0-10 | 0.001 | <0.006; <2% | 0.012 | <3% of reading or 0.012 ppm | 1% | 0.001 0.6% |

# Carbon Dioxide

## Why measure it?

Carbon dioxide ($CO_2$) is a greenhouse gas and is the main climate forcer contributing to anthropogenic climate change. Elevated $CO_2$ in the atmosphere is of global significance; variation in $CO_2$ concentrations at the local or city level is of interest to researchers and as an input to climate change models.

## Where does it come from?

$CO_2$ is produced naturally as a by-product of respiration. In the last 100 years the burning of fossil fuels for transport, energy, cooking and heating purposes has resulted in increased $CO_2$ emissions to the atmosphere. As a result, $CO_2$ levels over cities can be up to 50% higher than surrounding areas.

## How do we measure it?

The $CO_2$ analyzer module continuously measures carbon dioxide in air. Air is actively sampled by pump and travels through a glass and Teflon coated inlet system to the analyzer module. The $CO_2$ analyzer module incorporates non dispersive infrared receptor (NDIR) technology. NDIR is highly selective to $CO_2$ and therefore well suited to measuring the gas in ambient air.

## Near reference performance

The $CO_2$ module is factory calibrated and traceable to NIST Standard Reference Materials. It can be field calibrated against US EPA protocol gas standards if required. The $CO_2$ module is suitable for use in ambient, fenceline, and point source emission monitoring.

| RANGE (PPM) | RESOLUTION (PPM) | NOISE ZERO / PPM; SPAN % OF READING | LOWER DETECTABLE LIMIT / PPM | PRECISION | LINEARITY (% OF FS) | DRIFT 24 HOUR ZERO / PPM; SPAN % OF FS |
|---|---|---|---|---|---|---|
| 0-2000 | 1 | <5; <1% | 10 | <3% of reading or 10 ppm | 2% | 1; 0.6% |

# Particulate Matter

## Why measure it?

Airborne particulate matter (PM) is categorised into different size fractions. Total Suspended Particulate (TSP) includes all particle sizes and is a good measure of nuisance dust. $PM_{10}$ (particles ≤ 10 microns) is a criteria pollutant and is a serious health risk because $PM_{10}$ particles can penetrate the lungs. $PM_{2.5}$ (particles ≤ 2.5 microns) is also a criteria pollutant which has even greater health impact due to risk of penetration deeper into the respiratory system. Research has linked particulate pollution to lung and heart disease, strokes, cancer, and reproductive harm.

## Where does it come from?

Large particles come from natural sources e.g. soil and organic matter stirred up by wind or human activity. Small particles are by-products of combustion e.g. emissions from vehicles and power stations. Particles from these sources react with other gases in the atmosphere to create particles of various chemical compositions. Gas to particle conversion can also produce fine particulate.

## How do we measure it?

The Particle Monitor measures airborne particulate matter using a light scattering nephelometer. A sharp cut cyclone fitted to the inlet physically selects a target mass fraction e.g. $PM_{10}$, $PM_{2.5}$, or $PM_1$. The combination of nephelometer and sharp cut ensures high accuracy and durability. The nephelometer is able to automatically correct for thermal and optical drift. A built-in sheath air filter keeps the optics clean, and a fibre optic span enables a check of the optical components.

## Near reference performance

The Particle Monitor has demonstrated strong statistical correlation in head to head field trials with US EPA and EU certified reference methods. The sensor has been approved by MCERTS in the Aeroqual Dust Sentry. It is suited to robust and accurate measurement of a single target particulate fraction in industrial, urban, and research applications.

| SIZES | RANGE | ACCURACY | FLOW RATE | LOWER DETECTABLE LIMIT (2σ) |
|---|---|---|---|---|
| $PM_1$, $PM_{2.5}$ or $PM_{10}$ or TSP | Up to 2000 µg/m$^3$ | <±(2 µg/m$^3$ + 5% of reading) | 2.0 LPM | <1 µg/m$^3$ |

# Particulate Profile

## Why measure it?

A particulate profile is a wide-ranging measure of airborne particulate matter (PM). PM is categorised into different size fractions (see Particle Monitor). TSP provides a measure of nuisance dust. $PM_{10}$ and $PM_{2.5}$ are criteria pollutants and are often measured together in order to understand the impact of particle pollution on human health. $PM_1$ is of interest to researchers trying to quantity the health risks of combustion-related particle pollution. Measuring all particle sizes at once provides a complete cross section of particulate pollution in the atmosphere.

## Where does it come from?

Large particles come from natural sources e.g. soil and organic matter stirred up by wind or human activity. Small particles are by-products of combustion e.g. emissions from vehicles and power stations. Particles from these sources react with other gases in the atmosphere to create particles of various chemical compositions. Gas to particle conversion can also occur to produce fine particulate fractions.

## How do we measure it?

The Particle Profiler provides continuous and simultaneous measurement of $PM_{10}$, $PM_{2.5}$, $PM_1$, and TSP. The Profiler comprises an optical particle counter that converts counts to a mass fraction via a proprietary algorithm stored in the system firmware. Measurements are logged and reported in real-time. The Profiler is configured to display and log particle mass; particle counts are optional.

## Near reference performance

The Particle Profiler demonstrates good precision and accuracy in the field when calibrated against US EPA and EU certified reference methods. The sensor is valuable in research and air monitoring studies, and industrial applications where measuring more than one size fraction is necessary.

| SIZES | RANGE | ACCURACY | FLOW RATE | LOWER DETECTABLE LIMIT (2σ) |
|---|---|---|---|---|
| $PM_1$, $PM_{2.5}$, $PM_{10}$ and TSP | $PM_1$ 200 µg/m$^3$<br>$PM_{2.5}$ 2000 µg/m$^3$<br>$PM_{10}$ 5000 µg/m$^3$<br>TSP 5000 µg/m$^3$ | <±(5 µg/m$^3$ + 15% of reading) | 1.0 LPM | <1 µg/m$^3$ |

# Environmental

## Why measure environmental parameters?

Meteorological conditions play a crucial role in the creation, distribution and impact of air pollution. Noise pollution impacts quality of life and is therefore regulated and monitored in many applications. Solar radiation plays a role in ozone formation in photochemical smog. Different applications may call for specialty measurements. For example, vibration is of interest in construction site monitoring; soil moisture is of interest in forestry and agricultural research; visibility is a parameter commonly measured at airports and on highways. In this way the AQM 65 can be expanded to become a complete environmental monitoring system.

## How do we measure them?

The AQM 65 can measure, log and report environmental information along with gas and particulate data. We assessed a range of sensors from market-leading manufacturers based on price versus performance, ease of integration, and usability. After rigorous field testing we chose the following sensors and offer them factory integrated and fitted with the AQM 65, so you can be assured of their compatibility with AQM 65 hardware, communications and software. If you would like to integrate measurement from a sensor not on the list, please contact Aeroqual or an authorised representative.

# Vaisala Weather Transmitter WXT520

The WXT520 is a complete weather station that measures seven parameters simultaneously. With no moving parts the sensor is very low maintenance, extremely durable, and produces measurements of the highest quality.

| | |
|---|---|
| WIND SPEED | |
| Range | 0-60 m/s |
| Accuracy | ±3% (0-35 m/s) |
| WIND DIRECTION | |
| Range | 0-360° |
| Accuracy | ±3° |
| RAINFALL | |
| Output Resolution | 0.1mm/min |
| BAROMETRIC PRESSURE | |
| Range | 600-1100 hPa |
| Accuracy | ±1 hPa @ -52 to +60 °C |
| AIR TEMPERATURE | |
| Range | -52 to +60 °C |
| Accuracy | ±0.3 °C |
| RELATIVE HUMIDITY | |
| Accuracy | ±3 %RH (0-90 %RH); ±5 %RH (90-100 %RH) |

# Met One MSO

The MSO is a cup and vane wind speed and direction sensor coupled with temperature, humidity and barometric pressure sensors – providing a cost effective solution for key meteorological parameters.

| | |
|---|---|
| WIND SPEED | |
| Range | 0-50 m/s |
| Accuracy | ±2% |
| Resolution | 0.1 m/s |
| WIND DIRECTION | |
| Range | 0-360° |
| Accuracy | ±5° |
| Resolution | 1° |
| AIR TEMPERATURE | |
| Range | -40°C - +60°C |
| Accuracy | ±0.5°C |
| Resolution | 0.1°C |
| RELATIVE HUMIDITY | |
| Range | 0-100% |
| Accuracy | ±4% |
| Resolution | 1% |
| BAROMETRIC PRESSURE | |
| Range | 500-1100 mbars |
| Accuracy | ± 2 mbars |
| Resolution | 0.1 mbar |

# Gill WindSonic

WindSonic is a robust, low cost ultrasonic wind sensor with no moving parts. This 2-axis ultrasonic wind sensor offers wind speed and direction monitoring with very low maintenance.

| WIND SPEED | |
|---|---|
| Range | 0-60 m/s |
| Accuracy | ±2% @ 12 m/s |
| Resolution | 0.01 m/s |
| **WIND DIRECTION** | |
| Range | 0-359° (no dead band) |
| Accuracy | ±3° @ 12 m/s |
| Resolution | 1 ° |

# Novalynx 240-200SZ Silicon Pyranometer

The Novalynx Pyranometer is designed to measure solar radiation which is a key contributor to formation of ozone in photochemical smog. In clear daylight it compares well with first class thermopile type pyranometers, but at a fraction of the cost.

| | |
|---|---|
| Sensor | High stability silicon voltaic detector |
| Accuracy | ± 5% typical under natural daylight conditions |
| Sensitivity | 100 µA per 1000 W/m² typical |
| Linearity | Max deviation of 1% up to 3000 W/m² |
| Resolution | 0.1 W/m² |
| Temperature dependence | 0.15% per °C max |
| Operating temperature | -40°C to +65°C |


# Cirrus MK427 Noise Sensor

The MK427 is a outdoor Class 1 noise sensor. It requires no additional equipment to be made outdoor ready. Integrated automatic calibration removes the need for site visits to calibrate.

| | |
|---|---|
| Frequency Weighting | dB(A) to IEC 61672-1:2002 |
| Automatic Calibration | Electrostatic Actuator System with DC voltage control |
| Measurement Range | 30-100 dB(A) |
| Resolution | 0.1 dB(A) |

# Communication

Communicating with the AQM 65 is easy – wired or wireless, near or far. Staying connected to your instrument is essential for data acquisition, service and diagnostics. WIFI and Ethernet (LAN) communications come as standard. For remote communications choose our cellular IP modem which comes fully integrated and is pre-configured to operate with Aeroqual Connect and Aeroqual Cloud.

## WIFI

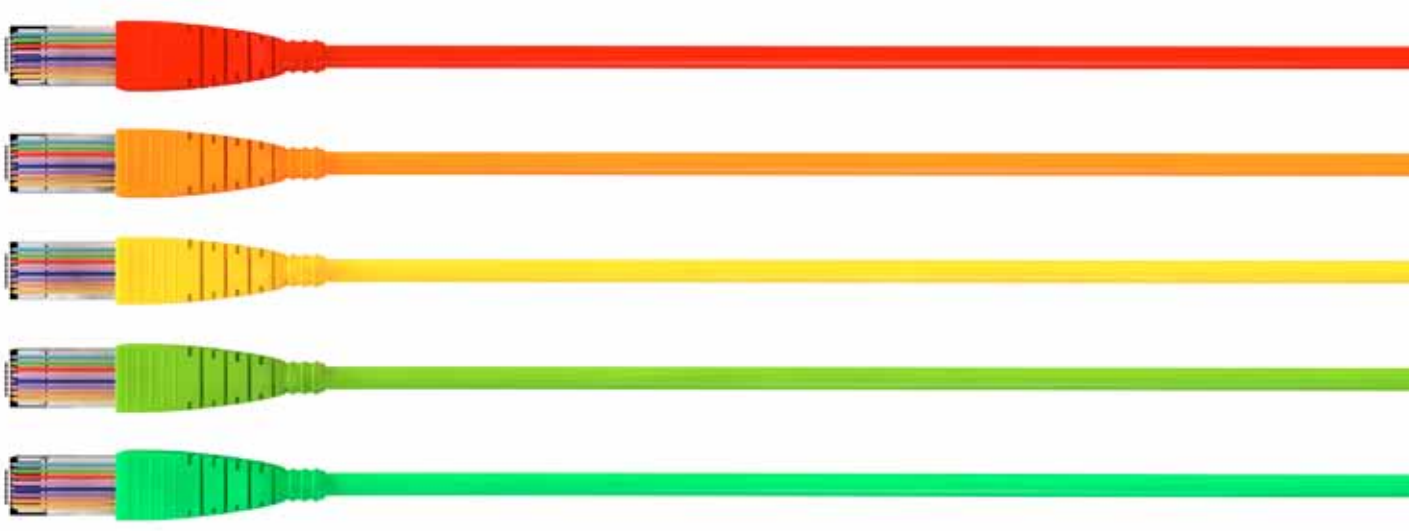
WIFI is a standard feature of the AQM 65 communications system. You connect to the AQM 65 instrument the same way as you do any wireless router. This allows quick and easy connection by PC, laptop, smartphone – without even having to open the AQM 65 door. You connect to the instrument via Aeroqual Connect software which opens in your web browser.

## Ethernet

Ethernet / LAN connection is a standard feature of the AQM 65. You connect to the AQM 65 instrument the same way as you would any computer on the Local Area Network (LAN). A weatherproof Ethernet port is located on the side of the AQM 65 enclosure, allowing for a quick and easy wired connection in cases when WIFI is not available or when you need maximum connection speed. You connect to the instrument via Aeroqual Connect software which opens in your web browser.

## Modem

Connection via cellular modem is an optional feature. This option allows you to connect remotely by using the local cellular (2G GPRS) network. The modem assigns a unique IP address to the instrument and you connect to the instrument via Aeroqual Connect or Cloud software which opens in your web browser. We selected the Moxa G3111 because it is extremely robust, operates on global cellular frequencies, and conforms to a host of international standards (FCC, EN). The modem comes factory fitted and tested so you can be sure of its compatibility with AQM 65 hardware and software.



# Software – Aeroqual Connect

Aeroqual Connect is the AQM 65 operating software pre-installed on every system built. Connect opens in the browser of any computer, tablet or mobile; there is no software to install or update. The computer forms a link to the AQM 65 over WIFI, Ethernet, or remotely via cellular modem (optional).


When you open Connect in your browser you will be prompted for your login details. After successful login you will see several 'apps' in the browser window. Here are the apps with a description of what you can do with each one:

## Manage Data

- View real-time and historical data in chart and table view
- Select averaging – 1 minute raw data, 15 minute, 1 hour, 8 hour or 24 hours
- Export data with selected averages in csv. format
- Use Journal to automatically capture setting changes and flag data during servicing

## Calibration & Service

- Enter service mode to invalidate data for quality control
- View calculated average and standard deviation of that data
- Change gain and offset for each sensor
- Use Journal to automatically capture setting changes and flag data during servicing

## Configure Instrument

- Used to configure your instrument the way you want it – from wifi settings to Aeroqual Cloud connectivity, software updates, active sensors and more
- Automatically export data from your instrument to another server or software programme (optional)

## Diagnostics & Advanced

- View and export sensor diagnostic information
- Change sensor module settings

## Administration

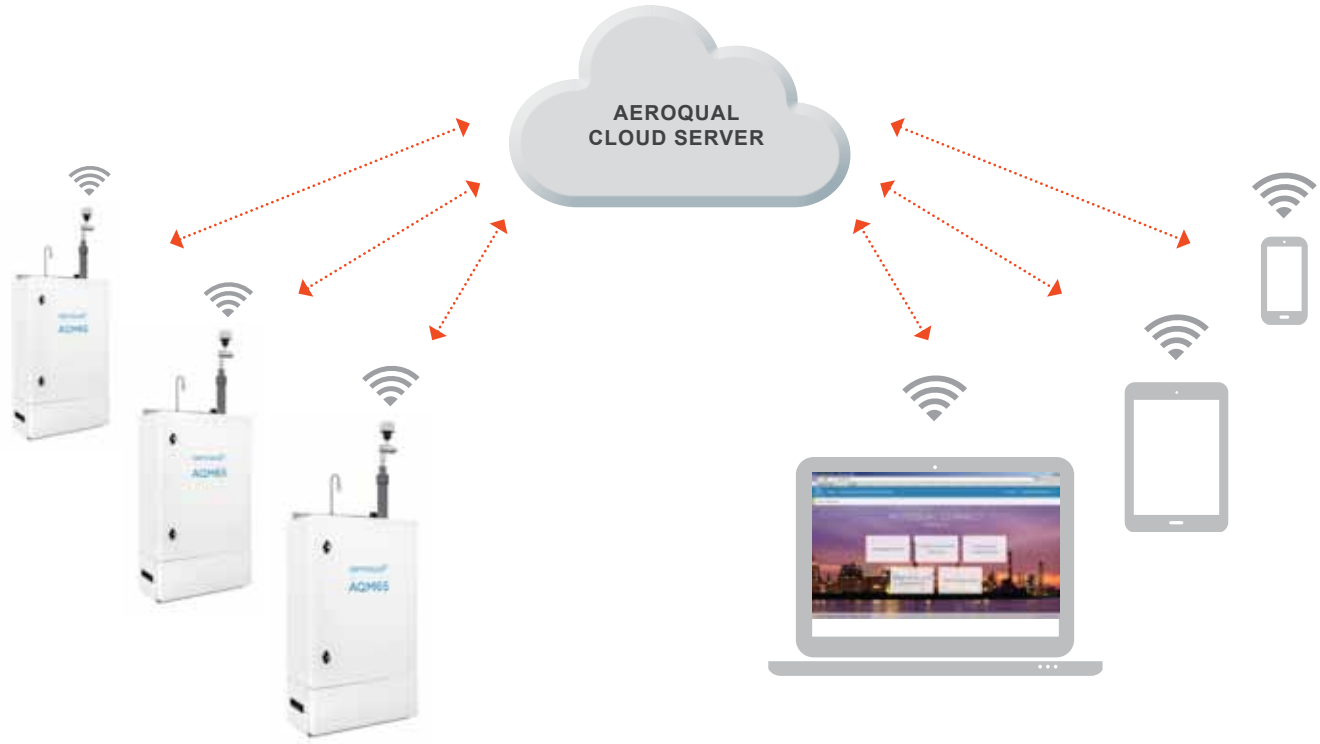
- Manage access privileges so only authorised users with usernames and passwords can use Connect

# Software – Aeroqual Cloud

Aeroqual Cloud gives you access to an AQM 65 or network of AQM 65s from any internet-enabled browser. The data is stored off-instrument and can therefore be accessed anywhere, anytime.

Aeroqual Cloud has all the same functions ('apps') as Aeroqual Connect plus a few additional options:

- Send SMS/text and email alerts
- FTP data to another server or software programme
- Send an Excel data file automatically via email




## Aeroqual Cloud has a number of advantages over Aeroqual Connect:

- Browsing speed is faster
- Data usage costs are lower
- Access multiple instruments at the same time
- Manage permissions across multiple users and stakeholders
- Data is backed up remotely, and is therefore completely secure
- Data can be accessed even when the instrument is offline

# Installation

The AQM 65 can be used almost anywhere – on roofs and lamp posts, by a busy street or an offshore oil rig, in cold and hot climates, on or off-grid. Installation is easy; get set up in under 30 minutes.

The robust IP65 enclosure consists of an aluminium casing with solar reflective outer layer and an internal 50mm layer of cross-linked PE foam. Carry handles enable portability, and connections are provided via a single easy to access panel. No additional enclosure is need to house the AQM 65.

Stable internal conditions are essential to maximise sensor performance. Stability is achieved using a thermal management system which consists of a Danfoss compressor, IP55-rated cooling fan, ducting and control software. The unique cooling and heating system ensures a constant temperature throughout the enclosure, within ±0.2°C. Careful control of the internal temperature means the AQM 65 can be installed in a wide range of climates, from tropical to sub-arctic.

## Standard AQM 65 with/without PM inlet


## AQM 65 with integrated calibration


Weight: 30kg*

Mounting Options: Platform, pole and wall mounting hardware included

Power Consumption:
90-264VAC, 47-63Hz
Typical draw: 100W*

Environmental Operating Range:
-35°C to +50°C

*Configuration used for power consumption and weight: Embedded PC, Sample Pump, System Manager, $NO_x$, $NO_2$, $O_3$, CO, $PM_{10}$ + inlet heater, $SO_2$, $H_2S$ (43W internal load); Internal temperature set point = 30°C, Ambient temperature used is 30°C.

# Maintenance

The AQM 65 is an air monitoring station that integrates a large number of measurements into a single compact instrument platform. The total cost of ownership and skill levels required for operation and maintenance are low compared with a traditional air quality station.

Here is an example of scheduled maintenance for a typical AQM 65 system comprising multiple gas and particulate measurements.

| | 2-4 WEEKS | 1-3 MONTHS | 3-6 MONTHS | 1 YEAR | 2 YEARS |
|---|---|---|---|---|---|
| ACTIVITY | Change gas inlet filter | Check inlet flow rates | Change particle inlet filters | Check gas module flow rates | Service gas analyzer modules |
| | — | Check zero calibration | Clean particle inlet and sharp cut cyclone | Leak test flow system | Factory calibrate particle sensor |
| | — | Check span calibration | — | — | Service pumps and compressor |
| SKILL LEVEL | LOW | MEDIUM | MEDIUM | MEDIUM | HIGH |
| WHO | End user or service agent | End user or service agent | End user or service agent | End user or service agent | Authorized service centre / Aeroqual |

# Integrated Calibration

By choosing the AirCal 8000 option you can calibrate the AQM 65 without going to site.

The AirCal 8000 is a dynamic gas dilution calibrator that is fully integrated with AQM 65 hardware and software. The gas cylinders are stored in a side-mounted enclosure and are permanently connected via regulators and tubing to the AQM 65 gas sampling system. It also includes a zero air generator.

Calibrations are managed through Aeroqual Connect or Cloud. When the AQM 65 is switched to calibration mode the AirCal 8000 will flow calibration gas to the gas sampling system. Using the Calibration App, a remote user can schedule calibration events automatically and make adjustments to gain and offset values. A full record of the gas delivery is automatically recorded in the journal for quality control reporting.


| | |
|---|---|
| GAS CONNECTIONS | |
| Compressed gas inlet ports (x2) | 1/8” inch Swagelok compression fitting |
| CYLINDER ENCLOSURE | |
| Gas cylinders | Capacity to store 2x 58 or 110L disposable cylinders (height 362mm, diameter 90 mm) |
| ZERO AIR GENERATOR | |
| Scrubbing media | Purafil chemisorbant, activated carbon, heated carulite catalyst |
| Ambient gases scrubbed | $NO_2$, NO, $SO_2$, CO, $H_2S$, $O_3$, hydrocarbons |
| Pump | 12VDC |
| GAS DILUTION MODULE | |
| NIST Traceable Mass Flow Meter (MFM) | 0 to 3000 sccm per minute<br>Accuracy <+/- 2% of reading |
| NIST Traceable Mass Flow Controller (MFC) | 0 to 50 sccm per minute<br>Accuracy <+/- 2% of reading |
| Dilution range set by user | 40 – 1000 times dilution |
| GAS DELIVERY MODES | |
| Manual | Gas delivery is manually initiated by engineer |
| Automatic | Gas delivery occurs automatically at scheduled time |

# Portable Calibration

The AirCal 1000 is a portable calibrator which is ideal for multi-site calibrations.

The AirCal 1000 is a dynamic dilution calibrator that allows two calibration gas cylinders to be connected at the same time. By swapping cylinders the AirCal 1000 can be used to calibrate a wide range of gas analyzer modules. It also includes a zero air generator.

The AirCal 1000 can be controlled using the PC software provided or manually operated using the buttons on the control panel. All necessary tubing and gas connections are supplied with the AirCal 1000. Conveniently, the AirCal 1000 can be used to calibrate other gas measurement instruments.


| | |
|---|---|
| GAS CONNECTIONS | |
| Compressed gas inlet ports (x2) | 1/8” inch Swagelok compression fitting |
| Outlet gas port | 1/4” inch PVDF compression fitting |
| ZERO AIR GENERATOR | |
| Scrubbing media | Purafil chemisorbant, activated carbon, heated carulite catalyst |
| Ambient gases scrubbed | NO2, NO, SO2, CO, H2S, O3, hydrocarbons |
| GAS DILUTION MODULE | |
| NIST Traceable Mass Flow Meter (MFM) | 0 to 3000 sccm per minute<br>Accuracy <+/- 2% of reading |
| NIST Traceable Mass Flow Controller (MFC) | 0 to 50 sccm per minute<br>Accuracy <+/- 2% of reading |
| Dilution range set by user | 40 – 1000 times dilution |
| SPECIFICATIONS | |
| Communication port | 9 pin serial RS232 port |
| Power supply module | 100-240V AC to 12V DC switching adaptor |
| Dimensions and weight | 422 x 422 x 148 mm; 12 kg |
| Instrument carry case | Impact and water resistant; 515 x 430 x 200 mm |

# Service

Our distributors are uniquely experienced in the specification, delivery and support of AQM 65 air monitoring projects. We are now represented in over 50 countries, meaning you're never too far from an Aeroqual service centre.

## Training

Training is the essential ingredient of project success. We have developed a range of tools to train customers and distributors globally. In most cases our authorised distributor will train your engineers when the equipment arrives on site.

We also provide an Online Learning System free of charge. Here you can learn everything you need to know about the installation, operation and maintenance of the AQM 65 – it is full of videos, diagrams and links to useful resources. Factory training here in Auckland, New Zealand, is another option. There is nothing like getting hands on training with the latest equipment and meeting the people behind the product. Come visit us and make the most of our fresh air, fine food and first class facilities.

## Technical Support

With your permission we can stay connected to your AQM 65 throughout its operating life. Connect and Cloud are powerful software tools that enable us to remotely view and analyze data, diagnose faults, and implement fixes. Having the manufacturer available when it's needed adds another layer of comfort to the support you will enjoy from your authorised Aeroqual distributor.

## Warranty

If there is a defect or a fault due to workmanship, most likely it will be covered by Warranty. Every AQM 65 comes with a factory-backed Warranty that is generously administered.

# Why choose Aeroqual?

Aeroqual is leading the move towards sensor-based air quality monitoring – a technology and market shift that promises to deliver better air quality for governments, industry, and citizens alike.

Established in 2001, Aeroqual has spent more than a decade perfecting sensor-based air quality measurements in a variety of applications and climates in more than 50 countries worldwide. The company's products have been tried and tested by blue chip customers such as Dubai Municipality, Vale, EDF Energy, and Samsung. As the shift towards sensor-based air quality monitoring accelerates, Aeroqual is setting the standard for others to follow.

Sensors have many advantages over traditional measurement techniques, but few companies have been able to produce credible and defensible air quality measurements. This is especially true in outdoor ambient monitoring applications where low detection levels and environmental factors make sensor-based measurement extremely challenging.

Making defensible air quality measurements using relatively low cost sensors requires unique skills and experience. Aeroqual has deep and multi-disciplinary expertise covering:

- Sensor design, fabrication and calibration
- Signal processing and algorithms
- Instrument design and development
- Application and support of instruments in the field
- Atmospheric science

As well as possessing world class technology, Aeroqual has invested in bespoke production facilities in Auckland, New Zealand and operates a quality management system certified to ISO 9001:2008. Our people are experts in the field, determined to help customers realize the benefits from sensor-based air quality measurement.

## Near Reference Pioneers

Launched in 2008, the AQM 60 pioneered a new 'Near Reference' air monitoring category. Data quality and traceability is to the highest possible standards for sensor-based air quality instruments.

## Recognized by the US EPA

In the US EPA's 2014 Air Sensor Guidebook Aeroqual's Series 500 was highlighted among a handful of manufacturers. The Guide featured our ozone, nitrogen dioxide, and carbon monoxide sensors.

## ISO 9001-2008 Certified

Our quality systems have been certified under ISO-9001-2008 – demonstration of our commitment to producing quality products and continuous improvement.

## MCERTS, a world first

Our Dust Sentry PM10 was the world's first nephelometer to pass the MCERTS indicative particle monitoring standard of the UK's Environment Agency.

# Product Range

Our ambient air monitoring product range spans portable and fixed instruments for spot checks and surveys, short and long term monitoring. The products have been designed to maximise accuracy and affordability, and are easy to deploy and easy to use. With a decade of experience making sensor-based air quality instruments, we are innovating and releasing new products at a rapid rate. Keep in touch with us to hear about the latest developments.

## Portable Monitors

- Handheld ultraportable instruments
- Measure multiple gaseous pollutants
- Long life lithium battery for a full day in the field
- On board data logging and software included (Series 500)
- Optional enclosure for short term fixed monitoring
- Applications: air quality surveys, checking ‘hot spots’, personal exposure studies


## Dust Monitors

- Fixed instruments for outdoor ambient monitoring
- Laser-based detection allows real-time measurement
- Choose from TSP, $PM_{10}$, $PM_{2.5}$ and $PM_1$
- Optional wind, noise, weather sensors
- MCERTS certified Dust Sentry $PM_{10}$
- Applications: fenceline monitoring, roadside monitoring, air quality research, short term studies


## Air Quality Monitoring Systems

- ‘Near reference’ multi-parameter monitoring
- Simultaneous measurement of gas, particulate, and environmental conditions (wind, noise, solar)
- Capable of monitoring to WHO requirements
- 1ppb detection of $O_3$, $NO_2$, NOx; <10ppb $SO_2$
- Optional integrated calibration
- Applications: national air monitoring networks, urban air monitoring, industrial fenceline monitoring, air quality research

# Standards Comparison

In field trials the AQM 65 has demonstrated the ability to measure common air pollutants to the levels required by international ambient air quality standards. Because the system can be field calibrated using Standard Reference Materials, the AQM 65's measurements are completely traceable, giving a very high level of confidence in the data. For independent reports on system performance please contact Aeroqual or ask your local representative.

## AQM 65 performance specifications versus selected international ambient air quality standards

| POLLUTANT | AQM 65 CALIBRATED RANGE | AQM 65 LIMIT OF DETECTION | EU STANDARDS (2008/50/EC) | US EPA STANDARDS (NAAQS) | WHO GUIDELINES (AQG 2005) |
|---|---|---|---|---|---|
| Carbon monoxide | 0-25 ppm<br>(0-29 mg/m$^3$) | <0.04 ppm<br>(<0.05 mg/m$^3$) | (8.74 ppm / 8h)<br>10 mg/m$^3$ / 8h | 9 ppm / 8h<br>(10.3 mg/m$^3$) | |
| Ozone | 0-0.5 ppm<br>(1000 µg/m$^3$) | 0.001 ppm<br>(2 µg/m$^3$) | (0.102 ppm /1h)<br>(0.061 ppm / 8h)<br>200 µg/m$^3$ / 1h<br>120 µg/m$^3$ / 8h | 0.075 ppm / 8h<br>(157 µg/m$^3$ / 8h) | (0.051 ppm /8h)<br>100 µg/m$^3$ / 8h |
| Nitrogen dioxide | 0-0.2 ppm<br>(380 µg/m$^3$) | 0.001 ppm<br>(1.9 µg/m$^3$) | (0.115 ppm / 1h)<br>(0.023 ppm / 1y)<br>200 µg/m$^3$ / 1h<br>40 µg/m$^3$ / 1y | 0.053 ppm / 1y<br>(100 µg/m$^3$) | (0.115 ppm / 1h)<br>(0.023 ppm / 1y)<br>200 µg/m$^3$ / 1h<br>40 µg/m$^3$ / 1y |
| Sulfur dioxide | 0-10 ppm<br>(0-29 mg/m$^3$) | 0.009 ppm<br>(25 µg/m$^3$) | (0.133 ppm / 1h)<br>(0.047 ppm / 24h)<br>350 µg/m$^3$ / 1h<br>125 µg/m$^3$ / 24h | 0.14 ppm / 24h<br>(365 µg/m$^3$) | (0.191 ppm / 10m)<br>(0.007 ppm / 24h)<br>500 µg/m$^3$ / 10m<br>20 µg/m$^3$ / 24h |
| $PM_{10}$ | 0-2000 µg/m$^3$ | 1 µg/m$^3$ | 50 µg/m$^3$ / 24h<br>40 µg/m$^3$ / 1y | 150 µg/m$^3$ / 24h | 50 µg/m$^3$ / 24h |
| $PM_{2.5}$ | 0-2000 µg/m$^3$ | 1 µg/m$^3$ | 25 µg/m$^3$ / 24h | 35 µg/m$^3$ / 24h | 25 µg/m$^3$ / 24h |

URS

"URS was highly satisfied not only with the instrument but also with the full services provided by Aeroqual."

ANGLOGOLD ASHANTI

"The integrated nature of Aeroqual products, ensure that the study objectives are met at a relatively low cost."

UEA
UNIVERSIDADE DO ESTADO DO AMAZONAS

"Aeroqual instruments provide a unique learning opportunity for graduate students to experience air quality monitoring."

EGNATIA ODOS S.A.

"Aeroqual offers a real-time air quality monitoring platform that is truly mobile, stable and accurate."