



The Aurora range of integrating nephelometers.

Aerosol monitoring and atmospheric research.

# World-class aerosol monitoring and measurement.



Today, right around the world, atmospheric scientists and environmental agencies rely on our range of Aurora integrating nephelometers. They've proven themselves to not only be accurate, flexible and easy to use, but also transportable and designed to cope with the demands of use in remote locations.

- Comprehensive range of nephelometers; from single or three wavelength integrating nephelometers to a polar three wavelength integrating nephelometer
- The Aurora range offers total remote control including calibration
- Rugged and robust. Proven capability in remote, unattended locations for long term monitoring
- Fully integrated with Ecotech's Airodis, the data collection, validation and reporting software
- User friendly and easy to maintain in the field
- Uncompromising performance with low cost of ownership

---

## VISIBILITY APPLICATION.

Visibility can be impaired by anything present in the air that reduces the amount of light reaching the observer, through scattering or absorption.

Common visibility deterioration is due to high particulate concentration or high humidity. Particles can be of natural or anthropogenic origin, for example, from car emissions, wood burning, sandstorms, volcanic eruptions or smog.



*Severe dust storm in Sydney, Australia*

Aurora integrating nephelometers are an ideal solution to help us in understanding, identifying and planning ways to control pollution and the imbalance in or degradation of the environment. This is why governments and EPA's use our Aurora in visibility applications.

## AUTOMOBILE APPLICATION.

Emissions from diesel exhaust is a known source of health deterioration. This is why reliable environmental monitoring is absolutely crucial for the automobile industry for whom compliance with regulatory standards is non-negotiable.

The Aurora meets the specific requirements for measuring diesel exhaust particulate emissions, by addressing some of the monitoring concerns such as:

- Linearity - The Aurora gives a linear response with emissions at extremely high particulate concentrations due to the use of optical measurement principle
  - Clogging - No filter used preventing clogging of the sample system
  - Hot sampling - Robust design of the instrument; dilution possible due to instrument being free of filter and pump
-

# Affordable excellence.

## AURORA 1000



### CLEAR CHOICE FOR VISIBILITY MONITORING.

The Aurora 1000 is the perfect choice for any air quality monitoring system. It is a highly cost-effective entry level instrument uncompromised in its reliability and designed to run in extreme conditions.

#### FEATURES

Single wavelength, available in 525 nm, 450 nm or 635 nm

Wide measurement range (0.3 to 20,000  $Mm^{-1}$ )

Fully automatic calibration using internal valves; ideal for remote locations

*Multiple options are available to be used in conjunction with the Aurora range. Refer to matrix table for a list of options and compatibility.*

# Better correlation.

## Aurora 2000



### REAL-TIME MASS CONCENTRATION.

Using a single wavelength nephelometer (525 nm, 450 nm or 635 nm) to measure aerosol light scattering in conjunction with a Spirant BAM\*, the Aurora 2000 uses the reading from the Spirant BAM's hourly average to calculate a correlation factor to derive real-time  $PM_{2.5}$  concentrations. When the Spirant BAM is not connected the user can manually derive and enter a correlation factor.

#### FEATURES

Enables real-time  $PM_{2.5}$  concentration measurement in conjunction with a Spirant BAM

12V DC (110-240 VAC, 50/60 Hz power converter included) 13 watts nominal, 45 watts max

*\*The Spirant BAM measures and records airborne particulate concentrations using a  $\beta$  ray attenuation method.*

# All-round capability.

## AURORA 3000



## PROVEN RESULTS FOR LONG TERM MONITORING.

The Aurora 3000 is the favoured choice of researchers as it facilitates simultaneous measurement across three wavelengths, enabling wide and in-depth analysis of the interaction between light and aerosols. Its capabilities include integrating measurements of full scatter and backscatter, making it a perfect instrument for climate change research. Like its siblings, the Aurora 3000 has a range from 0.3 to 20,000  $Mm^{-1}$ . A high-precision option is also available, with a lower detectable limit of 0.1  $Mm^{-1}$ .

### FEATURES

Multi-wavelength LED light source for long term stable measurements at 635 nm, 525 nm and 450 nm

Integrating measurements of full scatter and backscatter

Used in conjunction with the ACS 1000 for a light scattering enhancement factor measurement (optional)

**NEW** Automatic ball valve option: protect against contamination of a common sampling manifold, bypassing the instrument during calibration

**NEW** Mass flow control option enables flow to be controlled in conjunction with an external pump

## AEROSOL LIGHT SCATTERING APPLICATION.

The Aurora integrating nephelometer measures the light scattering coefficient of ambient aerosol particles with high sensitivity and time resolution, in a wide range of monitoring and research applications, related to air pollution and climate.

### LONG TERM MONITORING.

"The direct and indirect radiative effects of aerosol particles constitute the largest uncertainty in current radiative forcing estimates of the Earth's climatic system. In order to reduce the uncertainties associated with atmospheric aerosols in climate systems, detailed information on the temporal and spatial variability of different aerosol properties is required. Such information can be obtained from a combination of model simulations, remote sensing and continuous in-situ aerosol measurements."

- Lasskso et al, 2010 'South African EUCAARI measurements: seasonal variation of trace gases and aerosol optical properties.' *Atmospheric Chemistry and Physics*.

## LIGHT SCATTERING IN REMOTE LOCATIONS.

The Aurora range is widely used in remote and unattended locations, examples include:

- Research on aerosol optical properties at high-altitude in the Mediterranean Basin conducted by the Institute of Environmental Assessment and Water Research (IDAEA-CSIC) in Montseny, Spain
- Research on aerosol optical properties conducted by Paul Scherrer Institute (PSI) as part of the CATCOS project across Indonesia, Chile, Vietnam and Kenya
- Research on various aerosol properties at high altitude conducted by Observatoire de Physique du Globe, France in Puit De Dôme, France

# Best in class.

## Aurora 4000 - POLAR



## MEASURING THE AEROSOL PHASE FUNCTION.

The Aurora 4000 builds on the same three wavelength capabilities as the Aurora 3000. This device provides measurements of light scattering within up to 18 user selectable angular sectors, using varied backscatter shutter positioning. This can be used to determine the phase function of aerosols, which is crucial to climate research and modelling.

Despite its sophisticated capabilities, the Aurora 4000 maintains the same ease of use, maintenance and calibration as the rest of the Aurora range.

### FEATURES

Wide measurement range (0.1 to 20,000  $Mm^{-1}$ )

18 angular sectors; full integrated scattering, as well as integrated scattering of up to 17 different angular sectors from 10° to 90° through to 170°

Raw measurement counts available for customised data analysis

**NEW** Automatic ball valve option: protect against contamination of a common sampling manifold, bypassing the instrument during calibration

**NEW** Mass flow control option enables flow to be controlled in conjunction with an external pump

## AIRCRAFT MEASUREMENTS APPLICATION.

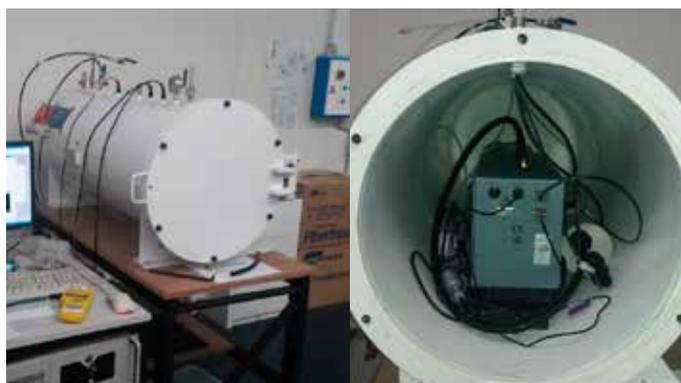
The Aurora is intended to meet the following critical requirements expected for aircraft measurements:

- Compact and light weight
- Flow control with no restrictions
- Very low LDL
- Small cell volume
- Fast data acquisition (down to three seconds)
- Low power consumption
- Can be operated at -40°C and at altitudes of up to 15,000 meters

## AEROSOL LIGHT SCATTERING RESEARCH.

Optical closure studies:

“Atmospheric aerosols play an important role in determining direct radiative transfer by scattering and absorbing solar radiation. Refractive indices are also necessary to determine the optical parameters relevant to radiative transfer such as



Aurora 4000 in a pressure chamber, testing the reliability when exposed to harsh conditions expected at altitudes of up to 15,000 meters.

single scatter albedo, asymmetry factor and specific absorption using Mie-Lorenz theory. Additionally, reliable phase function and polarization information is essential for the interpretation of satellite and aircraft measurements to infer aerosol optical depth, size and single scatter albedo.”

- H. Kim & S. E. Paulson 2013, 'Real refractive indices and volatility of secondary organic aerosol generated from photooxidation and ozonolysis of limonene,  $\alpha$  pinene and toluene.' *Atmospheric Chemistry and Physics*.

# The perfect complement.

ACS 1000



## INNOVATION IN HYGROSCOPIC STUDY.

Ecotech's Aerosol Conditioning System (ACS 1000) can be used with most aerosol monitoring instruments, adjusting relative humidity with minimal particle loss to measure the effect of water uptake on the properties of aerosols. The ACS 1000 simultaneously controls differing relative humidity levels in two sample channels, allowing real-time measurement by parallel instruments for comparison.

## FEATURES

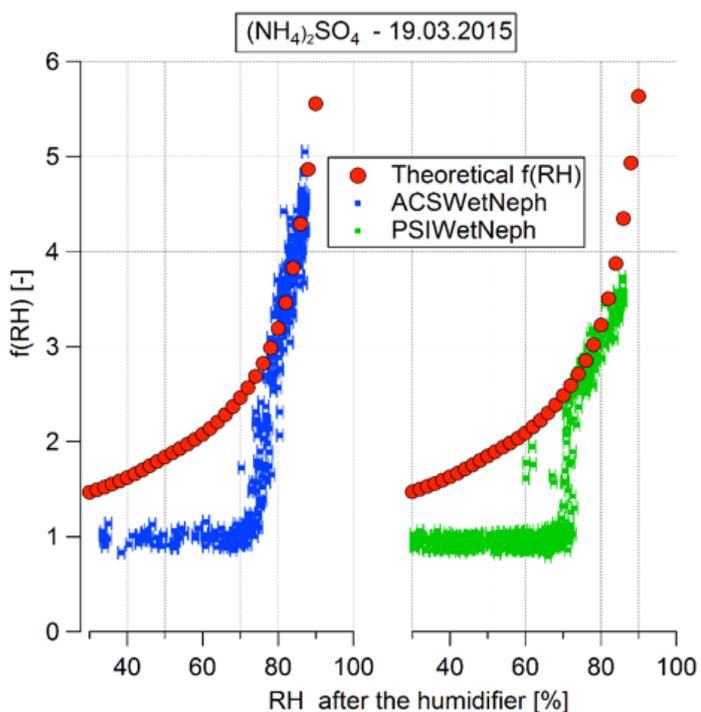
Sample RH controllable between 40 % and 90 % with minimal particle loss

Customisable flow and humidograms

Autoranging power supply 110-250 VAC, 50/60 Hz

Controls RH within  $\pm 0.2\%$  ( $1\sigma$ )

Measurement accuracy better than 0.3 %,  $\pm 0.1$  K



"Ammonium sulfate particles light scattering enhancement ( $f(RH)$ ) calculated (red markers) and measured by the ACS 1000 (blue dots) and the WetNeph developed by the Paul Scherrer Institute (green dots). The errors bars represent the precision of the RH measurements according to the manufacturer." Laborde et al. 2015, in prep.

# Options, features and accessories matrix.

	AURORA 1000	AURORA 2000	AURORA 3000	AURORA 4000
Mass Flow Control Option	✓	✓	✓	✓
PM <sub>10</sub> Inlet <b>PART NO: H020449</b>	✓	✓	✓	✓
PM <sub>2.5</sub> Inlet <b>PART NO: H020450</b>	✓	✓	✓	✓
Automated Ball Valve Option <b>PART NO: E011009</b>	✓	✓	✓	✓
Upgrade LDL Option <b>PART NO: E011007</b>	×	×	✓	✓ †
External Pump Controller Kit <b>PART NO: E011006</b>	✓	✓	✓	✓
External Pump Kit <b>PART NO: H020332</b>	✓	✓	✓	✓ †
External Pump <b>PART NO: P030004</b>	✓	✓	✓	✓
Aerosol Conditioning System (ACS 1000)	✓	✓	✓	✓ *
Ability to Log Raw Data	×	×	×	✓
Ability to Display Units In µg/m <sup>3</sup> Using Spirant BAM or User K Factor	×	✓	×	×
Calibration Kit <b>PART NO: H020331</b>	✓	✓	✓	✓
External 12 Volt Cable Kit <b>PART NO: C020022</b>	✓	✓	✓	✓
Exhaust Tube Kit <b>PART NO: H020330</b>	✓	✓	✓	✓
Service Kit <b>PART NO: H020335</b>	✓	✓	✓	✓
Wall Mounting Bracket <b>PART NO: H020005</b>	✓	✓	✓	✓
Roof Flange <b>PART NO: ECO-M9003004</b>	✓	✓	✓	✓
Rain Cap <b>PART NO: ECO-M9003011</b>	✓	✓	✓	✓
Black Silicone Carbon Tubing <b>PART NO: TUB-1015</b>	✓	✓	✓	✓
1/2" Inlet Tube (0.8 m, 1 m, 1.5 m or 2 m) <b>PART NO: H02032N</b> (refer to footnote)	✓	✓	✓	✓

† The selected Aurora comes standard with this feature

\* The Aurora 4000 gives RH feedback to the ACS 1000

N = 0 (0.8 m insulated), 2 (1 m un-insulated), 3 (1.5 m un-insulated) or 4 (2 m un-insulated) for sample Inlet Tube

# Training and support.

## A PARTNERSHIP WITH ECOTECH.

There's a lot more to our Aurora range or ACS 1000 system than what comes in the box. We provide continuous support for users right across the globe. Our own scientists and engineers can always be called upon for advice, knowledge and practical assistance, and they're available in any time zone.

We also facilitate user group meetings throughout the year, enabling a forum for researchers to share experiences and receive guidance from Ecotech experts as well as peers. Our blog is the hub of a virtual network, also offering firmware and software updates.

Owning an Aurora instrument means we are partners on your journey.

## Make Aurora your choice.

### Contact Ecotech for ordering and delivery details.

#### Ecotech Pty Ltd

T (Australia) 1300 364 946

T (International) +61 3 9730 7800

E [info@ecotech.com](mailto:info@ecotech.com)

[ecotech.com](http://ecotech.com)