PRODUCT CONFORMITY CERTIFICATE

This is to certify that the

AQMesh (heated inlet)

Manufactured by:

Environmental Instruments Ltd
Unit 5, The Mansley Centre
Timothy's Bridge Road
Stratford Upon Avon
CV37 9NQ, UK

has been assessed by CSA Group
and for the conditions stated on this certificate complies with:

MCERTS Performance Standards for Indicative Ambient Particulate Monitors, Environment Agency, August 2017, version 4

Certification ranges:

$PM_{2.5}$ 0-2,000 µg/m^3
PM_{10} 0-2,000 µg/m^3

Project No.:	80176974
Certificate No:	CSA MC240422/00
Initial Certification:	30 April 2024
This Certificate issued:	30 April 2024
Renewal Date:	29 April 2029

Andrew Young
Environmental Team Manager

MCERTS is operated on behalf of the Environment Agency by

CSA Group Testing UK Ltd
Unit 6, Hawarden Industrial Park
Hawarden, Deeside, CH5 3US
Tel: +44 (0)1244 670 900

UKAS PRODUCT CERTIFICATION 0011

Form 1335
Issue 11

Certificate Contents

Approved Site Application

Any potential user should make sure, in consultation with the manufacturer, that the monitoring system is suitable for the intended application. For general guidance on monitoring techniques refer to the Environment Agency guidance available at www.mcerts.net

The indicative dust monitoring analyser(s) can be operated in one of two ways:

For qualitative measurements: Providing qualitative measurement data for the analysis of particulate pollution trends, and source identification studies based for example on pollution roses etc. Such application can rely on instrument factory calibration only.

For quantitative measurements: Providing measurement data with the uncertainty defined for indicative instruments (+/- 50%). This can be achieved on condition that each instrument used for measurement has been calibrated on the specific site where monitoring is taking place against a standard reference method for a period of two weeks and the resulting slope and intercept have been used for instrument calibration. Using non-standard filters and procedures for this purpose is not acceptable. To maintain the validity of data this calibration has to be repeated at least every twelve months or when the instrument is moved to a different site.

They **cannot** be used on national automatic monitoring networks for compliance reporting against the Ambient Air Quality Directives.

The field test was carried out from the 14th December 2021 to the 1st November 2022 on two candidate 'AQMesh (heated inlet)' sensor systems, collocated with a Palas Fidas 200 (the reference method). The location of the field test was University of Manchester, Fallowfield, Manchester, UK. The serial numbers of the two 'AQMesh (heated inlet)' sensor systems were '2450622' and '2450623'.

Basis of Certification

This certification is based on the following test report(s) and on CSA Group's assessment and ongoing surveillance of the product and the manufacturing process:

Bureau Veritas, test report ref. AIR18443191, dated March 2024, "AQMesh, Test of the AQMesh (Heated inlet) Sensor Systems for use as an Indicative Monitor for PM_{10} and $PM_{2.5}$"

Product Certified

The 'AQMesh (heated inlet)' measuring system consists of the following parts:

- Base Station which provides data storage, communications as well as mounting for pollution sensors (gas and PM).
- Gas sensors (optional)
- PM Optical Particle Counter (optional)
- Antenna
- Mounting bracket
- Solar protection shield
- Power unit – internal battery, external battery, DC source in via; transformer, solar power pack, etc.

AQ mesh (heated inlet) sensor systems are available without the additional gas sensing cartridges. The certification testing demonstrated that PM monitoring was unaffected by the addition of gas sensing cartridges. The two variants are distinguished as follows: 'P' for PM monitoring only and 'C' for PM with additional gas monitoring.

Sensor type and firmware version
OPC sensor – Environmental Instruments Ltd, 2013065
Firmware version 2.0

OPC setting T1 (sample duration) - 30 seconds
OPC setting Tx (sample interval) - 60 seconds (fixed by firmware)

Sensor System
AQMesh firmware version - v3.37 onwards

Algorithm Version
AQMesh algorithm version - v3.1

This certificate applies to all instruments fitted with serial number 2450622 onwards.

Certified Performance

Test (***Laboratory***)	Results expressed as % of the certification range				Other results	MCERTS specification
	<0.5	<1	<2	<5		
Constancy of the sample volumetric flow					Not applicable (Note 1)	To remain constant within ± 3%
Tightness of the sampling system		0.90				Leakage not to exceed 2% of sampled volume

Test (**Field**)	Results expressed as % of the certification range				Other results	MCERTS specification
	<0.5	<1	<2	<5		
Intra-instrument uncertainty for the reference method						
PM_{10}					0.33 µg/m^3	≤2.5µg/m^3
$PM_{2.5}$					0.25 µg/m^3	≤2.5µg/m^3
Intra-instrument uncertainty for the candidate method						
PM_{10}						
All data (n= 279)					1.28 µg/m^3	≤5µg/m^3 for all data as well as for the subsets: < or ≥ 30 µg/m^3
≥ 30 µg/m^3 (n= 2)					2.36 µg/m^3	
< 30 µg/m^3 (n= 277)					1.26 µg/m^3	
$PM_{2.5}$ (Note 2)						
All data (slope corrected, n= 278)					2.16 µg/m^3	≤5µg/m^3 for all data as well as for the subsets: < or ≥ 18 µg/m^3
≥ 18 µg/m^3 (slope corrected, n= 7)					1.41 µg/m^3	
< 18 µg/m^3 (slope corrected, n= 271)					2.22 µg/m^3	
Highest resulting uncertainty estimate comparison against data quality objective (Measurement Uncertainty)						W_{CM}≤50% $W_{CM} \leq W_{dpo}$ (W_{dpo} Measurement uncertainty defined as 50% for indicative instruments)
PM_{10}						
All data (n= 279)					22.5 %	
≥ 30 µg/m^3 (n= 2)					37.1 %	
$PM_{2.5}$ (Note 2)						
All data (slope corrected, n= 278)					13.1 %	
≥ 18 µg/m^3 (slope corrected) (n= 7)					28.1 %	
Maintenance Interval					>2 weeks (Note 3)	≥2 weeks

Note 1 - This test was deemed not applicable as the flow rate is too low to be accurately determined.
Note 2 - This data was slope corrected by dividing the values by 0.714. All users must slope correct $PM_{2.5}$ data by dividing by 0.714.
Note 3 - Maintenance - the manufacturer states that the laser and pump should be replaced after 10,000 hours of working use and that the cleaning interval will depend on the environment the instrument is working in, but the instrument has data flags to indicate which issues arise. The manufacturer advises that instrument should be inspected at least every 6 months. No maintenance was required over the 13-week field trial period.
Note 4 - The 'AQMesh (heated inlet)' sensor system must be set up using the configuration, as follows; i) Environmental Instruments Ltd OPC model number 2013065 sensor with firmware version '2.0', and ii) Algorithm version: 3.0h PM. The firmware version '3.37'.

Description

AQMesh has a particulate matter sensor that consists of an optical particle counter (OPC) capable of measuring particles from 0.3µm up to 30µm via a pump drawn sample. $PM_{2.5}$ and PM_{10} are calculated assuming a uniform particle density. The addition of a heated inlet dries the particle sample prior to measurement to remove effects caused by humidity. Erroneous data and instrument faults are automatically flagged and available as part of the data download.

Raw sensor data is sent from AQMesh to server via cellular network. Worldwide coverage 4G/5G LTE Cat M1/NB1 with 2G fallback. Secure encryption and direct communication protocols, result in bi-directional communications and facilitates remote configuration, firmware update and sensor calibration of the devices through the AQMeshData.net web platform.

AQMesh can be powered using a number of options such as; internal battery, external battery, solar power pack or via AC/DC transformer connected to mains.

General Notes

1. This certificate is based upon the equipment tested. The Manufacturer is responsible for ensuring that on-going production complies with the standard(s) and performance criteria defined in this certificate. The manufacturer is required to maintain an approved quality management system controlling the manufacture of the certified product. Both the product and the quality management system shall be subject to regular surveillance according to 'Regulations Applicable to the Holders of CSA Group Testing UK Ltd Certificates'.

2. The design of the product certified is defined in the CSA Group design schedule V00 for certificate no. CSA MC240422/00.

3. If a certified product is found not to comply, CSA Group should be notified immediately at the address shown on this certificate.

4. The certification marks that can be applied to the product or used in publicity material are defined in 'Regulations Applicable to the Holders of CSA Group Testing UK Ltd Certificates'.

5. This document remains the property of CSA Group and shall be returned when requested by CSA Group.