PRODUCT CONFORMITY CERTIFICATE

This is to certify that the

Zephyr

Manufactured by:

EarthSense Systems Ltd
Space Park Leicester
92 Corporation Road
Leicester
Leicestershire, LE4 5SP
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*
(*This MCERTS scheme is not covered under CSA Group's UKAS flexible scope for ISO.IEC17065:2012)

Certification ranges:

$PM_{2.5}$ 0-1,000 µg/m^3
PM_{10} 0-1,000 µg/m^3

Project No.:	81036098
Certificate No:	MC210393/00
Initial Certification:	14 November 2022
This Certificate issued:	14 November 2022
Renewal Date:	13 November 2027

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

Form 1335
Issue 10

Certificate Contents

Approved Site Application

Any potential user should ensure, 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 Monitoring Technical Guidance Notes 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 tests were carried out from the 30 September 2021 to the 17 June 2022 on two candidate 'Zephyr' samplers, collocated with a Palas Fidas 200 (the reference method). The location of the field test was Teddington, London. The serial numbers of the two Zephyr monitors were '877' and '879'.

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. AIR12223708, dated 2 September 2022, "EarthSense, Test of the Zephyr Air Quality Monitor for use as an Indicative Monitor for PM_{10} and $PM_{2.5}$"

Product Certified

The ‘Zephyr’ measuring system consists of the following parts:

- The head unit which includes data storage, communications, a weatherproof shell and two vacant slots to fit sensing cartridges, and
- The sensing cartridges that host the pollutant sensors within a cavity that has an inlet fan and passive outlet fan. These are located on the bottom of the Zephyr head unit and connect to the head unit *via* an electrical connection.

There are four sensor cartridge options available, and a single Zephyr head unit can operate with two sensing cartridges fitted in parallel.

There are two sensor cartridges applicable for this certificate, these are:

Standard: Measuring NO_2, NO, O_3, PM_1, $PM_{2.5}$ and PM_{10}
Enhanced: Measuring NO_2, NO, O_3, PM_1, $PM_{2.5}$ and PM_{10}, CO, H_2S and SO_2

Certification relates to $PM_{2.5}$ and PM_{10} only.

Sensor type TM7 with algorithm version CDG 41.

This certificate applies to all instruments fitted with firmware version “2.137” onwards (serial number 879).

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			1.6%			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}					0.33µg/m³	≤2.5µg/m³
$PM_{2.5}$					0.25µg/m³	≤2.5µg/m³
Intra-instrument uncertainty for the candidate method						
PM_{10}						
All data (n=256)					0.75µg/m³	≤5µg/m³ for all data as well as for the subsets: < or ≥ 30 µg/m³
≥ 30 µg/m³ (n=11)					1.69µg/m³	
< 30 µg/m³ (n=245)					0.68µg/m³	
$PM_{2.5}$						
All data (n=256)					0.58µg/m³	≤5µg/m³ for all data as well as for the subsets: < or ≥ 30 µg/m³
≥ 18 µg/m³ (n=27)					0.93µg/m³	
< 18 µg/m³ (n=229)					0.52µg/m³	
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=256)					24.3%	
≥ 30 µg/m³ (n=11)					28.5%	
$PM_{2.5}$						
All data (n=256)					54.4%	
All data (slope corrected) (n=256)					14.3% (note 2)	
≥ 18 µg/m³ (slope corrected) (n=27)					27.5% (note 2)	
Maintenance Interval					>20 weeks Note 3	≥2 weeks

Note 1 - The Zephyr utilises a fan and not a pump, therefore it was agreed that this test was not applicable.

Note 2 - This data was slope corrected by dividing by 1.257. All users must slope correct $PM_{2.5}$ data by dividing by 1.257 - it is recommended that the manufacturer program this value into their algorithm in order to avoid confusion to end users. End users should check with the manufacturers that this has been carried out.

Note 3 – Maintenance - the manufacturer recommends replacement of the PM sensors every 24 months.

Description

Zephyr measures particulate matter fractions using an optical particle counter (OPC). Proprietary algorithms convert particle count measurements into absolute particulate concentration measurements, applying corrections to account for the effects of humidity.

Simultaneous measurements for PM_1, $PM_{2.5}$ and PM_{10} are provided without requirement for a heated or size selective inlet (only $PM_{2.5}$ and PM_{10} are covered under this certification). Zephyr can also be equipped to measure a range of other gaseous pollutants alongside PM measurements. These include NO, NO_2, O_3, SO_2, H_2S, CO, CO_2 and TVOC (not covered under this certification).

The system is equipped with a range of data transmission protocols that provide remote continuous monitoring options globally. End users access monitoring data via a web-based data portal or via an application programming interface (API) designed for integration with third party programmes.

Zephyr can be powered via a range of methods, including; Solar Panel, Internal Battery, External Battery and Mains Power.

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. Sira MC210393/00.

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.