Turnkey Instruments Ltd

Tel: +44 (0)1606 330020 www.turnkey.tel

APM

Osiris Monitor
Sira MC 090157/01

Topas Monitor
Sira MC 090158/01

Airborne Particulate Monitors

- **Real time air quality monitoring**
- **Simultaneous TSP, PM10, PM2.5 & PM1**
- **Multi-monitor networks**
- **Spot monitoring, portable or permanent installations**
- **Meteorological instruments**

Turnkey Instruments design and manufacture a range of easy to use instruments which continuously measure and record the concentration of airborne particles. In their environmental mode, these instruments can simultaneously monitor the concentrations of TSP, PM10, PM2.5 and PM1 particles. Alternatively, in their workplace mode, the inhalable, thoracic and respirable fractions can be monitored.

An internal reference filter can be used to confirm the gravimetric calibration of the instruments.

All instruments feature internal data logging for the particle concentrations. Osiris and Topas also allow wind speed and direction, temperature, humidity, rainfall and two external gas or noise meter inputs to be recorded at the same time.

All instruments use our own proprietary nephelometer. A pump continuously draws an air sample through the nephelometer, which analyses the individual particles as they pass through a laser beam. These same particles are then collected on the reference filter. The nephelometer's dedicated microprocessor can analyse individual particles even if there are millions of them per litre. This allows size fractions to be determined at concentrations up to several mg/m^3. Above this there is an indicator range which can be used without sizing up to 60 mg/m^3.

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Osiris (Particulate Monitoring)

The Osiris is a small and compact instrument that can be used to study short to long term particulate monitoring. Powered by various power options to suit your application. The Osiris can be used effectively to determine exceedance areas.

DustMate

DustMate is a hand-held detector ideal for short term sampling. Highly effective for monitoring air quality within buildings and clean rooms. It measures TSP, PM10, PM2.5 and PM1 simultaneously in real time. Data can then be transferred to a PC via PC-Link.

Topas (Particulate Monitoring)

The Topas fixed station monitor is intended for long term installation. Several sites can be networked together to form a city wide monitoring system, which can be controlled by various communication means including GSM, 3G router or radio modem.

Osiris (site sentry, full site monitoring system)

When Osiris is used with i-dB, Turnkey's latest noise monitor, a full site monitoring station can be used to meet all regulations. The system is designed to provide remote online monitoring of dust and noise emissions to meet regulatory requirements. This innovative web based remote system simultaneously measures multi-parameter dust, noise, wind speed and direction, temperature & humidity and rainfall from a single UK based manufacturer. All data is stored on a web based secure system with private login.

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AirQ Software, AirQWeb & AirQApp

Environmental Monitoring Software

AirQ the user friendly and quick reporting PC software, designed in-house will manage and display results from our range of environment sensors.

AirQ can be used to control sensors and record measurements in real time

- "Live" graphs and tables appearing on the PC screen.
- Software automatically starts and stops sensors.
- Change parameters and configurations.
- Upload stored results.
- Powerful database engine.

With **AirQ** a live "on-screen" pollution rose can be created which plots measurements against wind direction on a polar chart.

Networked Environmental Monitoring

Creating a network of sensors is easy. Any number of sensors can be connected to an **AirQ** network created with fixed wiring (up to 10km), licence free radio telemetry (up to 20km), telephone and GSM cellular modems.

A network can include alarm facilities such as beacons or sirens for early warning and response to high readings. It can also active water sprinkler systems for damping down exceedance levels of dust.

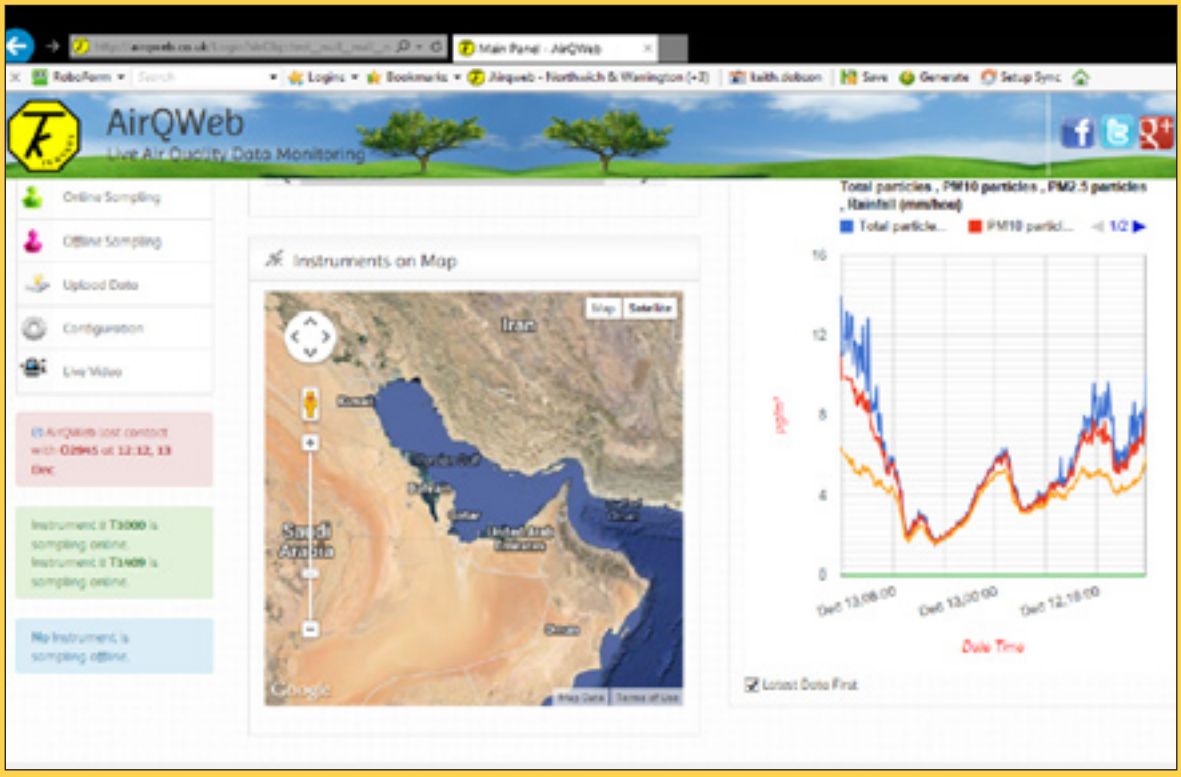
AirQWeb & AirQApp

Units fitted with a web router can be accessed via the internet (M2M simcard with 2GB data, fixed or dynamic public IP address, required).

Also via smartphone app, instant alerts can be sent to your phone before a likely exceedance breach occurs.

Alerts can be set for wind direction and wind speed, as well as dust levels.

A remote pan/tilt rotate IP camera can be added when connected via the web.



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Feature	Description	TOPAS	OSIRIS	DUSTMATE
Standard inlet	TSP (1mm stainless mesh)	✓	✓	✓
Heated inlet	Heating to 60°C	✓	✓	•
Detector	Turnkey laser nephelometer	✓	✓	✓
Environmental mode	TSP, PM10, PM2.5, PM1.0	✓	✓	✓
Workplace mode	Inhalable, thoracic, respirable	✓	✓	✓
Measurement range	0 to 6000 micrograms per cubic metre	✓	✓	✓
Detection limit	0.01 micrograms per cubic metre	✓	✓	✓
Indicator range	0 to 60mg/m^3 without particle sizing	✓	✓	✓
Particle size range	0.5 to 20 micron diameter	✓	✓	✓
Particle counting mode	Three size channels in particle per cc	✓	✓	✓
Flow rate	600cc per minute	✓	✓	✓
Reference filter	25mm diameter GFA circle	✓	✓	✓
Operating temperature	-5°C to +50°C	✓	✓	✓
Security	Password protection	✓	✓	✓
Alarm	Siren, text to cellular phone, visual beacon and email	✓	✓	×
Display	Two line alphanumeric with backlight	✓	✓	✓
Data storage	Internal with separate battery backup	128k byte	128k byte	32k byte
Averaging period	1 second to 4 hours	✓	✓	✓
Battery	Sealed lead acid, rechargeable	n/a	Internal 6v 2.8 AH	Belt pack 6v 1.2 AH
Sampling current drain	Including heated inlet and backlight	1.2A	1.2A	200mA (without heated inlet)
External power pack	80 to 260v AC input, weatherpoof	•	•	×
Meteorological inputs	Wind speed and direction, rainfall, temperature and humidity	✓	✓	×
Other logging inputs	Two 0 to 5 volt analogue inputs	✓	✓	×
RS232 I/O	9600 baud via PC-link	✓	✓	✓
Telemetry I/O	1200 baud opto isolated	✓	✓	×
Analogue output	0 to 4 volt analogue of TSP or PM10 channel, 12 bit resolution	•	•	×
Wall or lamppost box	Lockable steel	✓	✓	×
Case protection	To IP66 (excluding inlet and exhaust)	✓	✓	Carry case
Dimensions	External dimensions in mm	400 x 300	260 x 160 x 150	160 x 100 x 100
Weight	Instrument and enclosure approximate weight in kg	12kg	11.8kg	1.2kg
Power options	Solar, wind, mains and battery	✓	✓	Mains and battery only

✓ Fitted as standard × Not available • Available as option

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PRODUCT CONFORMITY CERTIFICATE

This is to certify that the

Osiris Airborne Particle Monitor

Manufactured by:

Turnkey Instruments Ltd

1 & 2 Dalby Court
Gadbrook Business Centre
Northwich, Cheshire
CW9 7TN

has been assessed by Sira Certification Service
And for the conditions stated on this certificate complies with:

MCERTS Performance Standards for Indicative Ambient Particulate Monitors, Version 4 dated August 2017

Certification Ranges :

PM_{10} 0 to 100µg/m^3

Project No.:	674/0356A / 80007209
Certificate No:	Sira MC090157/06
Initial Certification:	30 September 2009
This Certificate issued:	29 September 2019
Renewal Date:	29 September 2024

Emily Alexander
Environmental Project Engineer

MCERTS is operated on behalf of the Environment Agency by

Sira Certification Service

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

UKAS PRODUCT CERTIFICATION 0011

The MCERTS certificate consists of this document in its entirety.
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To authenticate the validity of this certificate please visit www.csagroupuk.org/mcerts

Form 1335
Issue 8

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 as a substitute for continuous ambient air quality monitoring systems (CAMs) employed in national air quality monitoring networks for the EU Air Quality Directive.

Basis of Certification

This certification is based on the following Test Report(s) and on Sira's assessment and ongoing surveillance of the product and the manufacturing process:

Bureau Veritas Report No. BV/AQ/AGGX0849/DH/2610

Product Certified

The measuring system consists of the following parts:

- Osiris analyser
- Heated Inlet
- Flow controller
- Lampost Box

This certificate applies to all instruments fitted with software version 0400 (serial number TNO 2296 onwards).

Certified Performance

Test	Results	MCERTS specification
Constancy of the sample volumetric flow	-2.7% See Note 1	Remain constant within ±3% of rated value
Tightness of the sampling system	<2%	Leakage not to exceed 2% of sampled volume
Maintenance Interval	Four weeks	Two weeks
Between sampler/instrument uncertainty for the complete data set	≤5µg/m^3	≤5µg/m^3
Between sampler/instrument uncertainty for two data sets obtained by splitting the full data set into values below and above 50% of the limit value	≤5µg/m^3	≤5µg/m^3
Highest resulting uncertainty estimate comparison against data quality objective (Measurement Uncertainty)	$W_{CM} \leq W_{dqo}$ 2007: W_{CM} = 46.20% 2003: W_{CM} = 50.10%	$W_{CM} \leq W_{dqo}$ Measurement uncertainty defined as 50% for indicative instruments

Note 1: The internal particulate filter is not used for calibration, therefore the constancy of sample volumetric flow is not treated as a pass/fail criterion of the instrument operation. The tests have been carried out for engineering assessment of the flow control system performance.

The OSIRIS and TOPAS instruments are fitted with an internal flow controller maintaining the flow rate at 600 cc/min as the flow resistance increases with the dust loading. The recommended filter is a circular Whatman GFA of 25 mm diameter.

Description

The Turnkey **Osiris, Topas** and **Dustmate** instruments give a continuous and simultaneous indication of the PM_1, $PM_{2.5}$, PM_{10} and TSP mass fractions. They use a light scattering technique to determine the concentration of airborne dust in the particle size range from about 0.3 microns (1 micron = 10^{-6} metre) to about 20 microns. The air sample is continuously drawn into the instrument by a pump with a flow rate set by the microprocessor. The incoming dusty air passes through a laser beam in a photometer and then through a filter to remove the particles before reaching the pump.

The light scattered by airborne particles can be thought of as consisting of three components. Light *reflected* from the surface of the particle, light *refracted* through the particle and light which is *diffracted* from its original path by the presence of the particle. The intensity of the light scattered by reflection or refraction strongly depends on the type of particle. Thus a white limestone particle will reflect much more light than a black diesel fume particle of the same size. On the other hand the diffracted component depends only on the size of the particle and is independent of its material composition.

For irregularly shaped particles, light which is reflected and refracted tends to be scattered over all possible directions. The diffracted component, however, tends to be scattered only through very small angles. For example, for a 5 micron diameter particle, 90% of the diffracted light is scattered by less than 10 degrees from the original direction of the light beam.

Turnkey's instruments analyse only the light scattered through 10 degrees or less. That is they respond only to the diffracted component and have a virtually constant response whether the particles are black or white. Other commercially available photometers detect light scattered through much wider angles or even at 90 degrees to the light beam.

In addition, all of Turnkey's instruments employ a sensitive scattering volume of less than 0.1 micro-litres. Therefore they can analyse the intensity of the light scattered by individual particles, even when there are many millions of them per litre. This allows the photometers to accurately count and size individual particles at concentrations of up to several mg/m^3. Having counted and sized the individual particles a dedicated microprocessor then continually determines the PM_1, $PM_{2.5}$, PM_{10} and TSP unit mass concentrations. These results are averaged and stored at chosen intervals and can be downloaded for analysis.

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 Sira Certificates'.

2. The design of the product certified is defined in the Sira Design Schedule V03 for certificate No. Sira MC090157/05

3. If certified product is found not to comply, Sira Certification Service should be notified immediately at the address shown on this certificate.

3. The Certification Marks that can be applied to the product or used in publicity material are defined in 'Regulations Applicable to the Holders of Sira Certificates'.

4. This document remains the property of Sira and shall be returned when requested by the company.