Umwelt Bundesamt

TÜVRheinland®
Precisely Right.

CERTIFICATE

of Product Conformity (QAL1)

Certificate No.: 0000040216_01

Certified AMS:	Model 5030i SHARP with PM_{10}-pre-separator for particulate matter PM_{10}
Manufacturer:	Thermo Fisher Scientific 27 Forge Parkway Franklin, MA 02038 USA
Test Institute:	TÜV Rheinland Energy GmbH

This is to certify that the AMS has been tested and found to comply with:

VDI 4202-1: 2010, VDI 4203-3: 2010, EN 12341: 1998, Guide to the Demonstration of Equivalence of Ambient Air Monitoring Methods: 2010 EN 15267-1: 2009 and EN 15267-2: 2009

Certification is awarded in respect of the conditions stated in this certificate (see also the following pages).

The present certificate replaces certificate 0000040216 of 29 April 2014.

TÜVRheinland® CERTIFIED

Suitability Tested
Complying with
2008/50/EC
EN 15267
Regular
Surveillance

www.tuv.com
ID 0000040216

Publication in the German Federal Gazette (BAnz.) of 1 April 2014

This certificate will expire on:
30 June 2020

German Federal Environment Agency
Dessau, 1 April 2019

Dr. Marcel Langner
Head of Section II 4.1

TÜV Rheinland Energy GmbH
Cologne, 31 March 2019

ppa. Dr. Peter Wilbring

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Accreditation according to EN ISO/IEC 17025:2018 and certified according to ISO 9001:2015.

Certificate:
0000040216_01 / 1 April 2019

Test report:	936/21209885/G of 20 September 2013
Initial certification:	01 April 2014
Date of expiry:	30 June 2020
Publication:	BAnz AT 01 April 2014 B12, chapter IV, No. 7.3

Approved application
The certified AMS is suitable for permanent monitoring of suspended particulate matter PM_{10} in ambient air (stationary operation).

The suitability of the AMS for this application was assessed on the basis of a laboratory test and a field test at four different test sites respectively time periods.

The AMS is approved for a temperature range of +5 °C to +40 °C.

Any potential user should ensure, in consultation with the manufacturer, that this AMS is suitable for ambient air applications at which it will be installed.

Basis of the certification
This certification is based on:

- test report 936/21209885/G of 20 September 2013 of TÜV Rheinland Energie und Umwelt GmbH
- suitability announced by the German Federal Environment Agency (UBA) as the relevant body
- the on-going surveillance of the product and the manufacturing process
- publication in the German Federal Gazette (BAnz AT 01 April 2014 B12, chapter IV, No. 7.3) Announcement by UBA from 27 February 2014

AMS designation:

Model 5030i SHARP with PM_{10}-pre-separator for particulate matter PM_{10}

Manufacturer:

Thermo Fisher Scientific, Franklin, USA

Field of application:

For permanent monitoring of suspended particulate matter PM_{10} in ambient air (stationary operation)

Measuring range during the performance test:

Component	Certification range	Unit
PM_{10}	0 - 1000	µg/m³

Software version:

V02.00.00.232+

Restrictions:

None

Notes:

1. The requirements of the coefficients of variation R^2 as per Standard EN EN 12341 were not fulfilled by both candidates for the location Cologne (winter), Bornheim (summer) and Teddington (summer).
2. The reference equivalence function for Teddington (summer) is not within the limits of the acceptance range as per Standard EN 12341.
3. The requirements according to the Guide “Demonstration of Equivalence of Ambient Air Monitoring Methods” are fulfilled for measuring component PM_{10}.
4. The measuring system must be operated in a lockable measuring cabinet.
5. The measuring system must be regularly calibrated on location with the gravimetric PM_{10} reference method according to EN 12341.
6. It is recommended to operate the measuring system with the threshold for the relative humidity being 58 %, especially at sites where the ratio of volatiles in suspended particulate matter is significantly high.
7. The test report on the performance test can be viewed on the internet at www.qal1.de.

Test report:

TÜV Rheinland Energie und Umwelt GmbH, Cologne
Report No.: 936/21209885/G of 20 September 2013

Certified product
This certificate applies to automated measurement systems conforming to the following description:

The model 5030i SHARP ambient air measuring system consists of the PM_{10} sampling head, the heated sampling tube (dynamic heating system DHS), the (optional) extension tube, the ambient air sensor (incl. radiation protection shield), the vacuum pump, the nephelometer assembly (=SHARP optic module), the central unit (=SHARP beta module, identical to Model 5014 i beta) incl. fibreglass filter belt, the respective corresponding connection lines, cables and adapters, the roof duct incl. flange and the manual in German.

The model 5030i SHARP ambient air measuring system is based on the combination of the measuring principles particle light dispersion (nephelometry) and beta reduction. The term SHARP stands for "Synchronised Hybrid Ambient Real-time Particulate".

The particle sample passes through the PM_{10} sampling head with a flow rate of 1 m³/h (=16.67 l/min) and flows via the heated sampling tube (DHS = dynamic heating system) to the actual model 5030i SHARP measuring system.

The nephelometer assembly is located beneath the heated tube. The fine dust passes laterally through the insulated nephelometer and then flows into the radial tube above the radiometric assembly. The nephelometer consists of a light-dispersion based photometer with a pulsed near-IR LED which works with a central wavelength of 880 nm.

A radial, insulated tube connects to the sampling tube at the point where the nephelometer is attached to the housing of the measuring system. The nephelometer can thus be easily detached from the actual measuring system. The model 5030i SHARP measuring system (nephelometer measurement with radiometric measurement combination) can thereby be easily converted into the model 5014i BETA measuring system.

After the particle sample has passed through the nephelometer the particles are separated on the fibreglass filter belt of the radiometric measurement. The filter belt is located between the proportional detector and the ^{14}C beta emitter. The beta ray travels upwards through the filer belt and the accumulating dust layer. The intensity of the beta ray is reduced by the increasing dust load, which then leads to a reduced beta intensity that is measured by the proportional detector. The mass on the filter belt is calculated from the continuous integrated count rate.

In order to maintain the sample flow at its nominal value the flow and the regulation of the proportional valve are measured continuously.

The PM concentrations are shown on the display on the front of the measuring system as SHARP- (=hybrid values), PM (= radiometric measurement values (the same as in model 5014i BETA)) and NEPH (=scattered light measurement values). The measurement values can be provided as data in a variety of output forms (analogue, digital, Ethernet).

General notes
This certificate is based upon the equipment tested. The manufacturer is responsible for ensuring that on-going production complies with the requirements of the EN 15267. 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 systems shall be subject to regular surveillance.

If a product of the current production does not conform to the certified product, TÜV Rheinland Energy GmbH must be notified at the address given on page 1.

A certification mark with an ID-Number that is specific to the certified product is presented on page 1 of this certificate. This can be applied to the product or used in publicity material for the certified product is presented on page 1 of this certificate.

This document as well as the certification mark remains property of TÜV Rheinland Energy GmbH. With revocation of the publication the certificate loses its validity. After the expiration of the certificate and on requests of the TÜV Rheinland Energy GmbH this document shall be returned and the certificate mark must not be employed anymore.

The relevant version of this certificate and the validity is also accessible on the internet: **qal1.de**.

Certification of Model 5030i SHARP with PM_{10}-pre-separator for particulate matter PM_{10} is based on the documents listed below and the regular, continuous monitoring of the Quality Management System of the manufacturer:

Initial certification according to EN 15267

Certificate No. 0000040216:	29 April 2014
Validity of the certificate:	31 March 2019

Test report: 936/21209885/G of 20 September 2013
TÜV Rheinland Energie und Umwelt GmbH, Cologne
Publication: BAnz AT 01 April 2014 B12, chapter IV, No. 7.3
Announcement by UBA from 27 February 2014

Renewal of the certificate according to EN 15267

Certificate No. 0000040216_01:	1 April 2019
Validity of the certificate:	30 June 2020

Calculation of overall uncertainty

PM10 5030i Sharp	23,8% ≥ 28 µg m-3	Orthogonal Regression				Between Instrument Uncertainties	
	W_{CM} / %	n_{c-s}	r^2	Slope (b) +/- u_b	Intercept (a) +/- u_a	Reference	Candidate
All Data	9.2	202	0.967	1.009 +/- 0.013	-0.392 +/- 0.327	0.63	1.10
< 30 µg m-3	8.0	161	0.903	0.986 +/- 0.024	0.109 +/- 0.431	0.63	1.13
≥ 30 µg m-3	13.7	41	0.938	1.112 +/- 0.044	-5.181 +/- 1.940	0.63	1.22

SN3	Dataset	Orthogonal Regression				Limit Value of 50 µg m-3	
		n_{c-s}	r^2	Slope (b) +/- u_b	Intercept (a) +/- u_a	W_{CM} / %	% ≥ 28 µg m-3
Individual Datasets	Bornheim Winter	42	0.976	0.987 +/- 0.024	0.975 +/- 0.745	8.46	42.9
	Cologne Winter	43	0.947	1.033 +/- 0.037	-1.570 +/- 1.256	12.91	53.5
	Bornheim Summer	71	0.952	0.986 +/- 0.026	0.461 +/- 0.534	8.69	9.9
	Teddington Summer	46	0.855	0.975 +/- 0.056	0.655 +/- 0.813	7.25	0.0
Combined Datasets	< 30 µg m-3	161	0.899	0.982 +/- 0.025	0.625 +/- 0.439	7.85	4.3
	≥ 30 µg m-3	41	0.938	1.102 +/- 0.044	-4.835 +/- 1.911	13.38	100.0
	All Data	202	0.966	0.994 +/- 0.013	0.286 +/- 0.329	9.29	23.8

SN4	Dataset	Orthogonal Regression				Limit Value of 50 µg m-3	
		n_{c-s}	r^2	Slope (b) +/- u_b	Intercept (a) +/- u_a	W_{CM} / %	% ≥ 28 µg m-3
Individual Datasets	Bornheim Winter	42	0.981	1.027 +/- 0.022	-0.073 +/- 0.689	9.19	42.9
	Cologne Winter	45	0.944	1.049 +/- 0.038	-2.653 +/- 1.250	13.58	51.1
	Bornheim Summer	75	0.935	1.017 +/- 0.030	-1.191 +/- 0.623	10.35	9.3
	Teddington Summer	46	0.833	0.921 +/- 0.057	0.304 +/- 0.831	16.19	0.0
Combined Datasets	< 30 µg m-3	167	0.876	0.996 +/- 0.027	-0.601 +/- 0.485	9.32	4.2
	≥ 30 µg m-3	41	0.929	1.128 +/- 0.048	-5.747 +/- 2.091	14.88	100.0
	All Data	208	0.960	1.029 +/- 0.014	-1.242 +/- 0.359	10.32	23.1

Calculation of overall uncertainty slope corrected

PM10 5030i Sharp Slope and Intercept Corrected	23.8% ≥ 28 µg m-3	Orthogonal Regression								Between Instrument Uncertainties	
	W_{CM} / %	n_{c-s}	r^2	Slope (b) +/- u_b			Intercept (a) +/- u_a			Reference	Candidate
All Data	9.6	202	0.967	1.000	+/-	0.013	0.003	+/-	0.324	0.63	1.09
< 30 µg m-3	8.5	161	0.903	0.976	+/-	0.024	0.504	+/-	0.427	0.63	1.12
≥ 30 µg m-3	13.8	41	0.938	1.102	+/-	0.044	-4.729	+/-	1.922	0.63	1.21

SN3	Dataset	Orthogonal Regression								Limit Value of 50 µg m-3	
		n_{c-s}	r^2	Slope (b) +/- u_b			Intercept (a) +/- u_a			W_{CM} / %	% ≥ 28 µg m-3
Individual Datasets	Bornheim Winter	42	0.976	0.978	+/-	0.024	1.358	+/-	0.738	8.82	42.9
	Cologne Winter	43	0.947	1.023	+/-	0.037	-1.159	+/-	1.244	13.10	53.5
	Bornheim Summer	71	0.952	0.976	+/-	0.026	0.850	+/-	0.529	9.12	9.9
	Teddington Summer	46	0.855	0.965	+/-	0.055	1.048	+/-	0.805	7.89	0.0
Combined Datasets	< 30 µg m-3	161	0.899	0.972	+/-	0.025	1.016	+/-	0.435	8.34	4.3
	≥ 30 µg m-3	41	0.938	1.092	+/-	0.043	-4.387	+/-	1.893	13.54	100.0
	All Data	202	0.966	0.985	+/-	0.013	0.676	+/-	0.326	9.65	23.8

SN4	Dataset	Orthogonal Regression								Limit Value of 50 µg m-3	
		n_{c-s}	r^2	Slope (b) +/- u_b			Intercept (a) +/- u_a			W_{CM} / %	% ≥ 28 µg m-3
Individual Datasets	Bornheim Winter	42	0.981	1.018	+/-	0.022	0.318	+/-	0.683	9.37	42.9
	Cologne Winter	45	0.944	1.039	+/-	0.037	-2.231	+/-	1.238	13.78	51.1
	Bornheim Summer	75	0.935	1.007	+/-	0.030	-0.785	+/-	0.618	10.70	9.3
	Teddington Summer	46	0.833	0.911	+/-	0.057	0.701	+/-	0.823	16.69	0.0
Combined Datasets	< 30 µg m-3	167	0.876	0.986	+/-	0.027	-0.196	+/-	0.480	9.81	4.2
	≥ 30 µg m-3	41	0.929	1.117	+/-	0.047	-5.288	+/-	2.072	14.97	100.0
	All Data	208	0.960	1.019	+/-	0.014	-0.837	+/-	0.355	10.60	23.1