

CERTIFICATE

of Product Conformity (QAL1)

Certificate No.: 0000069258

AMS designation: CEMS-2000 for NO, SO₂ and O₂

Manufacturer: Focused Photonics Inc
760 Bin'an Road
310052 Hangzhou
China

Test Laboratory: TÜV Rheinland Energy GmbH

**This is to certify that the AMS has been tested
and found to comply with the standards
EN 15267-1 (2009), EN 15267-2 (2009), EN 15267-3 (2007)
and EN 14181 (2014).**

Certification is awarded in respect of the conditions stated in this certificate
(this certificate contains 8 pages).



Suitability Tested
EN 15267
QAL1 Certified
Regular Surveillance

www.tuv.com
ID 0000069258

Publication in the German Federal Gazette
(BAnz) of 31 July 2020

This certificate will expire on:
30 July 2025

German Federal Environment Agency
Dessau, 07 September 2020

TÜV Rheinland Energy GmbH
Cologne, 06 September 2020



Dr. Marcel Langner
Head of Section II 4.1



ppa. Dr. Peter Wilbring

www.umwelt-tuv.eu
tre@umwelt-tuv.eu
Phone: + 49 221 806-5200

TÜV Rheinland Energy GmbH
Am Grauen Stein
51105 Köln

Test institute accredited to EN ISO/IEC 17025 by DAkkS (German Accreditation Body).
This accreditation is limited to the accreditation scope defined in the enclosure to certificate D-PL-11120-02-00.

Test Report:	936/21230216/C dated 17 February 2020
Initial certification:	31 July 2020
Expiry date:	30 July 2025
Publication:	BAnz AT 31.07.2020 B10, chapter I number 3.1

Approved application

The tested AMS is suitable for use at combustion plants according to Directive 2010/75/EU, chapter III (13th BImSchV) and TA Luft. The measured ranges have been selected so as to ensure as broad a field of application as possible.

The suitability of the AMS for this application was assessed on the basis of a laboratory test and a four-months field test at a lignite-fired power plant.

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

The notification of suitability of the AMS, performance testing and the uncertainty calculation have been effected on the basis of the regulations applicable at the time of testing. As changes in legal provisions are possible, any potential user should ensure that this AMS is suitable for monitoring the limit values and oxygen concentrations relevant to the application.

Any potential user should ensure, in consultation with the manufacturer, that this AMS is suitable for the intended purpose.

Basis of the certification

This certification is based on:

- Test report no. 936/21230216/C dated 17 February 2020 issued by TÜV Rheinland Energy GmbH
- Suitability announced by the German Federal Environment Agency (UBA) as the relevant body
- The ongoing surveillance of the product and the manufacturing process

Publication in the German Federal Gazette: BAnz AT 31.07.2020 B10, chapter I number 3.1,
UBA announcement of 27 May 2020:

AMS designation:

CEMS-2000 for NO, SO₂ and O₂

Manufacturer:

Focused Photonics Inc., Hangzhou, China

Field of application:

For measurement at plants according to the 13th BImSchV as well as TA Luft

Measuring ranges during performance testing:

Component	Certification range	supplementary range	Unit
NO	0–250	0–1340	mg/m ³
SO ₂	0–550	0–1430	mg/m ³
O ₂	0–25	-	Vol.-%

Software version:

QMA2000.P003.V05A.004

Restrictions:

None

Notes:

1. The maintenance interval is eight days.
2. Every four hours, the AMS performs automatic zero checks for NO and SO₂ and automatic span checks for O₂.

Test Report:

TÜV Rheinland Energy GmbH, Cologne
Report no.: 936/21230216/C dated 17 February 2020

Certified product

This certification applies to automated measurement systems conforming to the following description:

The CEMS-2000 system is a “hot-wet” gas analyser which continuously monitors flue gas emissions from industrial plants. The analyser uses the UV DOAS method to measure nitrogen monoxide and sulphur dioxide. A zirconium dioxide module determines the oxygen concentration.

The AMS under test comprises a pre-conditioning system, a sample gas chamber, the OMA-2000 multi-component analyser, temperature sensors, a jet pump and a zirconium dioxide module.

The flue gas sucked in via the sample probe reaches the measurement cell through a heated sample line. The measurement cell is placed inside what is called heating box to ensure that the flue gas has as high a temperature as possible and no condensation effects occur. A temperature control at the front of the sampling probe regulates the temperature of the sample line and the heating box. The jet pump serves the purpose of pre-conditioning as mentioned above.

The display of the multi-gas analyser shows the current concentrations of the measured components along with the status signals. The display is equipped with a touchscreen. The system has a number of outputs such as analogue and digital outputs for status and error messages. In the laboratory test, the heated sample line was 22 m long, in the field, it was 18 m long.

The AMS provides an automatic zero check which is performed every four hours using ambient air.

Software version QMA2000.P003.V05A.004 remained unchanged over the entire period of testing.

The AMS tested here comprises the following components:

- OMA-2000 analyser
- Heating chamber
- O₂ sensor (zirconium dioxide)
- Sampling probe with filter
- Heated sample line, max 120 °C, made of PTFE, max. length 22m
- Jet pump

General remarks

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 manufacturing process for 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 document as well as the certification mark remains property of TÜV Rheinland Energy GmbH. Upon revocation of the publication the certificate loses its validity. After the expiration of the certificate and on request of TÜV Rheinland Energy GmbH this document shall be returned and the certificate mark must no longer be used.

The relevant version of this certificate and its expiration date are also accessible on the internet at gal1.de.

Document history

Certification of the CEMS-2000 measuring system is based on the documents listed below and the regular, continuous surveillance of the manufacturer's quality management system:

Initial certification according to EN 15267

Certificate no.0000069258: 07 September 2020
Expiry date of the certificate: 30 July 2025
Test report 936/21230216/C dated 17 February 2020
TÜV Rheinland Energy GmbH, Cologne
Publication: BAnz AT 31.07.2020 B10, chapter I number 3.1
UBA announcement of 27 May 2020

Calculation of overall uncertainty according to EN 14181 and EN 15267-3

Measuring system

Manufacturer	Focused Photonics Inc.
AMS designation	CEMS-2000
Serial number of units under test	CA3215 B0969 / CA3215 B0970
Measuring principle	UV-DOAS

Test report

Test laboratory	TÜV Rheinland
Date of report	2020-02-17

Measured component

Certification range	NO 0 - 250 mg/m ³
---------------------	---------------------------------

Evaluation of the cross-sensitivity (CS)

(system with largest CS)

Sum of positive CS at zero point	4.60 mg/m ³
Sum of negative CS at zero point	0.00 mg/m ³
Sum of positive CS at span point	5.80 mg/m ³
Sum of negative CS at span point	-4.40 mg/m ³
Maximum sum of cross-sensitivities	5.80 mg/m ³
Uncertainty of cross-sensitivity	u_i 3.349 mg/m ³

Calculation of the combined standard uncertainty

Tested parameter

		u^2	
Standard deviation from paired measurements under field conditions *	u_D 0.730 mg/m ³	0.533	(mg/m ³) ²
Lack of fit	u_{lof} 1.155 mg/m ³	1.334	(mg/m ³) ²
Zero drift from field test	$u_{d,z}$ 0.433 mg/m ³	0.187	(mg/m ³) ²
Span drift from field test	$u_{d,s}$ 2.742 mg/m ³	7.519	(mg/m ³) ²
Influence of ambient temperature at span	u_t 5.615 mg/m ³	31.528	(mg/m ³) ²
Influence of supply voltage	u_v 1.268 mg/m ³	1.608	(mg/m ³) ²
Cross-sensitivity (interference)	u_i 3.349 mg/m ³	11.216	(mg/m ³) ²
Influence of sample gas flow	u_p -0.722 mg/m ³	0.521	(mg/m ³) ²
Uncertainty of reference material at 70% of certification range	u_{rm} 2.021 mg/m ³	4.083	(mg/m ³) ²

* The larger value is used :

"Repeatability standard deviation at set point" or

"Standard deviation from paired measurements under field conditions"

Combined standard uncertainty (u_c)

$$u_c = \sqrt{\sum (u_{max,j})^2} \quad 7.65 \text{ mg/m}^3$$

Total expanded uncertainty

$$U = u_c * k = u_c * 1.96 \quad 14.99 \text{ mg/m}^3$$

Relative total expanded uncertainty

U in % of the ELV 100 mg/m³ 15.0

Requirement of 2010/75/EU

U in % of the ELV 100 mg/m³ 20.0

Requirement of EN 15267-3

U in % of the ELV 100 mg/m³ 15.0

Calculation of overall uncertainty according to EN 14181 and EN 15267-3

Measuring system

Manufacturer	Focused Photonics Inc.
AMS designation	CEMS-2000
Serial number of units under test	CA3215 B0969 / CA3215 B0970
Measuring principle	UV-DOAS

Test report

Test laboratory	936/21230216/C TÜV Rheinland
Date of report	2020-02-17

Measured component

Certification range	SO ₂ 0 - 550 mg/m ³
---------------------	--

Evaluation of the cross-sensitivity (CS)

(system with largest CS)

Sum of positive CS at zero point	0.00 mg/m ³
Sum of negative CS at zero point	0.00 mg/m ³
Sum of positive CS at span point	0.00 mg/m ³
Sum of negative CS at span point	0.00 mg/m ³
Maximum sum of cross-sensitivities	0.00 mg/m ³
Uncertainty of cross-sensitivity	u _i 0.000 mg/m ³

Calculation of the combined standard uncertainty

Tested parameter

			u ²	
Standard deviation from paired measurements under field conditions *	u _D	4.730 mg/m ³	22.373	(mg/m ³) ²
Lack of fit	u _{lof}	2.318 mg/m ³	5.373	(mg/m ³) ²
Zero drift from field test	u _{d,z}	8.660 mg/m ³	74.996	(mg/m ³) ²
Span drift from field test	u _{d,s}	8.660 mg/m ³	74.996	(mg/m ³) ²
Influence of ambient temperature at span	u _t	7.184 mg/m ³	51.610	(mg/m ³) ²
Influence of supply voltage	u _v	3.013 mg/m ³	9.078	(mg/m ³) ²
Cross-sensitivity (interference)	u _i	0.000 mg/m ³	0.000	(mg/m ³) ²
Influence of sample gas flow	u _p	-1.323 mg/m ³	1.750	(mg/m ³) ²
Uncertainty of reference material at 70% of certification range	u _{rm}	4.446 mg/m ³	19.763	(mg/m ³) ²

* The larger value is used :

"Repeatability standard deviation at set point" or

"Standard deviation from paired measurements under field conditions"

Combined standard uncertainty (u_c)

$$u_c = \sqrt{\sum (u_{\max, j})^2} \quad 16.12 \text{ mg/m}^3$$

Total expanded uncertainty

$$U = u_c * k = u_c * 1.96 \quad 31.60 \text{ mg/m}^3$$

Relative total expanded uncertainty

U in % of the ELV 220 mg/m³ 14.4

Requirement of 2010/75/EU

U in % of the ELV 220 mg/m³ 20.0

Requirement of EN 15267-3

U in % of the ELV 220 mg/m³ 15.0

Calculation of overall uncertainty according to EN 14181 and EN 15267-3

Measuring system

Manufacturer	Focused Photonics Inc.
AMS designation	CEMS-2000
Serial number of units under test	CA3215 B0969 / CA3215 B0970
Measuring principle	circonia

Test report

Test laboratory	936/21230216/C
Date of report	TÜV Rheinland 2020-02-17

Measured component

Certification range	O ₂ 0 - 25 Vol.-%
---------------------	---------------------------------

Evaluation of the cross-sensitivity (CS)

(system with largest CS)

Sum of positive CS at zero point	0.00	Vol.-%
Sum of negative CS at zero point	0.00	Vol.-%
Sum of positive CS at span point	0.00	Vol.-%
Sum of negative CS at span point	-0.38	Vol.-%
Maximum sum of cross-sensitivities	-0.38	Vol.-%
Uncertainty of cross-sensitivity	u _i	-0.219 Vol.-%

Calculation of the combined standard uncertainty

Tested parameter

				u ²
Standard deviation from paired measurements under field conditions *	u _D	0.033	Vol.-%	0.001 (Vol.-%) ²
Lack of fit	u _{lof}	0.058	Vol.-%	0.003 (Vol.-%) ²
Zero drift from field test	u _{dz}	0.081	Vol.-%	0.007 (Vol.-%) ²
Span drift from field test	u _{ds}	0.115	Vol.-%	0.013 (Vol.-%) ²
Influence of ambient temperature at span	u _t	0.127	Vol.-%	0.016 (Vol.-%) ²
Influence of supply voltage	u _v	0.020	Vol.-%	0.000 (Vol.-%) ²
Cross-sensitivity (interference)	u _i	-0.219	Vol.-%	0.048 (Vol.-%) ²
Influence of sample gas flow	u _o	-0.036	Vol.-%	0.001 (Vol.-%) ²
Uncertainty of reference material at 70% of certification range	u _{rm}	0.202	Vol.-%	0.041 (Vol.-%) ²

* The larger value is used :

"Repeatability standard deviation at set point" or

"Standard deviation from paired measurements under field conditions"

Combined standard uncertainty (u_c)

$$u_c = \sqrt{\sum (u_{max, i})^2} \quad 0.36 \text{ Vol.-%}$$

Total expanded uncertainty

$$U = u_c * k = u_c * 1.96 \quad 0.71 \text{ Vol.-%}$$

Relative total expanded uncertainty

U in % of the range 25 Vol.-% **2.8**

Requirement of 2010/75/EU

U in % of the range 25 Vol.-% **10.0 ****

Requirement of EN 15267-3

U in % of the range 25 Vol.-% **7.5**

** The EU-directive 2010/75/EU on industrial emissions provides no requirements for this component.

A value of 10.0 % was used for this.