Umwelt Bundesamt

TÜVRheinland®
Precisely Right.

CERTIFICATE

of Product Conformity (QAL1)

Certificate No: 0000062062_02

Certified AMS:	ZPA-CEMS for CO, NO, SO_2, CO_2 and O_2
Manufacturer:	Fuji Electric France S.A.S. 46, rue Georges Besse Z.I. du Brézet F63039 Clermont-Ferrand Cedex 2 France
Test Institute:	TÜV Rheinland Energy & Environment 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 (2023), EN 15267-3 (2007) as well as EN 14181 (2014).

Certification is awarded in respect of the conditions stated in this certificate (this certificate contains 14 pages).
The present certificate replaces certificate 0000062062_01 dated 4 June 2020.

TÜVRheinland® CERTIFIED
Suitability Tested
EN 15267
QAL1 Certified
Regular Surveillance
www.tuv.com
ID 0000062062

Publication in the German Federal Gazette (BAnz) of 24 March 2020

German Environment Agency

Dessau, 20 March 2025

Dr. Marcel Langner
Head of Section II 4

This certificate will expire on:
23 March 2030

TÜV Rheinland Energy & Environment GmbH
Cologne, 18 March 2025

ppa. Dr. Peter Wilbring

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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 the certificate D-PL-11120-02-00.

Test report:	936/21239789/B dated 15 May 2019
Initial certification:	26 March 2019
Expiry date:	23 March 2030
Certificate:	Renewal (of previous certificate 0000062062_01 of 4 June 2020 valid until 23 March 2025)
Publication:	BAnz AT 24.03.2020 B7, chapter I No. 3.3

Approved application

The tested AMS is suitable for use at plants according to Directive 2010/75/EC, chapter III (combustion plants / 13th BImSchV:2017), Directive 2015/2193/EC (44th BImSchV:2022), plants according to the 27th BImSchV and TA Luft:2002. 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 three month field test at a large combustion (hard coal firing) 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 emission limit values and oxygen concentration relevant to the application.

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

Note

The legal regulations mentioned correspond to the current state of legislation during certification. Each user should, if necessary, in consultation with the competent authority, ensure that this AMS meets the legal requirements for the intended use. In addition, it cannot be ruled out that legal regulations governing the use of a measuring device for emission monitoring may change during the lifetime of the certificate.

Basis of the certification

This certification is based on:

- Test report 936/21239789/B dated 15 May 2019 of 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 24.03.2020 B7, chapter I No. 3.3, Announcement by UBA dated 24 February 2020:

AMS designation:
ZPA-CEMS for CO, NO, SO_2, CO_2 and O_2

Manufacturer:
Fuji Electric France S.A.S, Clermont-Ferrand, France

Field of application:
Modular AMS for measurement at plants according to the 13th BImSchV and TA Luft

Measuring ranges during the performance test:

Component	Certification range	supplementary measuring ranges		Unit
CO	0 – 375	0 – 625	0 –2,500	mg/m³
NO	0 – 268	0 – 670	0 –2,680	mg/m³
SO_2	0 – 571	0 – 1,428	0 – 5,710	mg/m³
CO_2	0 – 20	-	-	Vol.-%
O_2 para.	0 – 25	0 – 10	-	Vol.-%
O_2 (ZrO_2)	0 – 25	0 – 10	-	Vol.-%

Software version:
2.02g

Restrictions:
None

Notes:
1. The maintenance interval is four weeks.
2. There are two alternatives for measuring oxygen: the paramagnetic oxygen sensor (O_2 (para)) or the zirconium dioxide sensor (O_2 (ZrO_2)).
3. For measuring the components CO, NO, SO_2 and CO_2, the interval for automatic zero point adjustment must be set to 24 h. The option for automatic span point checks has not been activated during the field test.
4. The measuring system may be operated with a heated sampling probe and a M&C sample gas cooler (probe type SP2000-H, cooler type ECM).
5. The measuring system may be operated with a heated sampling probe and a JCT sample gas cooler (probe type JES-301-C, cooler type JCS-100).
6. The measuring system can be operated with a heated sampling probe and a Bühler sample gas cooler (probe type GAS 222.21, cooler type RC 1.2+).

7. The measuring system can be distributed with various combinations of measure-ment channels. The following table lists the AMS designation which indicates the relevant scope of measured components:

Designation			Combination of IR components
Without O_2 measurement	With O_2 mea-surement (ZrO_2)	With O_2 mea-surement (para)	
	ZPA-Yz	ZPA-Yp	O_2
ZPA-B	ZPA-Bz	ZPA-Bp	CO
ZPA-Z	ZPA-Zz	ZPA-Zp	CO + SO_2
ZPA-P	ZPA-Pz	ZPA-Pp	NOw
ZPA-F	ZPA-Fz	ZPA-Fp	NO + SO_2
ZPA-D	ZPA-Dz	ZPA-Dp	CO_2
ZPA-G	ZPA-Gz	ZPA-Gp	CO + NO
ZPA-J	ZPA-Jz	ZPA-Jp	CO + CO_2
ZPA-N	ZPA-Nz	ZPA-Np	CO + NO + SO_2
ZPA-W	ZPA-Wz	ZPA-Wp	CO + NO + CO_2
ZPA-Q	ZPA-Qz	ZPA-Qp	CO + NO + SO_2 + CO_2

8. Supplementary test (for the purpose of approving additional gas conditioning parts) as regards Federal Environment Agency notice of 27 February 2019 (BAnz AT 26.03.2019 B7, chapter I number 2.1).

Test Institute:
TÜV Rheinland Energy GmbH, Cologne
Report No.: 936/21239789/B dated 15 May 2019

Certified product

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

The modular ZPA-CEMS measuring system is an extractive system and comprises the following components:

- **Measuring cabinet**

Manufacturer:	Schneider Electric,
Type:	SPACIAL SF NSYSF20860P
Dimensions:	1900 x 600 x 600 mm (without air conditioning)
Material:	Painted steel + insulation
Air conditioning:	Air conditioner with 1000 W

- **Sample probe**

Manufacturer:	M&C TechGroup Germany GmbH
Type:	SP2000-H with ceramic filter, heated to 180°C
Manufacturer: (optional)	JCT Analysentechnik GmbH
Type:	JES-301-C with ceramic filter, heated to 180°C
Manufacturer: (optional)	Bühler Technologies GmbH
Type:	GAS 222.21 with ceramic filter, heated to 180°C

- **Heated sample gas line**

Temperature:	180°C
Length:	21m in the laboratory test for both tested instruments 21 m for system 1 and 26 m for system 2 in the field (given the specific set-up).
Material:	PTFE

- **Compressor cooler**

Manufacturer:	M&C TechGroup Germany GmbH
Type:	ECM, due point 5°C
Condensate discharge:	via a peristaltic pump
Manufacturer: (optional)	JCT Analysentechnik GmbH
Type:	JCS-100, due point 5°C
Condensate discharge:	via a peristaltic pump
Manufacturer: (optional)	Bühler Technologies GmbH
Type:	RC 1.2+, due point 5°C
Condensate discharge:	via a peristaltic pump

- Sample gas pump and
- analyser modules.

The ZPA analyser itself measures the components CO, NO, SO_2 and CO_2 using NDIR. There are two alternatives for measuring O_2: either a paramagnetic measuring cell (sensor is installed in the enclosure of the ZPA analyser downstream of the optical benches) or a ZFK-7 zirconium dioxide sensor (sensor is installed upstream of the ZPA analyser enclosure).

Module configurations:

Designation			Combination of IR components
Without O_2 measurement	With O_2 measurement (ZrO_2)	With O_2 measurement (para)	
	ZPA-Yz	ZPA-Yp	O_2
ZPA-B	ZPA-Bz	ZPA-Bp	CO
ZPA-Z	ZPA-Zz	ZPA-Zp	CO + SO_2
ZPA-P	ZPA-Pz	ZPA-Pp	NO
ZPA-F	ZPA-Fz	ZPA-Fp	NO + SO_2
ZPA-D	ZPA-Dz	ZPA-Dp	CO_2
ZPA-G	ZPA-Gz	ZPA-Gp	CO + NO
ZPA-J	ZPA-Jz	ZPA-Jp	CO + CO_2
ZPA-N	ZPA-Nz	ZPA-Np	CO + NO + SO_2
ZPA-W	ZPA-Wz	ZPA-Wp	CO + NO + CO_2
ZPA-Q	ZPA-Qz	ZPA-Qp	CO + NO + SO_2 + CO_2

The ZFK-7 sensor (ZrO_2) is connected to the ZPA analyser module such that the ZPA analyser module is used entirely for measured value output, operation and parameterisation of the ZFK-7.

Measured value output of the measuring system refers to dry gas under normal conditions.

The measuring system provides an option for automatic zero and span check and adjustment. This can be effected directly using (static) test gas application or via a probe when (dynamically) applying test gas.

Zero point adjustment during performance testing was performed every 24 h (6 min. purging duration) for the measured NDIR components. Synthetic air from a pressurised gas cylinder served as zero gas; it is also possible to use nitrogen or dry, clean compressed air/instrument air. Zero gas was provided to the measuring system via (static) application.

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 & Environment 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 certification mark may be applied to the product or used in advertising materials for the certified product.

This document as well as the certification mark remains property of TÜV Rheinland Energy & Environment 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 & Environment GmbH this document shall be returned and the certificate mark must not be employed anymore.

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

History of documents

Certification of ZPA-CEMS 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. 0000062062_00: 12 June 2019
Expiry date of the certificate: 25 March 2024
Test report: 936/21239789/A dated 21 September 2018
TÜV Rheinland Energy GmbH
Publication: BAnz AT 26.03.2019 B7, chapter I number 2.1
UBA announcement dated 27 February 2019

Supplementary testing according to EN 15267
Certificate No. 0000062062_01: 4 June 2020
Expiry date of the certificate: 23 March 2025
Test report: 936/21239789/B dated 15 May 2019
TÜV Rheinland Energy GmbH
Publication: BAnz AT 24.03.2020 B7, chapter I number 3.3
UBA announcement dated 24 February 2020

Renewal of certificates
Certificate No. 0000062062_02: 20 March 2025
Expiry date of the certificate: 23 March 2030

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

Measuring system					
Manufacturer		Fuji Electric			
AMS designation		ZPA-CEMS			
Serial number of units under test		N7CO387 / N4C1455T			
Measuring principle		NDIR			
Test report		936/21239789/A			
Test laboratory		TÜV Rheinland			
Date of report		2018-09-21			
Measured component		CO			
Certification range		0 - 375	mg/m³		
Evaluation of the cross-sensitivity (CS)					
(system with largest CS)					
Sum of positive CS at zero point		0.00	mg/m³		
Sum of negative CS at zero point		0.00	mg/m³		
Sum of postive CS at span point		4.10	mg/m³		
Sum of negative CS at span point		-2.40	mg/m³		
Maximum sum of cross-sensitivities		4.10	mg/m³		
Uncertainty of cross-sensitivity	u_i	2.367	mg/m³		
Calculation of the combined standard uncertainty					
Tested parameter				u^2	
Standard deviation from paired measurements under field conditions *	u_D	1.975	mg/m³	3.901	(mg/m³)²
Lack of fit	u_{lof}	-1.169	mg/m³	1.367	(mg/m³)²
Zero drift from field test	$u_{d,z}$	1.588	mg/m³	2.522	(mg/m³)²
Span drift from field test	$u_{d,s}$	2.309	mg/m³	5.331	(mg/m³)²
Influence of ambient temperature at span	u_t	1.400	mg/m³	1.960	(mg/m³)²
Influence of supply voltage	u_v	1.429	mg/m³	2.042	(mg/m³)²
Cross-sensitivity (interference)	u_i	2.367	mg/m³	5.603	(mg/m³)²
Influence of sample gas flow	u_p	-0.992	mg/m³	0.984	(mg/m³)²
Uncertainty of reference material at 70% of certification range	u_{rm}	3.031	mg/m³	9.188	(mg/m³)²
Combined standard uncertainty (u_C)	$u_c = \sqrt{\sum (u_{max\ j})^2}$			5.74	mg/m³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$			11.24	mg/m³

* The larger value is used :
"Repeatability standard deviation at set point" or
"Standard deviation from paired measurements under field conditions"

Relative total expanded uncertainty	**U in % of the ELV 150 mg/m³**	**7.49**
Requirement of 2010/75/EU	**U in % of the ELV 150 mg/m³**	**10.00**
Requirement of EN 15267-3	U in % of the ELV 150 mg/m³	7.50

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

Measuring system					
Manufacturer			Fuji Electric		
AMS designation			ZPA-CEMS		
Serial number of units under test			N7CO387 / N4C1455T		
Measuring principle			NDIR		
Test report			936/21239789/A		
Test laboratory			TÜV Rheinland		
Date of report			2018-09-21		
Measured component			CO		
Certification range			0 - 250 mg/m³		
Evaluation of the cross-sensitivity (CS)					
(system with largest CS)					
Sum of positive CS at zero point			0.00 mg/m³		
Sum of negative CS at zero point			0.00 mg/m³		
Sum of postive CS at span point			4.10 mg/m³		
Sum of negative CS at span point			-2.40 mg/m³		
Maximum sum of cross-sensitivities			4.10 mg/m³		
Uncertainty of cross-sensitivity		u_i	2.367 mg/m³		

Calculation of the combined standard uncertainty

Tested parameter				u^2	
Standard deviation from paired measurements under field conditions *	u_D	1.975	mg/m³	3.901	(mg/m³)²
Lack of fit	u_{lof}	0.577	mg/m³	0.333	(mg/m³)²
Zero drift from field test	$u_{d,z}$	1.588	mg/m³	2.522	(mg/m³)²
Span drift from field test	$u_{d,s}$	2.309	mg/m³	5.331	(mg/m³)²
Influence of ambient temperature at span	u_t	1.400	mg/m³	1.960	(mg/m³)²
Influence of supply voltage	u_v	1.429	mg/m³	2.042	(mg/m³)²
Cross-sensitivity (interference)	u_i	2.367	mg/m³	5.603	(mg/m³)²
Influence of sample gas flow	u_p	-0.992	mg/m³	0.984	(mg/m³)²
Uncertainty of reference material at 70% of certification range	u_{rm}	2.021	mg/m³	4.083	(mg/m³)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)	$u_c = \sqrt{\sum (u_{max\ j})^2}$	5.17	mg/m³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	10.14	mg/m³

Relative total expanded uncertainty	**U in % of the ELV 100 mg/m³**	**10.1**
Requirement of 2010/75/EU	**U in % of the ELV 100 mg/m³**	**10.0**
Requirement of EN 15267-3	U in % of the ELV 100 mg/m³	7.5

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

Measuring system			
Manufacturer	Fuji Electric		
AMS designation	ZPA-CEMS		
Serial number of units under test	N7CO387 / N4C1455T		
Measuring principle	NDIR		
Test report	936/21239789/A		
Test laboratory	TÜV Rheinland		
Date of report	2018-09-21		
Measured component	NO		
Certification range	0 - 268	mg/m³	
Evaluation of the cross-sensitivity (CS)			
(system with largest CS)			
Sum of positive CS at zero point	2.63	mg/m³	
Sum of negative CS at zero point	0.00	mg/m³	
Sum of postive CS at span point	2.63	mg/m³	
Sum of negative CS at span point	-1.69	mg/m³	
Maximum sum of cross-sensitivities	2.63	mg/m³	
Uncertainty of cross-sensitivity	u_i 1.516	mg/m³	

Calculation of the combined standard uncertainty

Tested parameter				u^2	
Standard deviation from paired measurements under field conditions *	u_D	2.153	mg/m³	4.635	(mg/m³)²
Lack of fit	u_{lof}	0.573	mg/m³	0.328	(mg/m³)²
Zero drift from field test	$u_{d,z}$	-1.393	mg/m³	1.940	(mg/m³)²
Span drift from field test	$u_{d,s}$	2.166	mg/m³	4.692	(mg/m³)²
Influence of ambient temperature at span	u_t	2.343	mg/m³	5.490	(mg/m³)²
Influence of supply voltage	u_v	1.164	mg/m³	1.355	(mg/m³)²
Cross-sensitivity (interference)	u_i	1.516	mg/m³	2.298	(mg/m³)²
Influence of sample gas flow	u_p	-0.484	mg/m³	0.234	(mg/m³)²
Uncertainty of reference material at 70% of certification range	u_{rm}	2.166	mg/m³	4.693	(mg/m³)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)	$u_c = \sqrt{\sum (u_{max,j})^2}$	5.07	mg/m³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	9.93	mg/m³

Relative total expanded uncertainty	**U in % of the ELV 107.2 mg/m³**	**9.3**
Requirement of 2010/75/EU	**U in % of the ELV 107.2 mg/m³**	**20.0**
Requirement of EN 15267-3	U in % of the ELV 107.2 mg/m³	15.0

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

Measuring system			
Manufacturer		Fuji Electric	
AMS designation		ZPA-CEMS	
Serial number of units under test		N7CO387 / N4C1455T	
Measuring principle		NDIR	
Test report		936/21239789/A	
Test laboratory		TÜV Rheinland	
Date of report		2018-09-21	
Measured component		SO_2	
Certification range		0 - 571	mg/m³
Evaluation of the cross-sensitivity (CS)			
(system with largest CS)			
Sum of positive CS at zero point		8.11	mg/m³
Sum of negative CS at zero point		-5.14	mg/m³
Sum of postive CS at span point		3.71	mg/m³
Sum of negative CS at span point		-16.90	mg/m³
Maximum sum of cross-sensitivities		-16.90	mg/m³
Uncertainty of cross-sensitivity	u_i	-9.758	mg/m³

Calculation of the combined standard uncertainty

Tested parameter				u^2	
Standard deviation from paired measurements under field conditions *	u_D	4.538	mg/m³	20.593	(mg/m³)²
Lack of fit	u_{lof}	0.593	mg/m³	0.352	(mg/m³)²
Zero drift from field test	$u_{d,z}$	-3.956	mg/m³	15.650	(mg/m³)²
Span drift from field test	$u_{d,s}$	3.297	mg/m³	10.870	(mg/m³)²
Influence of ambient temperature at span	u_t	5.009	mg/m³	25.090	(mg/m³)²
Influence of supply voltage	u_v	2.031	mg/m³	4.125	(mg/m³)²
Cross-sensitivity (interference)	u_i	-9.758	mg/m³	95.219	(mg/m³)²
Influence of sample gas flow	u_p	-2.953	mg/m³	8.720	(mg/m³)²
Uncertainty of reference material at 70% of certification range	u_{rm}	4.615	mg/m³	21.301	(mg/m³)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)	$u_c = \sqrt{\sum (u_{max,j})^2}$	14.21	mg/m³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	27.85	mg/m³

Relative total expanded uncertainty	**U in % of the ELV 228.4 mg/m³**	**12.2**
Requirement of 2010/75/EU	**U in % of the ELV 228.4 mg/m³**	**20.0**
Requirement of EN 15267-3	U in % of the ELV 228.4 mg/m³	15.0

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

Measuring system			
Manufacturer		Fuji Electric	
AMS designation		ZPA-CEMS	
Serial number of units under test		N7CO387 / N4C1455T	
Measuring principle		NDIR	
Test report		936/21239789/A	
Test laboratory		TÜV Rheinland	
Date of report		2018-09-21	
Measured component		CO_2	
Certification range		0 - 20	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 postive CS at span point		0.00	Vol.-%
Sum of negative CS at span point		-0.20	Vol.-%
Maximum sum of cross-sensitivities		-0.20	Vol.-%
Uncertainty of cross-sensitivity	u_i	-0.115	Vol.-%

Calculation of the combined standard uncertainty

Tested parameter				u^2	
Standard deviation from paired measurements under field conditions *	u_D	0.102	Vol.-%	0.010	(Vol.-%)²
Lack of fit	u_{lof}	0.087	Vol.-%	0.008	(Vol.-%)²
Zero drift from field test	$u_{d,z}$	-0.058	Vol.-%	0.003	(Vol.-%)²
Span drift from field test	$u_{d,s}$	0.300	Vol.-%	0.090	(Vol.-%)²
Influence of ambient temperature at span	u_t	0.058	Vol.-%	0.003	(Vol.-%)²
Influence of supply voltage	u_v	0.047	Vol.-%	0.002	(Vol.-%)²
Cross-sensitivity (interference)	u_i	-0.115	Vol.-%	0.013	(Vol.-%)²
Influence of sample gas flow	u_p	-0.077	Vol.-%	0.006	(Vol.-%)²
Uncertainty of reference material at 70% of certification range	u_{rm}	0.162	Vol.-%	0.026	(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)	$u_c = \sqrt{\sum (u_{max\ j})^2}$	0.40	Vol.-%
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	0.79	Vol.-%

Relative total expanded uncertainty	**U in % of the range 20 Vol.-%**	**3.9**
Requirement of 2010/75/EU	**U in % of the range 20 Vol.-%**	**10.0 ****
Requirement of EN 15267-3	U in % of the range 20 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.

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

Measuring system					
Manufacturer		Fuji Electric			
AMS designation		ZPA-CEMS			
Serial number of units under test		N7CO387 / N4C1455T			
Measuring principle		paramagnetic			
Test report		936/21239789/A			
Test laboratory		TÜV Rheinland			
Date of report		2018-09-21			
Measured component		O_2 (Para)			
Certification range		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 postive CS at span point		0.00	Vol.-%		
Sum of negative CS at span point		0.00	Vol.-%		
Maximum sum of cross-sensitivities		0.00	Vol.-%		
Uncertainty of cross-sensitivity	u_i	0.000	Vol.-%		

Calculation of the combined standard uncertainty

Tested parameter				u^2	
Standard deviation from paired measurements under field conditions *	u_D	0.056	Vol.-%	0.003	(Vol.-%)²
Lack of fit	u_{lof}	0.058	Vol.-%	0.003	(Vol.-%)²
Zero drift from field test	$u_{d,z}$	0.092	Vol.-%	0.008	(Vol.-%)²
Span drift from field test	$u_{d,s}$	-0.098	Vol.-%	0.010	(Vol.-%)²
Influence of ambient temperature at span	u_t	0.015	Vol.-%	0.000	(Vol.-%)²
Influence of supply voltage	u_v	0.026	Vol.-%	0.001	(Vol.-%)²
Cross-sensitivity (interference)	u_i	0.000	Vol.-%	0.000	(Vol.-%)²
Influence of sample gas flow	u_p	-0.058	Vol.-%	0.003	(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)	$u_c = \sqrt{\sum (u_{max,j})^2}$	0.26	Vol.-%
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	0.52	Vol.-%

Relative total expanded uncertainty	**U in % of the range 25 Vol.-%**	**2.1**
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.

Umwelt Bundesamt

Certificate:
0000062062_02 / 20 March 2025

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

Measuring system			
Manufacturer		Fuji Electric	
AMS designation		ZPA-CEMS	
Serial number of units under test		N4C13450+N4E0757 / N4C13460+N4E0758	
Measuring principle		ZrO2	
Test report		936/21239789/A	
Test laboratory		TÜV Rheinland	
Date of report		2018-09-21	
Measured component		O_2 (ZrO_2)	
Certification range		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 postive CS at span point		0.24	Vol.-%
Sum of negative CS at span point		0.00	Vol.-%
Maximum sum of cross-sensitivities		0.24	Vol.-%
Uncertainty of cross-sensitivity	u_i	0.139	Vol.-%

Calculation of the combined standard uncertainty

Tested parameter				u^2	
Standard deviation from paired measurements under field conditions *	u_D	0.034	Vol.-%	0.001	(Vol.-%)²
Lack of fit	u_{lof}	0.058	Vol.-%	0.003	(Vol.-%)²
Zero drift from field test	$u_{d,z}$	0.017	Vol.-%	0.000	(Vol.-%)²
Span drift from field test	$u_{d,s}$	0.115	Vol.-%	0.013	(Vol.-%)²
Influence of ambient temperature at span	u_t	0.046	Vol.-%	0.002	(Vol.-%)²
Influence of supply voltage	u_v	0.010	Vol.-%	0.000	(Vol.-%)²
Cross-sensitivity (interference)	u_i	0.139	Vol.-%	0.019	(Vol.-%)²
Influence of sample gas flow	u_p	0.057	Vol.-%	0.003	(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)	$u_c = \sqrt{\sum (u_{max,j})^2}$	0.29	Vol.-%
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	0.57	Vol.-%

Relative total expanded uncertainty	**U in % of the range 25 Vol.-%**	**2.3**
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.