

# CERTIFICATE

## of Product Conformity (QAL1)

Certificate No.: 0000062062\_01

**AMS designation:** ZPA-CEMS for CO, NO, SO<sub>2</sub>, CO<sub>2</sub> and O<sub>2</sub>

**Manufacturer:** Fuji Electric France S.A.S.  
46, Rue Georges Besse, ZI du Brézet  
63039 Clermont-Ferrand Cedex 2  
France

**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 14 pages).

The present certificate replaces certificate 0000062062 of 12 June 2019.



Suitability Tested  
EN 15267  
QAL1 Certified  
Regular Surveillance

www.tuv.com  
ID 0000062062

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

This certificate will expire on:  
23 March 2025

German Federal Environment Agency  
Dessau, 04 June 2020

TÜV Rheinland Energy GmbH  
Cologne, 03 June 2020



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Test institute accredited to EN ISO/IEC 17025:2005 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:** 936/21239789/B dated 15 May 2019  
**Initial certification:** 26 March 2019  
**Expiry date:** 23 March 2025  
**Publication:** BAnz AT 24.03.2020 B7, chapter I number 3.3

### **Approved application**

The tested AMS is suitable for use at combustion plants according to Directive 2010/75/EU, chapter III (13<sup>th</sup> BImSchV), plants in compliance with TA Luft and plants according to the 27<sup>th</sup> BImSchV. 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 field test at a large combustion plant (hard coal firing) for a period of more than three months.

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 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.

### **Basis of the certification**

This certification is based on:

- Test report 936/21239789/B dated 15 May 2019 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 24.03.2020 B7, chapter I number 3.3,  
UBA announcement dated 24 February 2020:

**AMS designation:**

ZPA-CEMS for CO, NO, SO<sub>2</sub>, CO<sub>2</sub> and O<sub>2</sub>

**Manufacturer:**

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

**Field of application:**

Modular AMS for measurement at plants according to the 13<sup>th</sup> BImSchV and TA Luft

**Measuring ranges during performance testing:**

Component	Certification range	supplementary measuring ranges		Unit
CO	0–375	0–625	0–2 500	mg/m <sup>3</sup>
NO	0–268	0–670	0–2 680	mg/m <sup>3</sup>
SO <sub>2</sub>	0–571	0–1 428	0–5 710	mg/m <sup>3</sup>
CO <sub>2</sub>	0–20	-	-	Vol.-%
O <sub>2</sub> para.	0–25	0–10	-	Vol.-%
O <sub>2</sub> (ZrO <sub>2</sub> )	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<sub>2</sub> (para)) or the zirconium dioxide sensor (O<sub>2</sub> (ZrO<sub>2</sub>)).
3. For measuring the components CO, NO, SO<sub>2</sub> and CO<sub>2</sub>, 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 measurement channels. The following table lists the AMS designation which indicates the relevant scope of measured components:

Designation			Combination of IR components
Without O <sub>2</sub> measurement	With O <sub>2</sub> measurement (ZrO <sub>2</sub> )	With O <sub>2</sub> measurement (para)	
	ZPA-Yz	ZPA-Yp	O <sub>2</sub>
ZPA-B	ZPA-Bz	ZPA-Bp	CO
ZPA-Z	ZPA-Zz	ZPA-Zp	CO + SO <sub>2</sub>
ZPA-P	ZPA-Pz	ZPA-Pp	NO
ZPA-F	ZPA-Fz	ZPA-Fp	NO + SO <sub>2</sub>
ZPA-D	ZPA-Dz	ZPA-Dp	CO <sub>2</sub>
ZPA-G	ZPA-Gz	ZPA-Gp	CO + NO
ZPA-J	ZPA-Jz	ZPA-Jp	CO + CO <sub>2</sub>
ZPA-N	ZPA-Nz	ZPA-Np	CO + NO + SO <sub>2</sub>
ZPA-W	ZPA-Wz	ZPA-Wp	CO + NO + CO <sub>2</sub>
ZPA-Q	ZPA-Qz	ZPA-Qp	CO + NO + SO <sub>2</sub> + CO <sub>2</sub>

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 Report:**

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

**Certified product**

This certification 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<sub>2</sub> and CO<sub>2</sub> using NDIR. There are two alternatives for measuring O<sub>2</sub>: 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 <sub>2</sub> measurement	With O <sub>2</sub> measurement (ZrO <sub>2</sub> )	With O <sub>2</sub> measurement (para)	
	ZPA-Yz	ZPA-Yp	O <sub>2</sub>
ZPA-B	ZPA-Bz	ZPA-Bp	CO
ZPA-Z	ZPA-Zz	ZPA-Zp	CO + SO <sub>2</sub>
ZPA-P	ZPA-Pz	ZPA-Pp	NO
ZPA-F	ZPA-Fz	ZPA-Fp	NO + SO <sub>2</sub>
ZPA-D	ZPA-Dz	ZPA-Dp	CO <sub>2</sub>
ZPA-G	ZPA-Gz	ZPA-Gp	CO + NO
ZPA-J	ZPA-Jz	ZPA-Jp	CO + CO <sub>2</sub>
ZPA-N	ZPA-Nz	ZPA-Np	CO + NO + SO <sub>2</sub>
ZPA-W	ZPA-Wz	ZPA-Wp	CO + NO + CO <sub>2</sub>
ZPA-Q	ZPA-Qz	ZPA-Qp	CO + NO + SO <sub>2</sub> + CO <sub>2</sub>

The ZFK-7 sensor (ZrO<sub>2</sub>) 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 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](http://gal1.de).

### Document history

Certification of the ZPA-CEMS 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. 0000062062\_00: 12 June 2019  
Expiry date: 25 March 2024  
Test Report: 936/21239789/A dated 21 September 2018  
TÜV Rheinland Energy GmbH, Cologne  
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: 04 June 2020  
Expiry date of the certificate: 23 March 2025  
Test report: 936/21239789/B dated 15 May 2019  
TÜV Rheinland Energy GmbH, Cologne  
Publication: BAnz AT 24.03.2020 B7, chapter I number 3.3  
UBA announcement dated 24 February 2020

### 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

Test laboratory	936/21239789/A
Date of report	TÜV Rheinland 2018-09-21

#### Measured component

Certification range	CO 0 - 375 mg/m <sup>3</sup>
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#### Evaluation of the cross-sensitivity (CS)

(system with largest CS)

Sum of positive CS at zero point	0.00 mg/m <sup>3</sup>
Sum of negative CS at zero point	0.00 mg/m <sup>3</sup>
Sum of positive CS at span point	4.10 mg/m <sup>3</sup>
Sum of negative CS at span point	-2.40 mg/m <sup>3</sup>
Maximum sum of cross-sensitivities	4.10 mg/m <sup>3</sup>
Uncertainty of cross-sensitivity	$u_i$ 2.367 mg/m <sup>3</sup>

#### Calculation of the combined standard uncertainty

##### Tested parameter

			$u^2$	
Standard deviation from paired measurements under field conditions *	$u_D$	1.975 mg/m <sup>3</sup>	3.901	(mg/m <sup>3</sup> ) <sup>2</sup>
Lack of fit	$u_{lof}$	-1.169 mg/m <sup>3</sup>	1.367	(mg/m <sup>3</sup> ) <sup>2</sup>
Zero drift from field test	$u_{d,z}$	1.588 mg/m <sup>3</sup>	2.522	(mg/m <sup>3</sup> ) <sup>2</sup>
Span drift from field test	$u_{d,s}$	2.309 mg/m <sup>3</sup>	5.331	(mg/m <sup>3</sup> ) <sup>2</sup>
Influence of ambient temperature at span	$u_t$	1.400 mg/m <sup>3</sup>	1.960	(mg/m <sup>3</sup> ) <sup>2</sup>
Influence of supply voltage	$u_v$	1.429 mg/m <sup>3</sup>	2.042	(mg/m <sup>3</sup> ) <sup>2</sup>
Cross-sensitivity (interference)	$u_i$	2.367 mg/m <sup>3</sup>	5.603	(mg/m <sup>3</sup> ) <sup>2</sup>
Influence of sample gas flow	$u_n$	-0.992 mg/m <sup>3</sup>	0.984	(mg/m <sup>3</sup> ) <sup>2</sup>
Uncertainty of reference material at 70% of certification range	$u_{rm}$	3.031 mg/m <sup>3</sup>	9.188	(mg/m <sup>3</sup> ) <sup>2</sup>

\* The larger value is used :

"Repeatability standard deviation at set point" or

"Standard deviation from paired measurements under field conditions"

Combined standard uncertainty ( $u_c$ )

$$u_c = \sqrt{\sum (u_{max,i})^2} \quad 5.74 \text{ mg/m}^3$$

Total expanded uncertainty

$$U = u_c * k = u_c * 1.96 \quad 11.24 \text{ mg/m}^3$$

#### Relative total expanded uncertainty

U in % of the ELV 150 mg/m<sup>3</sup> **7.49**

Requirement of 2010/75/EU

U in % of the ELV 150 mg/m<sup>3</sup> **10.00**

Requirement of EN 15267-3

U in % of the ELV 150 mg/m<sup>3</sup> **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**

Test laboratory	936/21239789/A
Date of report	TÜV Rheinland
	2018-09-21

**Measured component**

Certification range	CO	0 - 250 mg/m <sup>3</sup>
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**Evaluation of the cross-sensitivity (CS)**

(system with largest CS)

Sum of positive CS at zero point	0.00 mg/m <sup>3</sup>
Sum of negative CS at zero point	0.00 mg/m <sup>3</sup>
Sum of positive CS at span point	4.10 mg/m <sup>3</sup>
Sum of negative CS at span point	-2.40 mg/m <sup>3</sup>
Maximum sum of cross-sensitivities	4.10 mg/m <sup>3</sup>
Uncertainty of cross-sensitivity	$u_i$ 2.367 mg/m <sup>3</sup>

**Calculation of the combined standard uncertainty**

**Tested parameter**

			$u^2$
Standard deviation from paired measurements under field conditions *	$u_D$	1.975 mg/m <sup>3</sup>	3.901 (mg/m <sup>3</sup> ) <sup>2</sup>
Lack of fit	$u_{lof}$	0.577 mg/m <sup>3</sup>	0.333 (mg/m <sup>3</sup> ) <sup>2</sup>
Zero drift from field test	$u_{d,z}$	1.588 mg/m <sup>3</sup>	2.522 (mg/m <sup>3</sup> ) <sup>2</sup>
Span drift from field test	$u_{d,s}$	2.309 mg/m <sup>3</sup>	5.331 (mg/m <sup>3</sup> ) <sup>2</sup>
Influence of ambient temperature at span	$u_t$	1.400 mg/m <sup>3</sup>	1.960 (mg/m <sup>3</sup> ) <sup>2</sup>
Influence of supply voltage	$u_v$	1.429 mg/m <sup>3</sup>	2.042 (mg/m <sup>3</sup> ) <sup>2</sup>
Cross-sensitivity (interference)	$u_i$	2.367 mg/m <sup>3</sup>	5.603 (mg/m <sup>3</sup> ) <sup>2</sup>
Influence of sample gas flow	$u_o$	-0.992 mg/m <sup>3</sup>	0.984 (mg/m <sup>3</sup> ) <sup>2</sup>
Uncertainty of reference material at 70% of certification range	$u_{rm}$	2.021 mg/m <sup>3</sup>	4.083 (mg/m <sup>3</sup> ) <sup>2</sup>

\* The larger value is used :

"Repeatability standard deviation at set point" or

"Standard deviation from paired measurements under field conditions"

Combined standard uncertainty ( $u_c$ )

$$u_c = \sqrt{\sum (u_{max, i})^2} \quad 5.17 \text{ mg/m}^3$$

Total expanded uncertainty

$$U = u_c * k = u_c * 1.96 \quad 10.14 \text{ mg/m}^3$$

**Relative total expanded uncertainty**

**U in % of the ELV 100 mg/m<sup>3</sup> 10.1**

**Requirement of 2010/75/EU**

**U in % of the ELV 100 mg/m<sup>3</sup> 10.0**

Requirement of EN 15267-3

U in % of the ELV 100 mg/m<sup>3</sup> 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**

Test laboratory	936/21239789/A
Date of report	TÜV Rheinland
	2018-09-21

**Measured component**

Certification range	NO	0 - 268 mg/m <sup>3</sup>
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**Evaluation of the cross-sensitivity (CS)**

(system with largest CS)

Sum of positive CS at zero point	2.63 mg/m <sup>3</sup>
Sum of negative CS at zero point	0.00 mg/m <sup>3</sup>
Sum of positive CS at span point	2.63 mg/m <sup>3</sup>
Sum of negative CS at span point	-1.69 mg/m <sup>3</sup>
Maximum sum of cross-sensitivities	2.63 mg/m <sup>3</sup>
Uncertainty of cross-sensitivity	$u_i$ 1.516 mg/m <sup>3</sup>

**Calculation of the combined standard uncertainty**

**Tested parameter**

			$u^2$
Standard deviation from paired measurements under field conditions *	$u_D$	2.153 mg/m <sup>3</sup>	4.635 (mg/m <sup>3</sup> ) <sup>2</sup>
Lack of fit	$u_{lof}$	0.573 mg/m <sup>3</sup>	0.328 (mg/m <sup>3</sup> ) <sup>2</sup>
Zero drift from field test	$u_{d,z}$	-1.393 mg/m <sup>3</sup>	1.940 (mg/m <sup>3</sup> ) <sup>2</sup>
Span drift from field test	$u_{d,s}$	2.166 mg/m <sup>3</sup>	4.692 (mg/m <sup>3</sup> ) <sup>2</sup>
Influence of ambient temperature at span	$u_t$	2.343 mg/m <sup>3</sup>	5.490 (mg/m <sup>3</sup> ) <sup>2</sup>
Influence of supply voltage	$u_v$	1.164 mg/m <sup>3</sup>	1.355 (mg/m <sup>3</sup> ) <sup>2</sup>
Cross-sensitivity (interference)	$u_i$	1.516 mg/m <sup>3</sup>	2.298 (mg/m <sup>3</sup> ) <sup>2</sup>
Influence of sample gas flow	$u_o$	-0.484 mg/m <sup>3</sup>	0.234 (mg/m <sup>3</sup> ) <sup>2</sup>
Uncertainty of reference material at 70% of certification range	$u_{rm}$	2.166 mg/m <sup>3</sup>	4.693 (mg/m <sup>3</sup> ) <sup>2</sup>

\* The larger value is used :

"Repeatability standard deviation at set point" or

"Standard deviation from paired measurements under field conditions"

Combined standard uncertainty ( $u_c$ )

$$u_c = \sqrt{\sum (u_{max,i})^2} \quad 5.07 \text{ mg/m}^3$$

Total expanded uncertainty

$$U = u_c * k = u_c * 1.96 \quad 9.93 \text{ mg/m}^3$$

**Relative total expanded uncertainty**

**U in % of the ELV 107.2 mg/m<sup>3</sup> 9.3**

**Requirement of 2010/75/EU**

**U in % of the ELV 107.2 mg/m<sup>3</sup> 20.0**

Requirement of EN 15267-3

U in % of the ELV 107.2 mg/m<sup>3</sup> 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**

Test laboratory	936/21239789/A
Date of report	TÜV Rheinland
	2018-09-21

**Measured component**

Certification range	SO <sub>2</sub>	0 - 571 mg/m <sup>3</sup>
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**Evaluation of the cross-sensitivity (CS)**

(system with largest CS)

Sum of positive CS at zero point	8.11 mg/m <sup>3</sup>
Sum of negative CS at zero point	-5.14 mg/m <sup>3</sup>
Sum of positive CS at span point	3.71 mg/m <sup>3</sup>
Sum of negative CS at span point	-16.90 mg/m <sup>3</sup>
Maximum sum of cross-sensitivities	-16.90 mg/m <sup>3</sup>
Uncertainty of cross-sensitivity	u <sub>i</sub> -9.758 mg/m <sup>3</sup>

**Calculation of the combined standard uncertainty**

**Tested parameter**

			u <sup>2</sup>
Standard deviation from paired measurements under field conditions *	u <sub>D</sub>	4.538 mg/m <sup>3</sup>	20.593 (mg/m <sup>3</sup> ) <sup>2</sup>
Lack of fit	u <sub>lof</sub>	0.593 mg/m <sup>3</sup>	0.352 (mg/m <sup>3</sup> ) <sup>2</sup>
Zero drift from field test	u <sub>d,z</sub>	-3.956 mg/m <sup>3</sup>	15.650 (mg/m <sup>3</sup> ) <sup>2</sup>
Span drift from field test	u <sub>d,s</sub>	3.297 mg/m <sup>3</sup>	10.870 (mg/m <sup>3</sup> ) <sup>2</sup>
Influence of ambient temperature at span	u <sub>t</sub>	5.009 mg/m <sup>3</sup>	25.090 (mg/m <sup>3</sup> ) <sup>2</sup>
Influence of supply voltage	u <sub>v</sub>	2.031 mg/m <sup>3</sup>	4.125 (mg/m <sup>3</sup> ) <sup>2</sup>
Cross-sensitivity (interference)	u <sub>i</sub>	-9.758 mg/m <sup>3</sup>	95.219 (mg/m <sup>3</sup> ) <sup>2</sup>
Influence of sample gas flow	u <sub>o</sub>	-2.953 mg/m <sup>3</sup>	8.720 (mg/m <sup>3</sup> ) <sup>2</sup>
Uncertainty of reference material at 70% of certification range	u <sub>rm</sub>	4.615 mg/m <sup>3</sup>	21.301 (mg/m <sup>3</sup> ) <sup>2</sup>

\* The larger value is used :

"Repeatability standard deviation at set point" or

"Standard deviation from paired measurements under field conditions"

Combined standard uncertainty (u<sub>c</sub>)

$$u_c = \sqrt{\sum (u_{max,i})^2} \quad 14.21 \text{ mg/m}^3$$

Total expanded uncertainty

$$U = u_c * k = u_c * 1.96 \quad 27.85 \text{ mg/m}^3$$

**Relative total expanded uncertainty**

**U in % of the ELV 228.4 mg/m<sup>3</sup> 12.2**

**Requirement of 2010/75/EU**

**U in % of the ELV 228.4 mg/m<sup>3</sup> 20.0**

Requirement of EN 15267-3

U in % of the ELV 228.4 mg/m<sup>3</sup> 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**

Test laboratory	936/21239789/A
Date of report	TÜV Rheinland
	2018-09-21

**Measured component**

Certification range	CO <sub>2</sub>	0 - 20 Vol.-%
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**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	-0.20	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.-%) <sup>2</sup>
Lack of fit	$u_{lof}$	0.087 Vol.-%	0.008 (Vol.-%) <sup>2</sup>
Zero drift from field test	$u_{d,z}$	-0.058 Vol.-%	0.003 (Vol.-%) <sup>2</sup>
Span drift from field test	$u_{d,s}$	0.300 Vol.-%	0.090 (Vol.-%) <sup>2</sup>
Influence of ambient temperature at span	$u_t$	0.058 Vol.-%	0.003 (Vol.-%) <sup>2</sup>
Influence of supply voltage	$u_v$	0.047 Vol.-%	0.002 (Vol.-%) <sup>2</sup>
Cross-sensitivity (interference)	$u_i$	-0.115 Vol.-%	0.013 (Vol.-%) <sup>2</sup>
Influence of sample gas flow	$u_n$	-0.077 Vol.-%	0.006 (Vol.-%) <sup>2</sup>
Uncertainty of reference material at 70% of certification range	$u_{rm}$	0.162 Vol.-%	0.026 (Vol.-%) <sup>2</sup>

\* The larger value is used :

"Repeatability standard deviation at set point" or

"Standard deviation from paired measurements under field conditions"

Combined standard uncertainty ( $u_c$ )

$$u_c = \sqrt{\sum (u_{max,i})^2} \quad 0.40 \text{ Vol.-%}$$

Total expanded uncertainty

$$U = u_c * k = u_c * 1.96 \quad 0.79 \text{ Vol.-%}$$

**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**

Test laboratory	936/21239789/A
Date of report	TÜV Rheinland
	2018-09-21

**Measured component**

Certification range	O <sub>2</sub> (Para)	0 - 25 Vol.-%
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**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	0.00	Vol.-%
Maximum sum of cross-sensitivities	0.00	Vol.-%
Uncertainty of cross-sensitivity	u <sub>i</sub>	0.000 Vol.-%

**Calculation of the combined standard uncertainty**

**Tested parameter**

				u <sup>2</sup>
Standard deviation from paired measurements under field conditions *	u <sub>D</sub>	0.056	Vol.-%	0.003 (Vol.-%) <sup>2</sup>
Lack of fit	u <sub>lof</sub>	0.058	Vol.-%	0.003 (Vol.-%) <sup>2</sup>
Zero drift from field test	u <sub>d,z</sub>	0.092	Vol.-%	0.008 (Vol.-%) <sup>2</sup>
Span drift from field test	u <sub>d,s</sub>	-0.098	Vol.-%	0.010 (Vol.-%) <sup>2</sup>
Influence of ambient temperature at span	u <sub>t</sub>	0.015	Vol.-%	0.000 (Vol.-%) <sup>2</sup>
Influence of supply voltage	u <sub>v</sub>	0.026	Vol.-%	0.001 (Vol.-%) <sup>2</sup>
Cross-sensitivity (interference)	u <sub>i</sub>	0.000	Vol.-%	0.000 (Vol.-%) <sup>2</sup>
Influence of sample gas flow	u <sub>o</sub>	-0.058	Vol.-%	0.003 (Vol.-%) <sup>2</sup>
Uncertainty of reference material at 70% of certification range	u <sub>rm</sub>	0.202	Vol.-%	0.041 (Vol.-%) <sup>2</sup>

\* The larger value is used :

"Repeatability standard deviation at set point" or

"Standard deviation from paired measurements under field conditions"

Combined standard uncertainty (u<sub>c</sub>)

$$u_c = \sqrt{\sum (u_{max,i})^2} \quad 0.26 \text{ Vol.-%}$$

Total expanded uncertainty

$$U = u_c * k = u_c * 1.96 \quad 0.52 \text{ Vol.-%}$$

**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.

**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	ZrO <sub>2</sub>

**Test report**

Test laboratory	936/21239789/A
Date of report	TÜV Rheinland
	2018-09-21

**Measured component**

Certification range	O <sub>2</sub> (ZrO <sub>2</sub> )
	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	0.24	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.-%) <sup>2</sup>
Lack of fit	$u_{inf}$	0.058 Vol.-%	0.003 (Vol.-%) <sup>2</sup>
Zero drift from field test	$u_{d.z}$	0.017 Vol.-%	0.000 (Vol.-%) <sup>2</sup>
Span drift from field test	$u_{d.s}$	0.115 Vol.-%	0.013 (Vol.-%) <sup>2</sup>
Influence of ambient temperature at span	$u_t$	0.046 Vol.-%	0.002 (Vol.-%) <sup>2</sup>
Influence of supply voltage	$u_v$	0.010 Vol.-%	0.000 (Vol.-%) <sup>2</sup>
Cross-sensitivity (interference)	$u_i$	0.139 Vol.-%	0.019 (Vol.-%) <sup>2</sup>
Influence of sample gas flow	$u_n$	0.057 Vol.-%	0.003 (Vol.-%) <sup>2</sup>
Uncertainty of reference material at 70% of certification range	$u_{rm}$	0.202 Vol.-%	0.041 (Vol.-%) <sup>2</sup>

\* 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**

<b>Requirement of 2010/75/EU</b>	<b>U in % of the range 25 Vol.-%</b>	<b>2.3</b>
Requirement of EN 15267-3	U in % of the range 25 Vol.-%	10.0 **
	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.