

CERTIFICATE

of Product Conformity (QAL1)

Certificate No: 0000074625_02

Certified AMS: X-STREAM enhanced system for CO, NO_x, NO, SO₂, O₂ and CO₂

Manufacturer: Emerson Process Management Ltd.
2 Hunt Hill
Cumbernault, G68 9LF / Scotland
United Kingdom

Test Laboratory: 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) 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 0000074625_01 dated 3 September 2021.



Suitability Tested
EN 15267
QAL1 Certified
Regular
Surveillance

www.tuv.com
ID 0000074625

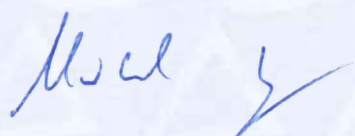
Publication in the German Federal Gazette
(BAnz) of 05 August 2021

German Environment Agency

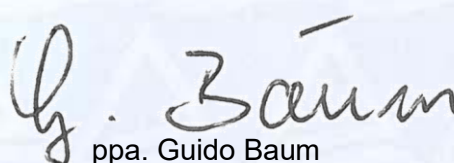
Dessau, 05 August 2026

This certificate will expire on:
04 August 2031

TÜV Rheinland
Energy & Environment GmbH
Cologne, 04 August 2026



Dr. Marcel Langner
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TÜV Rheinland Energy & Environment GmbH
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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: 936/21247061/C dated 03 May 2021
Initial certification: 02 June 2021
Expiry date: 04 August 2031
Certificate: Renewal (of previous certificate 0000074625_01 of 03 September 2021 valid until 04 August 2026)
Publication: BAnz AT 05.08.2021 B5, chap. I No. 4.1

Approved application

The tested AMS is suitable for use at combustion plants according to Directive 2010/75/EU, chapter III (13th BImSchV:2021), chapter IV (17th BImSchV:2021), 30th BImSchV:2022, plants in compliance with TA Luft:2021 and plants according to the 27th BImSchV:2013. 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 waste incineration 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 concentration relevant to the application.

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

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 936/21247061/C of 03 May 2021 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 05.08.2021 B5, chap. I No. 4.1,
UBA announcement dated 29 June 2021:

AMS designation:

X-CEMS for CO, NO_x, NO, SO₂, CO₂ and O₂

Manufacturer:

Emerson Process Management GmbH & Co. OHG, Hasselroth

Field of application:

Modular measuring system for plants requiring official approval and
for plants according to the 27th BImSchV

Measuring ranges during performance testing:

Component	Certification range	Supplementary range	Unit
CO	0 – 150	0 – 3,000	mg/m ³
NO _x *	0 – 150	0 – 2,000	mg/m ³
NO**	0 – 150	0 – 2,000	mg/m ³
SO ₂	0 – 150	0 – 2,500	mg/m ³
CO ₂	0 – 25	-	Vol.-%
O ₂ (paramagnetic)	0 – 25	-	Vol.-%
O ₂ (electrochemical)	0 – 25	-	Vol.-%

* state as NO, corresponds to 0 – 230 mg/m³ NO_x as NO₂

** without converter

Software version:

1.7.0

Restriction:

None

Notes:

1. The maintenance interval is four weeks.
2. The SO₂ measuring module is able to monitor limit values above 60 mg/m³.
3. The measuring system can optionally be operated without a converter for the determination of the NO component (instead of NO_x). In this case, the sample gas probe, type SP3100, from the company M&C can also be used.
4. Supplementary test (optional omission of the NO_x converter and approval of an additional gas sampling probe in this case) as regards the notices of the Federal Environment Agency of 31 March 2021 (BAnz AT 03.05.2021 B9, chapter I number 3.2).

Test Report:

TÜV Rheinland Energy GmbH, Cologne
Report no.: 936/21247061/C dated 03 May 2021

Publication in the German Federal Gazette: BAnz AT 28.07.2022 B4, chap. III notification 9,
UBA announcement dated 28 June 2022:

**9 Notification as regards Federal Environment Agency (UBA) notice
of 29 June 2021 (BAnz AT 05.08.2021 B5, chapter I number 4.1 and
chapter III correction 3)**

The current software version for the X-CEMS measuring system for CO, NO, NO_x,
SO₂, CO₂ and O₂ from Emerson Process Management GmbH & Co. OHG is
1.7.1.

The light electrode in the mercury UV lamp for the determination of SO₂ has been
discontinued by the manufacturer and replaced by an equivalent successor model.

Statement issued by TÜV Rheinland Energy GmbH dated 10 February 2022

Publication in the German Federal Gazette: BAnz AT 02.08.2023 B7, chap. III notification 4,
UBA announcement dated 5 July 2023:

**4 Notification as regards Federal Environment Agency (UBA) notices
of 29 June 2021 (BAnz AT 05.08.2021 B5, chapter I number 4.1) and
of 28 June 2022 (BAnz AT 28.07.2022 B4, chapter III notification 9)**

The new name of the X-CEMS measuring system for CO, NO, NO_x, SO₂, CO₂ and
O₂
from Emerson Process Management GmbH & Co. OHG is now "X-STREAM
enhanced system".

The company name of Emerson Process Management GmbH & Co. OHG has
changed to Emerson Process Management Ltd.

The new production location for the X-STREAM enhanced system from Emerson
Process Management Ltd. is:

Emerson Process Management Ltd.
2 Hunt Hill
Cumbernauld, G68 9LF
Scotland

Statement issued by TÜV Rheinland Energy GmbH dated 06 February 2023

Certified product

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

The modular measuring system X-CEMS is an extractive emission measuring device. Depending on the measured component, different measuring principles are used. Nondispersive infrared absorption (NDIR) is used to determine CO, NO and CO₂; nondispersive UV absorption (NDUV) is used to determine SO₂. Either a paramagnetic or an electrochemical oxygen measurement is used to determine O₂. If the AMS is to be used to determine the NO_x concentration, it must be equipped with the optional NO_x converter BÜNOx 2+. Without a converter only the measurement of NO is possible.

The AMS tested here comprises the following components:

- Heated (max. 185 °C, self-regulating) sampling probe M&C SP3100 (filter material: stainless steel, pore size 3 µm)
- Heated (180 °C) sampling line PFA, 4 mm inner diameter, 20 m long;
- Measuring cabinet with temperature-controlled exhaust fan consisting of the following components, mounted on a swivel frame:
 - 2-stage test gas cooler Bühler EKG 2-19
 - Sample gas pump
 - Analyser X-Stream enhanced
 - Optional NO_x converter Bühler BÜNOx 2+
 - Condensate pumps and condensate tanks with level monitoring

The analyser X-Stream enhanced can determine a maximum of 5 components. Here there is a choice between 4 photometer channels (CO, NO, SO₂ and CO₂) and an oxygen channel (paramagnetic or electrochemical). A separate optical bench is available for every measured component (except for oxygen). There is no compensation between the separate channels.

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. Upon revocation of the publication the certificate loses its validity. After the expiration of the certificate and on request of TÜV Rheinland Energy & Environment 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: gal1.de.

Document history

Certification of the X-STREAM enhanced 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. 0000074625_00: 02 June 2021
Expiry date of the certificate: 02 May 2026
Test report: 936/21247061/A dated 10 December 2020
TÜV Rheinland Energy GmbH
Publication: BAnz AT 03.05.2021 B9, chapter I number 3.2
UBA announcement dated 31 March 2021

Notifications

Statement issued by TÜV Rheinland Energy GmbH dated 29 June 2021
Publication: BAnz AT 05.08.2021 B5, chapter III correction 3
UBA announcement dated 29 June 2021
(Correction of CO-range in in the publication)

Supplementary testing according to EN 15267

Certificate no. 0000074625_01: 03 September 2021
Expiry date of the certificate: 04 August 2026
Test report: 936/21247061/C of 03 May 2021
TÜV Rheinland Energy GmbH
Publication: BAnz AT 05.08.2021 B5, chapter I number 4.1
UBA announcement dated 29 June 2021

Notifications

Statement issued by TÜV Rheinland Energy GmbH dated 10 February 2022
Publication: BAnz AT 28.07.2022 B4, chapter III notification 9
UBA announcement dated 28 June 2022
(Software and hardware changes)

Statement issued by TÜV Rheinland Energy GmbH dated 06 February 2023
Publication: BAnz AT 02.08.2023 B7, chapter III notification 4
UBA announcement dated 05 July 2023
(Changing name and address of producer and system name)

Renewal of certificates

Certificate no. 0000074625_02: 05 August 2026
Expiry date of the certificate: 04 August 2031

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

Measuring system

Manufacturer	Emerson Process Management GmbH & Co. OHG
AMS designation	X-CEMS
Serial number of units under test	3242850 - System 1 / 3242850 - System 2
Measuring principle	NDIR

Test report

Test laboratory	TÜV Rheinland
Date of report	2021-05-03

Measured component

Certification range	CO	0 - 150 mg/m³
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Evaluation of the cross-sensitivity (CS)

(system with largest CS)

Sum of positive CS at zero point	2.81 mg/m³
Sum of negative CS at zero point	0.00 mg/m³
Sum of positive CS at span point	2.90 mg/m³
Sum of negative CS at span point	0.00 mg/m³
Maximum sum of cross-sensitivities	2.90 mg/m³
Uncertainty of cross-sensitivity	u_i 1.676 mg/m³

Calculation of the combined standard uncertainty

Tested parameter

		u^2
Standard deviation from paired measurements under field conditions *	u_D 0.264 mg/m³	0.070 (mg/m³)²
Lack of fit	u_{lof} 0.277 mg/m³	0.077 (mg/m³)²
Zero drift from field test	$u_{d,z}$ 0.173 mg/m³	0.030 (mg/m³)²
Span drift from field test	$u_{d,s}$ 0.693 mg/m³	0.480 (mg/m³)²
Influence of ambient temperature at span	u_t 0.513 mg/m³	0.263 (mg/m³)²
Influence of supply voltage	u_v 0.204 mg/m³	0.042 (mg/m³)²
Cross-sensitivity (interference)	u_i 1.676 mg/m³	2.809 (mg/m³)²
Influence of sample gas flow	u_b -0.271 mg/m³	0.073 (mg/m³)²
Uncertainty of reference material at 70% of certification range	u_{rm} 1.212 mg/m³	1.470 (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)

Total expanded uncertainty

$$u_c = \sqrt{\sum (u_{max,j})^2} \quad 2.31 \text{ mg/m}^3$$

$$U = u_c \cdot k = u_c \cdot 1.96 \quad 4.52 \text{ mg/m}^3$$

Relative total expanded uncertainty

Requirement of 2010/75/EU

Requirement of EN 15267-3

U in % of the ELV 60 mg/m³	7.5
U in % of the ELV 60 mg/m³	10.0
U in % of the ELV 60 mg/m³	7.5

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

Measuring system

Manufacturer	Emerson Process Management GmbH & Co. OHG
AMS designation	X-CEMS
Serial number of units under test	3242850 - System 1 / 3242850 - System 2
Measuring principle	NDIR

Test report

Test laboratory	TÜV Rheinland
Date of report	2021-05-03

Measured component

Certification range	NOx 0 - 150 mg/m³
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Evaluation of the cross-sensitivity (CS)

(system with largest CS)

Sum of positive CS at zero point	4.41 mg/m³
Sum of negative CS at zero point	0.00 mg/m³
Sum of positive CS at span point	2.28 mg/m³
Sum of negative CS at span point	-2.28 mg/m³
Maximum sum of cross-sensitivities	4.41 mg/m³
Uncertainty of cross-sensitivity	u_i 2.546 mg/m³

Calculation of the combined standard uncertainty

Tested parameter

		u^2
Standard deviation from paired measurements under field conditions *	u_D 1.716 mg/m³	2.945 (mg/m³)²
Lack of fit	u_{of} 0.684 mg/m³	0.468 (mg/m³)²
Zero drift from field test	$u_{d,z}$ 0.866 mg/m³	0.750 (mg/m³)²
Span drift from field test	$u_{d,s}$ 1.992 mg/m³	3.968 (mg/m³)²
Influence of ambient temperature at span	u_t 1.617 mg/m³	2.615 (mg/m³)²
Influence of supply voltage	u_v 0.572 mg/m³	0.327 (mg/m³)²
Cross-sensitivity (interference)	u_i 2.546 mg/m³	6.482 (mg/m³)²
Influence of sample gas flow	u_n -0.812 mg/m³	0.659 (mg/m³)²
Uncertainty of reference material at 70% of certification range	u_{rm} 1.212 mg/m³	1.470 (mg/m³)²
Converter efficiency for AMS measuring NOx	u_{ce} 3.984 mg/m³	15.872 (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)

$$u_c = \sqrt{\sum (u_{max,j})^2} \quad 5.96 \text{ mg/m}^3$$

Total expanded uncertainty

$$U = u_c \cdot k = u_c \cdot 1.96 \quad 11.69 \text{ mg/m}^3$$

Relative total expanded uncertainty

Requirement of 2010/75/EU

Requirement of EN 15267-3

U in % of the ELV 80 mg/m³	14.6
U in % of the ELV 80 mg/m³	20.0
U in % of the ELV 80 mg/m³	15.0

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

Measuring system

Manufacturer	Emerson Process Management GmbH & Co. OHG
AMS designation	X-CEMS
Serial number of units under test	3242850 - System 1 / 3242850 - System 2
Measuring principle	NDIR

Test report

Test laboratory	TÜV Rheinland
Date of report	2021-05-03

Measured component

Certification range	NO 0 - 150 mg/m³
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Evaluation of the cross-sensitivity (CS)

(system with largest CS)

Sum of positive CS at zero point	4.41 mg/m³
Sum of negative CS at zero point	0.00 mg/m³
Sum of positive CS at span point	2.28 mg/m³
Sum of negative CS at span point	-2.28 mg/m³
Maximum sum of cross-sensitivities	4.41 mg/m³
Uncertainty of cross-sensitivity	u_i 2.546 mg/m³

Calculation of the combined standard uncertainty

Tested parameter

		u^2
Standard deviation from paired measurements under field conditions *	u_D 1.716 mg/m³	2.945 (mg/m³)²
Lack of fit	u_{of} 0.684 mg/m³	0.468 (mg/m³)²
Zero drift from field test	u_{dz} 0.866 mg/m³	0.750 (mg/m³)²
Span drift from field test	u_{ds} 1.992 mg/m³	3.968 (mg/m³)²
Influence of ambient temperature at span	u_t 1.617 mg/m³	2.615 (mg/m³)²
Influence of supply voltage	u_v 0.572 mg/m³	0.327 (mg/m³)²
Cross-sensitivity (interference)	u_i 2.546 mg/m³	6.482 (mg/m³)²
Influence of sample gas flow	u_b -0.812 mg/m³	0.659 (mg/m³)²
Uncertainty of reference material at 70% of certification range	u_{rm} 1.212 mg/m³	1.470 (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)

$$u_c = \sqrt{\sum (u_{max,j})^2} \quad 4.44 \text{ mg/m}^3$$

Total expanded uncertainty

$$U = u_c * k = u_c * 1.96 \quad 8.70 \text{ mg/m}^3$$

Relative total expanded uncertainty

Requirement of 2010/75/EU

Requirement of EN 15267-3

U in % of the ELV 80 mg/m³	10.9
U in % of the ELV 80 mg/m³	20.0
U in % of the ELV 80 mg/m³	15.0

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

Measuring system

Manufacturer	Emerson Process Management GmbH & Co. OHG
AMS designation	X-CEMS
Serial number of units under test	3242850 - System 1 / 3242850 - System 2
Measuring principle	NDUV

Test report

Test laboratory	TÜV Rheinland
Date of report	2021-05-03

Measured component

Certification range	SO ₂ 0 - 150 mg/m ³
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Evaluation of the cross-sensitivity (CS)

(system with largest CS)

Sum of positive CS at zero point	3.38 mg/m ³
Sum of negative CS at zero point	0.00 mg/m ³
Sum of positive CS at span point	2.81 mg/m ³
Sum of negative CS at span point	-4.40 mg/m ³
Maximum sum of cross-sensitivities	-4.40 mg/m ³
Uncertainty of cross-sensitivity	u _i -2.537 mg/m ³

Calculation of the combined standard uncertainty

Tested parameter

		u ²
Standard deviation from paired measurements under field conditions *	u _D 1.007 mg/m ³	1.014 (mg/m ³) ²
Lack of fit	u _{of} 0.615 mg/m ³	0.378 (mg/m ³) ²
Zero drift from field test	u _{d,z} 1.126 mg/m ³	1.268 (mg/m ³) ²
Span drift from field test	u _{d,s} 2.078 mg/m ³	4.318 (mg/m ³) ²
Influence of ambient temperature at span	u _t 1.769 mg/m ³	3.129 (mg/m ³) ²
Influence of supply voltage	u _v 1.078 mg/m ³	1.162 (mg/m ³) ²
Cross-sensitivity (interference)	u _i -2.537 mg/m ³	6.436 (mg/m ³) ²
Influence of sample gas flow	u _b -0.902 mg/m ³	0.814 (mg/m ³) ²
Uncertainty of reference material at 70% of certification range	u _{rm} 1.212 mg/m ³	1.470 (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)

$$u_c = \sqrt{\sum (u_{\max,j})^2} \quad 4.47 \text{ mg/m}^3$$

Total expanded uncertainty

$$U = u_c \cdot k = u_c \cdot 1.96 \quad 8.76 \text{ mg/m}^3$$

Relative total expanded uncertainty

Requirement of 2010/75/EU

Requirement of EN 15267-3

U in % of the ELV 60 mg/m ³	14.6
U in % of the ELV 60 mg/m ³	20.0
U in % of the ELV 60 mg/m ³	15.0

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

Measuring system

Manufacturer	Emerson Process Management GmbH & Co. OHG
AMS designation	X-CEMS
Serial number of units under test	3242850 - System 1 / 3242850 - System 2
Measuring principle	NDIR

Test report

Test laboratory	TÜV Rheinland
Date of report	2021-05-03

Measured component

Certification range	CO ₂	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	-0.20 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	0.023 Vol.-%	0.001 (Vol.-%) ²
Lack of fit	u_{lof}	0.046 Vol.-%	0.002 (Vol.-%) ²
Zero drift from field test	u_{dz}	-0.014 Vol.-%	0.000 (Vol.-%) ²
Span drift from field test	u_{ds}	0.217 Vol.-%	0.047 (Vol.-%) ²
Influence of ambient temperature at span	u_t	0.102 Vol.-%	0.010 (Vol.-%) ²
Influence of supply voltage	u_v	0.020 Vol.-%	0.000 (Vol.-%) ²
Cross-sensitivity (interference)	u_i	-0.115 Vol.-%	0.013 (Vol.-%) ²
Influence of sample gas flow	u_o	-0.176 Vol.-%	0.031 (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)

$$u_c = \sqrt{\sum (u_{max,j})^2} \quad 0.38 \text{ Vol.-%}$$

Total expanded uncertainty

$$U = u_c * k = u_c * 1.96 \quad 0.75 \text{ Vol.-%}$$

Relative total expanded uncertainty

Requirement of 2010/75/EU

Requirement of EN 15267-3

U in % of the range 25 Vol.-%

3.0

U in % of the range 25 Vol.-%

10.0 **

U in % of the range 25 Vol.-%

7.5

** The EU-directive 2010/75/EC on industrial emissions does not define requirements for this component.

A value of 10 % was used instead.

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

Measuring system

Manufacturer	Emerson Process Management GmbH & Co. OHG
AMS designation	X-CEMS
Serial number of units under test	3242850 - System 1 / 3242850 - System 2
Measuring principle	Paramagnetic

Test report

Test laboratory	TÜV Rheinland
Date of report	2021-05-03

Measured component

Certification range	O ₂	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 _i 0.000 Vol.-%

Calculation of the combined standard uncertainty

Tested parameter

			u ²
Standard deviation from paired measurements under field conditions *	u _D	0.017 Vol.-%	0.000 (Vol.-%) ²
Lack of fit	u _{lof}	0.052 Vol.-%	0.003 (Vol.-%) ²
Zero drift from field test	u _{d,z}	0.023 Vol.-%	0.001 (Vol.-%) ²
Span drift from field test	u _{d,s}	-0.029 Vol.-%	0.001 (Vol.-%) ²
Influence of ambient temperature at span	u _t	0.101 Vol.-%	0.010 (Vol.-%) ²
Influence of supply voltage	u _v	0.006 Vol.-%	0.000 (Vol.-%) ²
Cross-sensitivity (interference)	u _i	0.000 Vol.-%	0.000 (Vol.-%) ²
Influence of sample gas flow	u _o	-0.098 Vol.-%	0.010 (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)

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

Total expanded uncertainty

$$U = u_c * k = u_c * 1.96 \quad 0.50 \text{ Vol.-%}$$

Relative total expanded uncertainty

Requirement of 2010/75/EU

Requirement of EN 15267-3

U in % of the range 25 Vol.-%

U in % of the range 25 Vol.-%

U in % of the range 25 Vol.-%

2.0

10.0 **

7.5

** The EU-directive 2010/75/EC on industrial emissions does not define requirements for this component.

A value of 10 % was used instead.

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

Measuring system

Manufacturer	Emerson Process Management GmbH & Co. OHG
AMS designation	X-CEMS
Serial number of units under test	3242850 - System 1 / 3242850 - System 2
Measuring principle	Electrochemical

Test report

Test laboratory	TÜV Rheinland
Date of report	2021-05-03

Measured component

Certification range	O ₂	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	-0.11 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	-0.11 Vol.-%
Uncertainty of cross-sensitivity	u_i -0.064 Vol.-%

Calculation of the combined standard uncertainty

Tested parameter

			u^2
Standard deviation from paired measurements under field conditions *	u_D	0.067 Vol.-%	0.004 (Vol.-%) ²
Lack of fit	u_{lof}	0.058 Vol.-%	0.003 (Vol.-%) ²
Zero drift from field test	$u_{d,z}$	0.035 Vol.-%	0.001 (Vol.-%) ²
Span drift from field test	$u_{d,s}$	-0.035 Vol.-%	0.001 (Vol.-%) ²
Influence of ambient temperature at span	u_t	0.175 Vol.-%	0.031 (Vol.-%) ²
Influence of supply voltage	u_v	0.026 Vol.-%	0.001 (Vol.-%) ²
Cross-sensitivity (interference)	u_i	-0.064 Vol.-%	0.004 (Vol.-%) ²
Influence of sample gas flow	u_o	-0.088 Vol.-%	0.008 (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)

$$u_c = \sqrt{\sum (u_{max,j})^2} \quad 0.31 \text{ Vol.-%}$$

Total expanded uncertainty

$$U = u_c * k = u_c * 1.96 \quad 0.60 \text{ Vol.-%}$$

Relative total expanded uncertainty

Requirement of 2010/75/EU

Requirement of EN 15267-3

U in % of the range 25 Vol.-%

U in % of the range 25 Vol.-%

U in % of the range 25 Vol.-%

2.4

10.0 **

7.5

** The EU-directive 2010/75/EC on industrial emissions does not define requirements for this component.

A value of 10 % was used instead.