CERTIFICAT ◆ CERTIFICADO ◆ СЕРТИФИКАТ ◆ 認証書 ◆ CERTIFICATE ◆ CERTIFIKAT

Umwelt Bundesamt

Certificate number: 2422091-ts

TÜV SÜD Industrie Service

CERTIFICATE

of product conformity (QAL 1)

Certificate number: 2422091-ts

AMS	MCA 10-HWIR monitoring CO, NO, SO_2, NO_2, N_2O, HCl, NH_3, CH_4, TOC, CO_2, O_2 and moisture
Manufacturer	Dr. Födisch Umweltmesstechnik AG Zwenkauer Straße 159 04420 Markranstädt Germany
Test institute	TÜV SÜD Industrie Service GmbH

This is to certify that the AMS was tested and certified subject to DIN EN 15267-1 (2009), DIN EN 15267-2 (2009), DIN EN 15267-3 (2008) and DIN EN 14181 (2004) standards.

Certification applies to the conditions listed in this certificate (the certificate consists of 18 pages).

This certificate replaces the certificate 1729865-ts dated from 26th August 2015

DIN EN 15267 TÜV SÜD Eignungsprüfung Valid until 08/2020 Produktion überwacht

Certificate No: 2422091-ts

Publication in the German Federal Gazette
dated 14th March 2016

Umweltbundesamt
Dessau, 26th April 2016

Dr. Marcel Langner
Head of Section II 4.1

Certificate validity
until 25th August 2020

TÜV SÜD Industrie Service GmbH
Testing laboratory Emission measurement/ calibration
Munich, 24th April 2016

Dr. Michael Waeber

TÜV®

Umwelt Bundesamt

Certificate number: 2422091-ts

TÜV SÜD Industrie Service

Test report	2422091 from 20th October 2015
Initial certification	26th August 2015
Certificate validity until	25th August 2020 (5 years)
Publication	BAnz AT 14th March 2016 B7, chapter I, no. 4.3

Approved application

The AMS tested is suitable for plants according to Directive 2010/75/EU, chapter III (13th BImSchV), at waste incineration plants according to Directive 2010/75/EU, chapter IV (17th BImSchV) and other plants requiring official approval. The suitability of the AMS for this application was assessed on the basis of a laboratory test and a field test of the MCA 10-HWIR multi-component measuring system lasting over three months at a plant in compliance with the 17th BImSchV. The multi-component measuring system is authorized for the ambient temperature range from +5 °C to +40 °C.

The AMS publication, the suitability test and the performance of the uncertainty calculations were conducted based on the provisions valid at the time of testing. Due to possible amendments to legal foundations every user should ensure before use of the AMS that it is suitable for monitoring the applicable limit values.

The operator should consult the manufacturer to ensure that the AMS is suitable for the plant where it is being installed.

Certification basis

This certificate is based on:

- TÜV SÜD Industrie Service GmbH test report 2422091 from 20th October 2015
- Suitability publication by the Umweltbundesamt as responsible body
- Monitoring of the product and the manufacturing process
- Publication in the German Federal Gazette (BAnz AT 14.03.2016 B7, chapter I, No. 4.3, UBA publication from 18th February 2016):

AMS:	MCA 10-HWIR monitoring CO, NO, SO_2, NO_2, N_2O, HCl, NH_3, CH_4, CO_2, O_2, moisture and TOC
Manufacturer:	Dr. Födisch Umweltmesstechnik AG, Markranstädt
Suitability:	For plants requiring authorisation and plants in compliance with the 27th BImSchV

Measurement ranges in the suitability test:

Component	Certification range	supplementary measurement range		Unit
CO	0 - 75	0 - 300	0 - 5000	mg/m³
CO_2	0 – 25	0 – 50	-	Vol.-%
NO	0 - 200	0 - 400	0 - 3000	mg/m³
NO_2	0 - 50	0 - 500	-	mg/m³
N_2O	0 - 50	0 - 3000	-	mg/m³
NH_3	0 - 10	0 - 50	0 - 500	mg/m³
SO_2	0 - 75	0 - 300	0 - 2500	mg/m³
HCl	0 - 15	0 - 90	0 - 5000	mg/m³
H_2O	0 - 40	-	-	Vol.-%
CH_4	0 - 50	0 - 500	-	mg/m³
Ges-C	0 - 15	0 - 30	-	mg/m³
O_2	0 - 25	-	-	Vol.-%

Software versions: MCA 10: 3.61 | 3.61 | 3.61
FID: 5.31e

Restrictions:

None

Notes:

1. The maintenance interval is six months.
2. The AMS determines gas concentrations in moist test gas.
3. The analyser should be operated with the activated thermo-AUTOCAL-function.
4. The AMS should be equipped with additional heating for temperatures of less than 20 °C at the point of installation.
5. The AMS should be operated at an interval of 12 h for automatic alignment. For the component TOC the AMS should be operated at an interval of 24 h for automatic alignment of zero and span point.
6. When HCl, NO_2 or NH_3 are applied, automatic zero point alignment shall be conducted by adding zero gas locally at the injector block.
7. When checking and aligning the span points for NO_2, HCl and NH_3 the sample gas is added locally at the injector block.
8. The manufacturer's specifications for implementing the air supply to the instruments should be observed.
9. Supplementary test (add-on of the component TOC) to the publication by the Umweltbundesamt dated 22th July 2015 (BAnz AT 26.08.2015 B4, chapter I number 2.2).

Test report: TÜV SÜD Industrie Service GmbH, Munich
Report-No.: 2422091 from 20th Oktober 2015

Certified product

The certificate applies to AMS that comply with the following description:

The entire tested AMS MCA 10-HWIR consists of the sample gas extraction probe, heated sample hose and the measurement cabinet with analyser. The measurement cabinet is equipped with air conditioning and additional switch cabinet heating. The basic components of the measurement cabinet are:

- Multi-component analyser MCA 10-HWIR
- TOC analyser Thermo-FID ES
- Panel-PC P1550 Win7 15"
- PLC control

The AMS MCA 10-HWIR records emissions of CO, NO, NO_2, N_2O, SO_2, HCl, NH_3, CH_4, TOC, CO_2 and their reference components O_2 and moisture in flue gas. The sample gas is applied hot to the AMS after filtering using an air jet pump, without prior separation of the flue gas moisture.

The following 4 measurement principles are applied:

Dual frequency measurement procedure
Gas filter correlation
Zirconium dioxide measurement cell
Flame ionization detector (FID)

The sample gas extraction is conducted through a stainless steel extraction probe with a PTFE filter heated to 185 °C. A sample gas line heated to 185 °C and fitted with a PTFE seal (internal diameter 6 mm) is attached to the probe. The line is max. 50 metres long. After the heated line the sample gas flows into the gas distributor block in the MCA 10-HWIR analyser. The connection for zero air, the exhaust duct and the carrier gas line for the air jet pump are also in the gas distributor block.

The entire system is made up of the following components:

Probe	
Manufacturer:	M&C TechGroup Germany GmbH, D - 40885 Ratingen
Type:	SP2000-H
Filter	F-T2 150 PTFE filter 2 µm
Heated connection	
Manufacturer:	Winkler GmbH, D-69126 Heidelberg
Heated temperature:	185 °C, PTFE line (ID: 6 mm), length in the suitability test 50 m
Regulator	integrated into the MCA 10-HWIR
Air conditioning	
Manufacturer:	Rittal GmbH & Co. KG, Herbron
Type:	Wandanbau-Kühlgerät 1500 W/230VAC

Switch cabinet heating	
Manufacturer:	Rittal GmbH & Co. KG, Herbron
Type:	SK 3105 / 230VAC / 400 W
Regulator	integrated into the MCA 10-HWIR

Programmable logic control (PLC)	
Manufacturer:	Panasonic
Software:	V 3.61

Panel PC with operating software	
Software:	MCA10_HID.exe
Version:	V 3.61
System requirements	Operating system Windows XP or higher CPU Pentium II or higher Memory 500 MB ROM 5 GB free storage for data storage Interfaces USB 2.0 Display Mind. 1024*768 Pixel

Analysis system	
Manufacturer:	Dr. Födisch Umweltmesstechnik AG
System type:	MCA 10-HWIR
Software:	V 3.61|3.61|3.61|
Measurement principle:	CO, NO, NO_2, N_2O, SO_2, HCl, NH_3, CH_4, CO_2, H_2O: Extractive heat measuring infrared spectroscopy system O_2: Zirconium dioxide cell

TOC analyser	
Manufacturer:	SK-Elektronik GmbH / Leverkusen formerly Mess- und Analysentechnik GmbH / Leverkusen
System type:	Thermo-FID ES
Software:	5.31e
Measurement principle:	TOC: Flame ionization detector (FID)

General comments

This certificate is based on the analyser tested. The manufacturer is responsible for the continuous compliance of the production to the DIN EN 15267 requirements. The manufacturer is obliged to maintain a tested quality management system to control the manufacture of the certified product. Regular monitoring must be conducted on both the product and the quality management systems.

Should the product from the current production series no longer comply with the certified product, the Environmental Service Department of TÜV SÜD Industrie Service GmbH should be informed (Address see footnote).

The certification mark, which appears on the certified product or is used in advertising materials, is presented on page 1 of this certificate.

This document and the certification mark shall remain the property of TÜV SÜD Industrie Service GmbH.

Should the publication be revoked, this certificate will become invalid. This document must be returned when the period of validity has elapsed and at the request of TÜV SÜD Industrie Service GmbH and the certification mark may no longer be used.

The current version of the certificate and its validity can also be viewed on the internet page: **qal1.de**.

The certification of the multi-component measuring system MCA 10-HWIR is based on the following documents and the regular continuous monitoring of the manufacturer's quality management system:

Initial certification to DIN EN 15267:

Certificate No. 1729865-ts	26th August 2015
Certificate validity until	25th August 2020 (5 years)

Test report: 1729865 from 10th June 2015,
TÜV SÜD Industrie Service GmbH
Publication: BAnz AT 26th August 2015 B4, chapter I no. 2.2
UBA publication from 22nd July 2015

Supplementary test to DIN EN 15267:

Certificate No. 2422091-ts:	14th March 2016
Certificate validity until	25th August 2020 (5 years)

Test report: 2422091 from 20th October 2015,
TÜV SÜD Industrie Service GmbH
Publication: BAnz AT 14th March 2016 B7, chapter I no. 4.3
UBA publication from 18th February 2016

Calculation of total uncertainty for QAL1 testing to DIN EN 14181 and DIN EN 15267-3 for the MCA 10-HWIR AMS

Total uncertainty for the measurement component O_2 in the measurement range 0-25 Vol.%

Performance characteristic	*Uncertainty*	*Value standard uncertainty Vol.%*	*Square of standard uncertainty (Vol.%)²*
Lack-of-fit	u_{lof}	0,045	0,00203
Zero drift from field test	$u_{d,z}$	-0,017	0,00029
Span drift from field test	$u_{d,s}$	-0,052	0,0027
Influence of ambient temperature at span	u_t	0,017	0,0003
Influence of sample gas pressure	u_p		
Influence of sample gas flow	u_f	0,081	0,00656
Influence of supply voltage	u_v	0,011	0,00012
Cross-sensitivity (interference)	u_i	0,15	0,0225
Repeatability standard deviation at span	$u_r = s_r$	0,01	ur < ud
Standard deviation from paired measurements under field cond.	$u_d = s_d$	0,053	0,00281
Uncertainty of reference material 1 % by 70% of ZR	u_{rm}	0,10104	0,01021
Excursion of measurement beam	u_{mb}		
Converter efficiency for AMS measuring NOx	u_{ce}		
Variation of response factors (TOC)	u_{rf}		
		total	0,04751
Combined standard uncertainty	$u_c = \sqrt{\sum (u_i)^2}$	0,21797	Vol.%
Total expanded uncertainty	$U_{0,95} = 1,96 \times u_c$	0,42722	Vol.%
Relativ expanded uncertainty	U	**1,7**	% ZR
Permissible uncertainty of EN 15267-3	(of ZR 25 Vol.%)	**7,5**	% ZR
Complied with requirements relating to the measurement uncertainty		**yes**	regarding EN 15267-3
Permissible uncertainty 13. / 17. BImSchV	(of ZR 25 Vol.%)	**10**	% ZR

Total uncertainty for the measurement component CO in the measurement range 0-75 mg/m³

Performance characteristic	*Uncertainty*	*Value standard uncertainty mg/m³*	*Square of standard uncertainty (mg/m³)²*
Lack-of-fit	u_{lof}	0,13	0,0169
Zero drift from field test	$u_{d,z}$	-0,299	0,0894
Span drift from field test	$u_{d,s}$	-1,083	1,1729
Influence of ambient temperature at span	u_t	0,565	0,3192
Influence of sample gas pressure	u_p		
Influence of sample gas flow	u_f	0,77	0,5929
Influence of supply voltage	u_v	0,18	0,0324
Cross-sensitivity (interference)	u_i	-0,225	0,0506
Repeatability standard deviation at span	$u_r = s_r$	0,096	ur < ud
Standard deviation from paired measurements under field cond.	$u_d = s_d$	0,44	0,1936
Uncertainty of reference material 2 % by 70% of ZR	u_{rm}	0,6062	0,3675
Excursion of measurement beam	u_{mb}		
Converter efficiency for AMS measuring NOx	u_{ce}		
Variation of response factors (TOC)	u_{rf}		
		total	2,8354
Combined standard uncertainty	$u_c = \sqrt{\sum (u_i)^2}$	1,6839	mg/m³
Total expanded uncertainty	$U_{0,95} = 1,96 \times u_c$	3,3004	mg/m³
Relativ expanded uncertainty	U	**6,6**	% LV
Permissible uncertainty of EN 15267-3	(of LV 50 mg/m³)	**7,5**	% LV
Complied with requirements relating to the measurement uncertainty		**yes**	regarding EN 15267-3
Permissible uncertainty 13. / 17. BImSchV	(of LV 50 mg/m³)	**10**	% LV
Complied with requirements relating to the measurement uncertainty		**yes**	regarding 13. / 17. BImSchV

Total uncertainty for the measurement component NO in the measurement range 0-200 mg/m³

Performance characteristic	*Uncertainty*	*Value standard uncertainty mg/m³*	*Square of standard uncertainty (mg/m³)²*
Lack-of-fit	u_{lof}	-0,566	0,3204
Zero drift from field test	$u_{d,z}$	0,219	0,048
Span drift from field test	$u_{d,s}$	-1,801	3,2436
Influence of ambient temperature at span	u_t	1,159	1,3433
Influence of sample gas pressure	u_p		
Influence of sample gas flow	u_f	-1,08	1,1664
Influence of supply voltage	u_v	0,699	0,4886
Cross-sensitivity (interference)	u_i	1,42	2,0164
Repeatability standard deviation at span	$u_r = s_r$	0,174	ur < ud
Standard deviation from paired measurements under field cond.	$u_d = s_d$	2,01	4,0401
Uncertainty of reference material 2 % by 70% of ZR	u_{rm}	1,6166	2,6134
Excursion of measurement beam	u_{mb}		
Converter efficiency for AMS measuring NOx	u_{ce}		
Variation of response factors (TOC)	u_{rf}		
		total	15,2802
Combined standard uncertainty	$u_c = \sqrt{\sum (u_i)^2}$	3,909	mg/m³
Total expanded uncertainty	$U_{0,95} = 1,96 \times u_c$	7,6616	mg/m³
Relativ expanded uncertainty	U	**5,9**	% LV
Permissible uncertainty of EN 15267-3	(of LV 130,4 mg/m³)	**15**	% LV
Complied with requirements relating to the measurement uncertainty		**yes**	regarding EN 15267-3
Permissible uncertainty 13. / 17. BImSchV	(of LV 130,4 mg/m³)	**20**	% LV
Complied with requirements relating to the measurement uncertainty		**yes**	regarding 13. / 17. BImSchV

Total uncertainty for the measurement component NO_2 in the measurement range 0-50 mg/m³

Performance characteristic	*Uncertainty*	*Value standard uncertainty mg/m³*	*Square of standard uncertainty (mg/m³)²*
Lack-of-fit	u_{lof}	0,378	0,1429
Zero drift from field test	$u_{d,z}$	0,127	0,0161
Span drift from field test	$u_{d,s}$	0,849	0,7208
Influence of ambient temperature at span	u_t	0,445	0,198
Influence of sample gas pressure	u_p		
Influence of sample gas flow	u_f	-0,51	0,2601
Influence of supply voltage	u_v	0,31	0,0961
Cross-sensitivity (interference)	u_i	0,289	0,0835
Repeatability standard deviation at span	$u_r = s_r$	0,05	ur < ud
Standard deviation from paired measurements under field cond.	$u_d = s_d$	0,620	0,3844
Uncertainty of reference material 2 % by 70% of ZR	u_{rm}	0,4041	0,1633
Excursion of measurement beam	u_{mb}		
Converter efficiency for AMS measuring NOx	u_{ce}		
Variation of response factors (TOC)	u_{rf}		
		total	2,0652
Combined standard uncertainty	$u_c = \sqrt{\sum (u_i)^2}$	1,4371	mg/m³
Total expanded uncertainty	$U_{0,95} = 1,96 \times u_c$	2,8167	mg/m³
Relativ expanded uncertainty	U	**5,6**	% LV
Permissible uncertainty of EN 15267-3	(of LV 50 mg/m³)	**15**	% LV
Complied with requirements relating to the measurement uncertainty		**yes**	regarding EN 15267-3
Permissible uncertainty 13. / 17. BImSchV	(of LV 50 mg/m³)	**20**	% LV
Complied with requirements relating to the measurement uncertainty		**yes**	regarding 13. / 17. BImSchV

Total uncertainty for the measurement component N_2O in the measurement range 0-50 mg/m³

Performance characteristic	*Uncertainty*	*Value standard uncertainty mg/m³*	*Square of standard uncertainty (mg/m³)²*
Lack-of-fit	u_{lof}	-0,193	0,0372
Zero drift from field test	$u_{d,z}$	0,217	0,0471
Span drift from field test	$u_{d,s}$	-0,854	0,7293
Influence of ambient temperature at span	u_t	0,493	0,243
Influence of sample gas pressure	u_p		
Influence of sample gas flow	u_f	-0,410	0,1681
Influence of supply voltage	u_v	0,163	0,0266
Cross-sensitivity (interference)	u_i	0,361	0,1303
Repeatability standard deviation at span	$u_r = s_r$	0,086	ur < ud
Standard deviation from paired measurements under field cond.	$u_d = s_d$	0,47	0,2209
Uncertainty of reference material 2 % by 70% of ZR	u_{rm}	0,4041	0,1633
Excursion of measurement beam	u_{mb}		
Converter efficiency for AMS measuring NOx	u_{ce}		
Variation of response factors (TOC)	u_{rf}		
		total	1,7658
Combined standard uncertainty	$u_c = \sqrt{\sum (u_i)^2}$	1,3288	mg/m³
Total expanded uncertainty	$U_{0,95} = 1,96 \times u_c$	2,6044	mg/m³
Relativ expanded uncertainty	U	**5,2**	% LV
Permissible uncertainty of EN 15267-3	(of LV 50 mg/m³)	**15**	% LV
Complied with requirements relating to the measurement uncertainty		**yes**	regarding EN 15267-3
Permissible uncertainty 13. / 17. BImSchV	(of LV 50 mg/m³)	**20**	% LV
Complied with requirements relating to the measurement uncertainty		**yes**	regarding 13. / 17. BImSchV

Total uncertainty for the measurement component SO_2 in the measurement range 0-75 mg/m³

Performance characteristic	*Uncertainty*	*Value standard uncertainty mg/m³*	*Square of standard uncertainty (mg/m³)²*
Lack-of-fit	u_{lof}	-0,268	0,0718
Zero drift from field test	$u_{d,z}$	0,16	0,0256
Span drift from field test	$u_{d,s}$	-1,273	1,6205
Influence of ambient temperature at span	u_t	0,748	0,5595
Influence of sample gas pressure	u_p		
Influence of sample gas flow	u_f	-0,424	0,1798
Influence of supply voltage	u_v	0,063	0,004
Cross-sensitivity (interference)	u_i	0,524	0,2746
Repeatability standard deviation at span	$u_r = s_r$	0,102	ur < ud
Standard deviation from paired measurements under field cond.	$u_d = s_d$	0,88	0,7744
Uncertainty of reference material 2 % by 70% of ZR	u_{rm}	0,6062	0,3675
Excursion of measurement beam	u_{mb}		
Converter efficiency for AMS measuring NOx	u_{ce}		
Variation of response factors (TOC)	u_{rf}		
		total	3,8777
Combined standard uncertainty	$u_c = \sqrt{\sum (u_i)^2}$	1,9692	mg/m³
Total expanded uncertainty	$U_{0,95} = 1,96 \times u_c$	3,8596	mg/m³
Relativ expanded uncertainty	U	**7,7**	% LV
Permissible uncertainty of EN 15267-3	(of LV 50 mg/m³)	**15**	% LV
Complied with requirements relating to the measurement uncertainty		**yes**	regarding EN 15267-3
Permissible uncertainty 13. / 17. BImSchV	(of LV 50 mg/m³)	**20**	% LV
Complied with requirements relating to the measurement uncertainty		**yes**	regarding 13. / 17. BImSchV

Total uncertainty for the measurement component HCl in the measurement range 0-15 mg/m³

Performance characteristic	*Uncertainty*	*Value standard uncertainty mg/m³*	*Square of standard uncertainty (mg/m³)²*
Lack-of-fit	u_{lof}	-0,172	0,0296
Zero drift from field test	$u_{d,z}$	0,146	0,0213
Span drift from field test	$u_{d,s}$	0,251	0,063
Influence of ambient temperature at span	u_t	0,158	0,025
Influence of sample gas pressure	u_p		
Influence of sample gas flow	u_f	0,29	0,0841
Influence of supply voltage	u_v	0,093	0,0086
Cross-sensitivity (interference)	u_i	0,235	0,0552
Repeatability standard deviation at span	$u_r = s_r$	0,055	ur < ud
Standard deviation from paired measurements under field cond.	$u_d = s_d$	0,22	0,0484
Uncertainty of reference material 5 % by 70% of ZR	u_{rm}	0,3031	0,0919
Excursion of measurement beam	u_{mb}		
Converter efficiency for AMS measuring NOx	u_{ce}		
Variation of response factors (TOC)	u_{rf}		
		total	0,4271
Combined standard uncertainty	$u_c = \sqrt{\sum (u_i)^2}$	0,6535	mg/m³
Total expanded uncertainty	$U_{0,95} = 1,96 \times u_c$	1,2809	mg/m³
Relativ expanded uncertainty	U	**12,8**	% LV
Permissible uncertainty of EN 15267-3	(of LV 10 mg/m³)	**30**	% LV
Complied with requirements relating to the measurement uncertainty		**yes**	regarding EN 15267-3
Permissible uncertainty 13. / 17. BImSchV	(of LV 10 mg/m³)	**40**	% LV
Complied with requirements relating to the measurement uncertainty		**yes**	regarding 13. / 17. BImSchV

Total uncertainty for the measurement component NH_3 in the measurement range 0-10 mg/m³

Performance characteristic	*Uncertainty*	*Value standard uncertainty mg/m³*	*Square of standard uncertainty (mg/m³)²*
Lack-of-fit	u_{lof}	0,114	0,013
Zero drift from field test	$u_{d,z}$	0,137	0,0188
Span drift from field test	$u_{d,s}$	0,171	0,0292
Influence of ambient temperature at span	u_t	0,106	0,0112
Influence of sample gas pressure	u_p		
Influence of sample gas flow	u_f	-0,057	0,0032
Influence of supply voltage	u_v	0,124	0,0154
Cross-sensitivity (interference)	u_i	-0,117	0,0137
Repeatability standard deviation at span	$u_r = s_r$	0,027	ur < ud
Standard deviation from paired measurements under field cond.	$u_d = s_d$	0,14	0,0196
Uncertainty of reference material 2 % by 70% of ZR	u_{rm}	0,0808	0,0065
Excursion of measurement beam	u_{mb}		
Converter efficiency for AMS measuring NOx	u_{ce}		
Variation of response factors (TOC)	u_{rf}		
		total	0,1306
Combined standard uncertainty	$u_c = \sqrt{\sum (u_i)^2}$	0,3614	mg/m³
Total expanded uncertainty	$U_{0,95} = 1,96 \times u_c$	0,7083	mg/m³
Relativ expanded uncertainty	U	**14,2**	% LV
Permissible uncertainty of EN 15267-3	(of LV 5 mg/m³)	**30**	% LV
Complied with requirements relating to the measurement uncertainty		**yes**	regarding EN 15267-3
Permissible uncertainty 13. / 17. BImSchV	(of LV 5 mg/m³)	**40**	% LV
Complied with requirements relating to the measurement uncertainty		**yes**	regarding 13. / 17. BImSchV

Total uncertainty for the measurement component TOC in the measurement range 0-15 mg/m³

Performance characteristic	*Uncertainty*	*Value standard uncertainty mg/m³*	*Square of standard uncertainty (mg/m³)²*
Lack-of-fit	u_{lof}	0,062	0,0038
Zero drift from field test	$u_{d,z}$	-0,238	0,0566
Span drift from field test	$u_{d,s}$	0,222	0,0493
Influence of ambient temperature at span	u_t	0,106	0,0112
Influence of sample gas pressure	u_p		
Influence of sample gas flow	u_f	0,022	0,0005
Influence of supply voltage	u_v	0,06	0,0036
Cross-sensitivity (interference)	u_i	0,222	0,0493
Repeatability standard deviation at span	$u_r = s_r$	0,016	ur < ud
Standard deviation from paired measurements under field cond.	$u_d = s_d$	0,1	0,01
Uncertainty of reference material 2 % by 70% of ZR	u_{rm}	0,1212	0,0147
Excursion of measurement beam	u_{mb}		
Converter efficiency for AMS measuring NOx	u_{ce}		
Änderung der Responsfaktoren (TOC) & Mischgasabweichung	u_{rf}	0,226	0,0511
		total	0,2501
Combined standard uncertainty	$u_c = \sqrt{\sum (u_i)^2}$	0,5001	mg/m³
Total expanded uncertainty	$U_{0,95} = 1,96 \times u_c$	0,9802	mg/m³
Relativ expanded uncertainty	U	**9,8**	% LV
Permissible uncertainty of EN 15267-3	(of LV 10 mg/m³)	**22,5**	% LV
Complied with requirements relating to the measurement uncertainty		**yes**	regarding EN 15267-3
Permissible uncertainty 13. / 17. BImSchV	(of LV 10 mg/m³)	**30**	% LV
Complied with requirements relating to the measurement uncertainty		**yes**	regarding 13. / 17. BImSchV

Total uncertainty for the measurement component CH_4 in the measurement range 0-50 mg/m³

Performance characteristic	*Uncertainty*	*Value standard uncertainty mg/m³*	*Square of standard uncertainty (mg/m³)²*
Lack-of-fit	u_{lof}	-0,28	0,0784
Zero drift from field test	$u_{d,z}$	-0,65	0,4225
Span drift from field test	$u_{d,s}$	-0,866	0,75
Influence of ambient temperature at span	u_t	0,286	0,0818
Influence of sample gas pressure	u_p		
Influence of sample gas flow	u_f	0,13	0,0169
Influence of supply voltage	u_v	0,319	0,1018
Cross-sensitivity (interference)	u_i	0,517	0,2673
Repeatability standard deviation at span	$u_r = s_r$	0,055	ur < ud
Standard deviation from paired measurements under field cond.	$u_d = s_d$	0,38	0,1444
Uncertainty of reference material 2 % by 70% of ZR	u_{rm}	0,4041	0,1633
Excursion of measurement beam	u_{mb}		
Converter efficiency for AMS measuring NOx	u_{ce}		
Variation of response factors (TOC)	u_{rf}		
		total	2,0264
Combined standard uncertainty	$u_c = \sqrt{\sum (u_i)^2}$	1,4235	mg/m³
Total expanded uncertainty	$U_{0,95} = 1,96 \times u_c$	2,7901	mg/m³
Relativ expanded uncertainty	U	**5,6**	% LV
Permissible uncertainty of EN 15267-3	(of LV 50 mg/m³)	**22,5**	% LV
Complied with requirements relating to the measurement uncertainty		**yes**	regarding EN 15267-3
Permissible uncertainty 13. / 17. BImSchV	(of LV 50 mg/m³)	**30**	% LV
Complied with requirements relating to the measurement uncertainty		**yes**	regarding 13. / 17. BImSchV

Total uncertainty for the measurement component CO_2 in the measurement range 0-25 Vol.%

Performance characteristic	*Uncertainty*	*Value standard uncertainty Vol.%*	*Square of standard uncertainty (Vol.%)²*
Lack-of-fit	u_{lof}	0,143	0,02045
Zero drift from field test	$u_{d,z}$	0,045	0,00203
Span drift from field test	$u_{d,s}$	0,172	0,02958
Influence of ambient temperature at span	u_t	0,078	0,00608
Influence of sample gas pressure	u_p		
Influence of sample gas flow	u_f	0,018	0,00032
Influence of supply voltage	u_v	0,009	0,00008
Cross-sensitivity (interference)	u_i	-0,186	0,0346
Repeatability standard deviation at span	$u_r = s_r$	0,014	ur < ud
Standard deviation from paired measurements under field cond.	$u_d = s_d$	0,03	0,0009
Uncertainty of reference material 2 % by 70% of ZR	u_{rm}	0,20207	0,04083
Excursion of measurement beam	u_{mb}		
Converter efficiency for AMS measuring NOx	u_{ce}		
Variation of response factors (TOC)	u_{rf}		
		total	0,13487
Combined standard uncertainty	$u_c = \sqrt{\sum (u_i)^2}$	0,36725	Vol.%
Total expanded uncertainty	$U_{0,95} = 1,96 \times u_c$	0,71981	Vol.%
Relativ expanded uncertainty	U	**2,9**	% ZR
Permissible uncertainty of EN 15267-3	(of ZR 25 Vol.%)	**7,5**	% ZR
Complied with requirements relating to the measurement uncertainty		**yes**	regarding EN 15267-3
Permissible uncertainty 13. / 17. BImSchV	(of ZR 25 Vol.%)	**10**	% ZR
Complied with requirements relating to the measurement uncertainty		**yes**	regarding 13. / 17. BImSchV

Total uncertainty for the measurement component H_2O in the measurement range 0-40 Vol.%

Performance characteristic	*Uncertainty*	*Value standard uncertainty Vol.%*	*Square of standard uncertainty (Vol.%)²*
Lack-of-fit	u_{lof}	-0,157	0,0246
Zero drift from field test	$u_{d,z}$	0,014	0,0002
Span drift from field test	$u_{d,s}$	0,621	0,3856
Influence of ambient temperature at span	u_t	0,19	0,0361
Influence of sample gas pressure	u_p		
Influence of sample gas flow	u_f	0,221	0,0488
Influence of supply voltage	u_v	0,074	0,0055
Cross-sensitivity (interference)	u_i	0	0
Repeatability standard deviation at span	$u_r = s_r$	0,049	ur < ud
Standard deviation from paired measurements under field cond.	$u_d = s_d$	0,08	0,0064
Uncertainty of reference material 2 % by 70% of ZR	u_{rm}	0,3233	0,1045
Excursion of measurement beam	u_{mb}		
Converter efficiency for AMS measuring NOx	u_{ce}		
Variation of response factors (TOC)	u_{rf}		
		total	0,6117
Combined standard uncertainty	$u_c = \sqrt{\sum (u_i)^2}$	0,7821	Vol.%
Total expanded uncertainty	$U_{0,95} = 1,96 \times u_c$	1,5329	Vol.%
Relativ expanded uncertainty	U	**3,8**	% ZR
Permissible uncertainty of EN 15267-3	(of ZR 40 Vol.%)	**7,5**	% ZR
Complied with requirements relating to the measurement uncertainty		**yes**	regarding EN 15267-3
Permissible uncertainty 13. / 17. BImSchV	(of ZR 40 Vol.%)	**10**	% ZR
Complied with requirements relating to the measurement uncertainty		**yes**	regarding 13. / 17. BImSchV