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Umwelt Bundesamt

Certificate number: 4057004-ts

C E R T I F I C A T E

of product conformity (QAL 1)

Certificate number: 4057004-ts

Certified AMS	MGA 20 for CO, NO, SO_2, NO_2, NO_x, N_2O, CH_4, CO_2 and O_2
Manufacturer	Dr. Födisch Umweltmesstechnik AG Zwenkauer Straße 159 D-04420 Markranstädt Germany

Test institute TÜV SÜD Industrie Service GmbH

This is to certify that the AMS has been tested and found to comply with the standards DIN EN 15267-1 (2009), DIN EN 15267-2 (2023), DIN EN 15267-3 (2008) and DIN EN 14181 (2015).

Certification applies to the conditions listed in this certificate (the certificate consists of 16 pages).

This certificate replaces the certificate 3610685-ts dated 31 October 2024.

DIN EN 15267 TÜV SÜD Eignungsprüfung Valid until 05/2030 Produktion überwacht

Certificate No.: 4057004-ts

Publication in the German Federal Gazette (BAnz) of 19 May 2025

This certificate will expire on: 18 May 2030

Umweltbundesamt
Dessau, 14 August 2025

Dr. Marcel Langner
Head of Section II 4

TÜV SÜD Industrie Service GmbH
Testing laboratory emission measurement/ calibration
Munich, 13 August 2025

Hans-Jörg Eisenberger

Certificate number: 4057004-ts

Test report	4057004_V2 from 11 September 2024
Initial certification	31 October 2024
Certification validity until	18 May 2030 (5 years)
Publication	BAnz AT 19 May 2025 B3, chapter I, no 2.1

Approved application

The tested AMS is suitable for use at plants requiring authorisation in compliance with the 13th BImSchV:2021, the 17th BImSchV:2021 and the 30th BImSchV:2019 and TA-Luft:2021 plants in accordance with the 27th BImSchV:2013 and the 44th BImSchV:2021. The suitability of the AMS for this application was assessed on the basis of a laboratory test and a field test of the measuring system lasting over three months at a plant in compliance with the 17th BImSchV:2021. The 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 values.

The operator should consult the manufacturer to ensure that the AMS is suitable for the plant at which it is to be installed.

Note:
The legal regulations mentioned do not always have to correspond to the current state of legislation. Each user should ensure, if necessary, in consultation with the competent authority, that this AMS fulfils the legal requirements for the intended use. Furthermore, it cannot be ruled out that legal regulations on the use of a measuring system for emission monitoring may change during the term of the certificate.

Certification basis

This certificate is based on:

- TÜV SÜD Industrie Service GmbH test report 4057004_V2 from 11 September 2024
- Suitability announcement by the German Federal Environmental Agency as relevant body
- The ongoing surveillance of the product and the manufacturing process

- Publication in the German Federal Gazette (BAnz AT 19.05.2025 B3, chapter I, no. 2.1, UBA announcement from 2 April 2025)

AMS: MGA 20 for CO, NO, SO_2, NO_2, NO_x, N_2O, CH_4, CO_2 and O_2

Manufacturer: Dr. Födisch Umweltmesstechnik AG
Markranstädt

Suitability: For plants requiring approval to the 13th BImSchV, 17th BImSchV, 30th BImSchV, TA-Luft as well as plants according to 27th BImSchV and 44th BImSchV

Measurement ranges in the suitability test:

Component	Certification range	Additional measurement ranges		Unit
CO	0 - 75	0 - 5000	-	mg/m³
NO	0 – 50	0 - 80	0 - 3000	mg/m³
NO_2	0 - 50	0 - 1000	-	mg/m³
NO_x as NO_2 *[virtual]*	0 - 80	0 - 3000	-	mg/m³
N_2O	0 - 50	0 - 2000	-	mg/m³
SO_2	0 - 45	0 - 75	0 - 2000	mg/m³
CH_4	0 - 50	0 - 1500	-	mg/m³
CO_2	0 – 25	0 – 50		Vol.-%
O_2	0 – 25	-	-	Vol.-%

Software version:

MGA 20 (Mainboard | Display): V 3.30 | 2.40

Restrictions:

None

Notes:

1. The analyser must be operated with the active Thermo-AUTOCAL function.
2. The AMS must be operated with an interval of 12 h for automatic zero-point adjustment or O_2 span point adjustment.
3. To adhere to the required CO total measurement uncertainty at a limit value of 50 mg/m³ the alignment must be conducted using a test gas with a tolerance of 1 %.
4. When checking and adjusting span points for CO, NO, NO_2, SO_2, NO_x, N_2O, CH_4 and CO_2 the addition of test gas with moisture is conducted locally on the 3-way value in front of the measurement gas cooler or via the test gas entry on the sample probe.
5. The transfer of analogue and digital signals can alternatively be conducted using the digital interface Modbus TCP/IP according to VDI 4201 part 1 and 3.

6. The service life of the NH_3 filter specified by the manufacturer must be observed.
7. The maintenance interval is four weeks.
8. If the measuring system is exposed to NH_3 concentrations greater than 10 mg/m³ for longer than 4 days, the gas sampling probe and heating line must be cleaned with demineralised water. Cleaning the system is necessary in order to be able to comply with the required response time for the SO_2 component.
9. Supplementary suitability test (measurement system with the component O_2 in the measurement range 0 – 25 Vol.%) to the publication by the German Federal Environmental Agency dated from 21 August 2024 (BAnz AT 31.10.2024 B9, chapter I number 2.1).

Test report: TÜV SÜD Industrie Service GmbH, Munich
Report no.: 4057004_V2 from 11 September 2024

Certified Product

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

The entire tested multi-component AMS MGA 20 consists of a sampling probe, a heated sample gas line and the measuring cabinet with NH_3-adsorber, gas cooler and the analyser. The measuring cabinet is equipped with a cabinet ventilator and an additional enclosure heating. The main components of the measuring cabinet are:

- Multi-component analyser MGA 20
- NH3-adsorber Bühler ADF – 300 KG
- Measurement gas cooler JCS 101.303A50XY
- Measurement gas pump MGP 12

The multi-component AMS MGA 20 is suitable for measuring emissions of CO, NO, SO_2, NO_2, NO_x, N_2O, CH_4, CO_2 and the reference component O_2 in flue gases. This is a cold measuring extractive system.

The following measurement principles are used:

Dual frequency measurement procedure
Gas filter correlation
Zirconium dioxide measurement cell

The sample gas extraction consists of a self-regulating stainless-steel probe with heated at 200 °C ceramic filter. The sample gas probe is conducted with a sample gas line, heated at 190 °C and equipped with a PTFE seal (internal diameter 4 mm). The lines maximum length is 50 m.

The entire system consists of the following components:

Analyser systems

Manufacturer:	Dr. Födisch Umweltmesstechnik AG
System type:	MGA 20
Software:	V 3.30 | 2.40 (Mainboard | Display)
Measurement principle:	CO, NO, SO_2, NO_2, NO_x, N_2O, CH_4, CO_2 extractive cold measuring infrared spectroscopy system O_2: Two cell Zirconium dioxide sensor

Probe

Manufacturer:	Dr. Födisch Umweltmesstechnik AG
Type:	HSP 12
Probe heating:	self-regulating, heated to maximum 200 °C Temperature monitoring via alarm contact < 140 °C
Probe length:	100 cm
Filter:	Ceramic filter 3 µm

Heated pipe

Manufacturer:	Winkler GmbH, D-69126 Heidelberg
Type:	Standard, 100 W/m DN4/6
Heated temperature:	190 °C
Length:	10 m (PTFE pipes) Laboratory 50 m (PTFE pipes) Field test
Diameter:	4 mm ID
Regulator	in the MGA 20 analysis cabinet

Heating regulator measurement gas pipe

Manufacturer:	JUMO GmbH & Co. KG, D-36039 Fulda
Type:	JUMO eTRON PT100
Nominal value:	190 °C

A 3-phase power relays, combined with a heating regulator was necessary for the 50 m pipe in the field test:

Manufacturer:	JUMO GmbH & Co. KG, D-36039 Fulda
Type:	3-Phase thyristor circuit breaker

NH_3 adsorber

Manufacturer:	Bühler Technologies GmbH, D-40880 Ratingen
Type:	ADF – 300 KG; Adsorption filter with NH_3 adsorber material / 300 mm
Note:	Adsorber material refillable “NH_3 ceramic granulate”

Measurement gas cooler

Manufacturer:	JCT Analysentechnik GmbH, A - 2700 Wiener Neustadt
Type:	JCS 101.303A50XY / 345 VA
Number of col units:	1-unit
Flow:	max. 250 l/h
Condensate:	using measurement gas pump

Measurement gas pump

Manufacturer:	Dr. Födisch Umweltmesstechnik AG
Type:	MGP 12
Power:	280 l/h

Moisture block filter

Manufacturer:	Sun Control
Type:	Hydrophobe Filter Midiart 2000

Analysis cabinet ventilator

Manufacturer:	Rittal GmbH & CO. KG, Herbron
Type:	SK 3243.100
Regulator:	integrated in the MGA 20

Analysis cabinet heating

Manufacturer:	Rittal GmbH & CO. KG, Herbron
Type:	SK 3105.900
Regulator:	integrated in the MGA 20

Instruction manuals and technical documentation

MGA 20:	Instruction manual for the multi gas analyser MGA 20 (Version 1.6)
Probe:	Gas sampling probe HSP 12 (version 1.0)
Measurement gas pump:	Instruction manual for the MGP 12 (version 1.0)

General notes

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 required to maintain an approved 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.

If the product from the current production series no longer complies with the certified product, the Environmental Service Department of TÜV SÜD Industrie Service GmbH must be informed (address see footnote).

A certification mark with an ID-Number that is specific to the certified product is presented on page 1 of this certificate. This can be applied on the product or used in publicity material for the certified product.

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 expiration is also accessible on the internet at **qal1.de** and **resymesa.de**.

The certification of the MGA 20 measuring system is based on the following documents and the regular continuous monitoring of the manufacturer's quality management system:

Initial certification in accordance with DIN EN 15267:

Certificate no. 3610685-ts	31 October 2024
Certificate validity until	30 October 2029 (5 years)

Report no.: 3610685_V2 from 01 March 2024,
TÜV SÜD Industrie Service GmbH
Publication: BAnz AT 31.10.2024 B9, chapter I no. 2.1
UBA announcement from 21 August 2024

Supplementary suitability test in accordance with DIN EN 15267:

Certificate no. 4057004-ts	19 May 2025
Certificate validity until	18 May 2030 (5 years)

Report no.: 4057004_V2 from 11 September 2024,
TÜV SÜD Industrie Service GmbH
Publication: BAnz AT 19.05.2025 B3, chapter I no. 2.1
UBA announcement from 2 April 2025 (certification of O_2 measurement channel)

Calculation of total uncertainty for QAL1 testing according to DIN EN 14181 and DIN EN 15267-3 for the measuring system MGA 20

Total uncertainty measurement component O_2 range 0 – 25 Vol.-%

Performance characteristic	*Uncertainty*	*Value standard uncertainty Vol.%*	*Square of standard uncertainty Vol.%²*
Lack-of-fit	u_{lof}	0,104	0,0108
Zero drift from field test	$u_{d,z}$	0,017	0,0003
Span drift from field test	$u_{d,s}$	-0,052	0,0027
Influence of ambient temperature at span	u_t	0,067	0,0045
Influence of sample gas pressure	u_p		
Influence of sample gas flow	u_f	-0,013	0,0002
Influence of supply voltage	u_v	0,009	0,0001
Cross-sensitivity (interference)	u_i	0,162	0,0262
Repeatability standard deviation at span	$u_r = s_r$	0,029	ur < du
Standard deviation from paired meas-urements under field cond.	$u_d = s_d$	0,048	0,0023
Uncertainty of reference material 1 % by 70% of ZR	u_{rm}	0,101	0,0102
Excursion of measurement beam	u_{mb}		
Converter efficiency for AMS measuring NOx	u_{ce}		
Variation of response factors (TOC)	u_{rf}		
		total	0,0573
Combined standard uncertainty	$u_c = \sqrt{\sum (u_i)^2}$	0,239	Vol.%
Total expanded uncertainty	$U_{0,95} = 1,96 \times u_c$	0,469	Vol.%
Relativ expanded uncertainty	U	**1,9**	% CR
Permissible uncertainty of EN 15267-3	(of CR 25 Vol.%)	**7,5**	% CR
Complied with requirements relating to the measurement uncertainty		**yes**	regarding EN 15267-3
Permissible uncertainty 13. / 17. BImSchV	(of CR 25 Vol.%)	**10**	% CR
Complied with requirements relating to the measurement uncertainty		**yes**	regarding 13. / 17. BImSchV

Total uncertainty measurement component CO measurement range 0 – 75 mg/m³

Performance characteristic	*uncertainty*	*Value of standard uncertainty in mg/m³*	*Square sum of standard uncertainty in (mg/m³)²*
Lack-of-fit	u_{lof}	-0,836	0,6989
Zero point drift	$u_{d,z}$	0,199	0,0396
Span point drift	$u_{d,s}$	1,109	1,2299
Influence of Ambient temperature at span point	u_t	0,794	0,6304
Influence of sample gas pressure	u_p		
Influence of sample gas flow	u_f	-0,241	0,0581
Influence of voltage	u_v	0,340	0,1156
Cross-sensitivity	u_i	0,727	0,5285
Repeat standard deviation at span point	$u_r = s_r$	0,465	0,2162
Standard deviation from paired meas-urements	$u_d = s_d$	0,370	$u_d < u_r$
Uncertainty of test gas1 % at 70% of CR	u_{rm}	0,303	0,0918
Excursion of measurement beam	u_{MR}		
Converter efficiency for AMS measur-ing NOx	u_{ce}		
Variation of response factors (TOC)	u_{rf}		
		Sum	3,609
Combined standard uncertainty	$u_c = \sqrt{\sum (u_i)^2}$	1,900	mg/m³
Expanded uncertainty	$U_{0,95} = 1,96 \cdot u_c$	3,723	mg/m³
Relative expanded uncertainty	U	**7,4**	% ELV
Required measurement uncertainty to EN 15267-3	(at ELV 50 mg/m³)	**7,5**	% ELV
Requirement concerning uncertainty fulfilled		**yes**	concerning EN 15267-3
Required measurement uncertainty 13. / 17. BImSchV	(at ELV 50 mg/m³)	**10**	% ELV
Requirement concerning uncertainty fulfilled		**yes**	concerning 13. / 17. BImSchV

Total uncertainty measurement component NO measurement range 0 – 50 mg/m³

Performance characteristic	*uncertainty*	*Value of standard uncertainty in mg/m³*	*Square sum of standard uncertainty in (mg/m³)²*
Lack-of-fit	u_{lof}	-0,563	0,317
Zero point drift	$u_{d,z}$	0,24	0,0576
Span point drift	$u_{d,s}$	-0,449	0,2016
Influence of Ambient temperature at span point	u_t	0,582	0,3387
Influence of sample gas pressure	u_p		
Influence of sample gas flow	u_f	-0,167	0,0279
Influence of voltage	u_v	0,188	0,0353
Cross-sensitivity	u_i	-0,774	0,5991
Repeat standard deviation at span point	$u_r = s_r$	0,487	$u_r < u_d$
Standard deviation from paired measurements	$u_d = s_d$	0,590	0,3481
uncertainty of test gas 2 % at 70% from MR	u_{rm}	0,404	0,1633
Excursion of measurement beam	u_{MR}		
Converter efficiency for AMS measuring NOx	u_{ce}		
Variation of response factors (TOC)	u_{rf}		
		Sum	2,0886
Combined standard uncertainty	$u_c = \sqrt{\sum (u_i)^2}$	1,445	mg/m³
Expanded uncertainty	$U_{0,95} = 1,96 \cdot u_c$	2,833	mg/m³
Relative expanded uncertainty	U	**8,5**	% ELV
Required measurement uncertainty to EN 15267-3	(at ELV 33,33 mg/m³)	**15,0**	% ELV
Requirement concerning uncertainty fulfilled		**yes**	concerning EN 15267-3
Required measurement uncertainty 13. / 17. BImSchV	(at ELV 33,33 mg/m³)	**20**	% ELV
Requirement concerning uncertainty fulfilled		**yes**	concerning 13. / 17. BImSchV

Total uncertainty measurement component NO_2 measurement range 0 – 50 mg/m³

Performance characteristic	*uncertainty*	*Value of standard uncertainty in mg/m³*	*Square sum of standard uncertainty in (mg/m³)²*
Lack-of-fit	u_{lof}	-0,283	0,0801
Zero point drift	$u_{d,z}$	0,866	0,75
Span point drift	$u_{d,s}$	-0,826	0,6823
Influence of Ambient temperature at span point	u_t	0,64	0,4096
Influence of sample gas pressure	u_p		
Influence of sample gas flow	u_f	-0,322	0,1037
Influence of voltage	u_v	0,188	0,0353
Cross-sensitivity	u_i	0,286	0,0818
Repeat standard deviation at span point	$u_r = s_r$	0,19	$u_r < u_d$
Standard deviation from paired measurements	$u_d = s_d$	0,480	0,2304
uncertainty of test gas 2 % at 70% from MR	u_{rm}	0,404	0,1633
Excursion of measurement beam	u_{MR}		
Converter efficiency for AMS measuring NOx	u_{ce}		
Variation of response factors (TOC)	u_{rf}		
		Sum	2,5365
Combined standard uncertainty	$u_c = \sqrt{\sum (u_i)^2}$	1,593	mg/m³
Expanded uncertainty	$U_{0,95} = 1,96 \cdot u_c$	3,122	mg/m³
Relative expanded uncertainty	U	**9,4**	% ELV
Required measurement uncertainty to EN 15267-3	(at ELV 33,33 mg/m³)	**15,0**	% ELV
Requirement concerning uncertainty fulfilled		**yes**	concerning EN 15267-3
Required measurement uncertainty 13. / 17. BImSchV	(at ELV 33,33 mg/m³)	**20**	% ELV
Requirement concerning uncertainty fulfilled		**yes**	concerning 13. / 17. BImSchV

Total uncertainty measurement component N_2O measurement range 0 – 50 mg/m³

Performance characteristic	*uncertainty*	*Value of standard uncertainty in mg/m³*	*Square sum of standard uncertainty in (mg/m³)²*
Lack-of-fit	u_{lof}	0,563	0,317
Zero point drift	$u_{d,z}$	0,765	0,5852
Span point drift	$u_{d,s}$	-0,56	0,3136
Influence of Ambient temperature at span point	u_t	1,013	1,0262
Influence of sample gas pressure	u_p		
Influence of sample gas flow	u_f	-0,154	0,0237
Influence of voltage	u_v	0,082	0,0067
Cross-sensitivity	u_i	-0,534	0,2852
Repeat standard deviation at span point	$u_r = s_r$	0,217	$u_r < u_d$
Standard deviation from paired measurements	$u_d = s_d$	0,350	0,1225
uncertainty of test gas 2 % at 70% from MR	u_{rm}	0,404	0,1633
Excursion of measurement beam	u_{MR}		
Converter efficiency for AMS measuring NOx	u_{ce}		
Variation of response factors (TOC)	u_{rf}		
		Sum	2,8434
Combined standard uncertainty	$u_c = \sqrt{\sum (u_i)^2}$	1,686	mg/m³
Expanded uncertainty	$U_{0,95} = 1,96 \cdot u_c$	3,305	mg/m³
Relative expanded uncertainty	U	**6,6**	% ELV
Required measurement uncertainty to EN 15267-3	(at ELV 50 mg/m³)	**15,0**	% ELV
Requirement concerning uncertainty fulfilled		**yes**	concerning EN 15267-3
Required measurement uncertainty 13. / 17. BImSchV	(at ELV 50 mg/m³)	**20**	% ELV
Requirement concerning uncertainty fulfilled		**yes**	concerning 13. / 17. BImSchV

Total uncertainty measurement component SO_2 measurement range 0 – 45 mg/m³

Performance characteristic	*uncertainty*	*Value of standard uncertainty in mg/m³*	*Square sum of standard uncertainty in (mg/m³)²*
Lack-of-fit	u_{lof}	0,338	0,1142
Zero point drift	$u_{d,z}$	0,19	0,0361
Span point drift	$u_{d,s}$	-0,457	0,2088
Influence of Ambient temperature at span point	u_t	0,204	0,0416
Influence of sample gas pressure	u_p		
Influence of sample gas flow	u_f	-0,094	0,0088
Influence of voltage	u_v	0,102	0,0104
Cross-sensitivity	u_i	-0,486	0,2362
Repeat standard deviation at span point	$u_r = s_r$	0,144	$u_r < u_d$
Standard deviation from paired measurements	$u_d = s_d$	0,720	0,5184
uncertainty of test gas 2 % at 70% from MR	u_{rm}	0,364	0,1323
Excursion of measurement beam	u_{MR}		
Converter efficiency for AMS measuring NOx	u_{ce}		
Variation of response factors (TOC)	u_{rf}		
		Sum	1,3068
Combined standard uncertainty	$u_c = \sqrt{\sum (u_i)^2}$	1,143	mg/m³
Expanded uncertainty	$U_{0,95} = 1,96 \cdot u_c$	2,241	mg/m³
Relative expanded uncertainty	U	**7,5**	% ELV
Required measurement uncertainty to EN 15267-3	(at ELV 30 mg/m³)	**15,0**	% ELV
Requirement concerning uncertainty fulfilled		**yes**	concerning EN 15267-3
Required measurement uncertainty 13. / 17. BImSchV	(at ELV 30 mg/m³)	**20**	% ELV
Requirement concerning uncertainty fulfilled		**yes**	concerning 13. / 17. BImSchV

Total uncertainty measurement component NO_x measurement range 0 – 80 mg/m³

Performance characteristic	*uncertainty*	*Value of standard uncertainty in mg/m³*	*Square sum of standard uncertainty in (mg/m³)²*
Lack-of-fit	u_{lof}	-0,711	0,5055
Zero point drift	$u_{d,z}$	1,404	1,9712
Span point drift	$u_{d,s}$	1,404	1,9712
Influence of Ambient temperature at span point	u_t	1,299	1,6874
Influence of sample gas pressure	u_p		
Influence of sample gas flow	u_f	-0,589	0,3469
Influence of voltage	u_v	0,202	0,0408
Cross-sensitivity	u_i	1,27	1,6129
Repeat standard deviation at span point	$u_r = s_r$	0,435	$u_r < u_d$
Standard deviation from paired measurements	$u_d = s_d$	1,310	1,7161
uncertainty of test gas 5 % at 70% from MR	u_{rm}	0,216	0,0467
Excursion of measurement beam	u_{MR}		
Converter efficiency for AMS measuring NOx	u_{ce}		
Variation of response factors (TOC)	u_{rf}		
		Sum	9,8987
Combined standard uncertainty	$u_c = \sqrt{\sum (u_i)^2}$	3,146	mg/m³
Expanded uncertainty	$U_{0,95} = 1,96 \cdot u_c$	6,167	mg/m³
Relative expanded uncertainty	U	**12,3**	% ELV
Required measurement uncertainty to EN 15267-3	(at ELV 50 mg/m³)	**15,0**	% ELV
Requirement concerning uncertainty fulfilled		**yes**	concerning EN 15267-3
Required measurement uncertainty 13. / 17. BImSchV	(at ELV 50 mg/m³)	**20**	% ELV
Requirement concerning uncertainty fulfilled		**yes**	concerning 13. / 17. BImSchV

Total uncertainty measurement component CH_4 measurement range 0 – 50 mg/m³

Performance characteristic	*uncertainty*	*Value of standard uncertainty in mg/m³*	*Square sum of standard uncertainty in (mg/m³)²*
Lack-of-fit	u_{lof}	0,58	0,3364
Zero point drift	$u_{d,z}$	0,528	0,2788
Span point drift	$u_{d,s}$	-0,505	0,255
Influence of Ambient temperature at span point	u_t	0,965	0,9312
Influence of sample gas pressure	u_p		
Influence of sample gas flow	u_f	-0,206	0,0424
Influence of voltage	u_v	0,160	0,0256
Cross-sensitivity	u_i	-0,511	0,2611
Repeat standard deviation at span point	$u_r = s_r$	0,395	0,156
Standard deviation from paired measurements	$u_d = s_d$	0,280	$u_d < u_r$
uncertainty of test gas 2 % at 70% from MR	u_{rm}	0,404	0,1633
Excursion of measurement beam	u_{MR}		
Converter efficiency for AMS measuring NOx	u_{ce}		
Variation of response factors (TOC)	u_{rf}		
		Sum	2,4498
Combined standard uncertainty	$u_c = \sqrt{\sum (u_i)^2}$	1,565	mg/m³
Expanded uncertainty	$U_{0,95} = 1,96 \cdot u_c$	3,068	mg/m³
Relative expanded uncertainty	U	**6,1**	% ELV
Required measurement uncertainty to EN 15267-3	(at ELV 50 mg/m³)	**15,0**	% ELV
Requirement concerning uncertainty fulfilled		**yes**	concerning EN 15267-3
Required measurement uncertainty 13. / 17. BImSchV	(at ELV 50 mg/m³)	**20**	% ELV
Requirement concerning uncertainty fulfilled		**yes**	concerning 13. / 17. BImSchV

Total uncertainty measurement component CO_2 measurement range 0 – 25 Vol.%

Performance characteristic	*uncertainty*	*Value of standard uncertainty in Vol.%*	*Square sum of standard uncertainty in (Vol.%)²*
Lack-of-fit	u_{lof}	0,273	0,0745
Zero point drift	$u_{d,z}$	0,017	0,0003
Span point drift	$u_{d,s}$	-0,335	0,1122
Influence of Ambient temperature at span point	u_t	0,137	0,0188
Influence of sample gas pressure	u_p		
Influence of sample gas flow	u_f	-0,064	0,0041
Influence of voltage	u_v	0,013	0,0002
Cross-sensitivity	u_i	0,196	0,0384
Repeat standard deviation at span point	$u_r = s_r$	0,045	$u_r < u_d$
Standard deviation from paired measurements	$u_d = s_d$	0,050	0,0025
Uncertainty of test gas1 % at 70% of MR	u_{rm}	0,101	0,0102
Excursion of measurement beam	u_{MR}		
Converter efficiency for AMS measuring NOx	u_{ce}		
Variation of response factors (TOC)	u_{rf}		
		Sum	0,2612
Combined standard uncertainty	$u_c = \sqrt{\sum (u_i)^2}$	0,511	Vol.%
Expanded uncertainty	$U_{0,95} = 1,96 \cdot u_c$	1,002	Vol.%
Relative expanded uncertainty	U	**4,0**	% CR
Required measurement uncertainty to EN 15267-3	(at CR 25 Vol.%)	**7,5**	% CR
Requirement concerning uncertainty fulfilled		**yes**	concerning EN 15267-3
Required measurement uncertainty 13. / 17. BImSchV	(at CR 25 Vol.%)	**10**	% CB
Requirement concerning uncertainty fulfilled		**yes**	concerning 13. / 17. BImSchV