Umwelt Bundes Amt
For our Environment

TÜVRheinland®
Precisely Right.

CERTIFICATE

on Product Conformity (QAL1)

Number of Certificate: 0000025930_02

Certified AMS:	Modular System MAC GMS800 for CO, NO, NO_2, SO_2, CH_4, N_2O, CO_2 and O_2
Manufacturer:	SICK MAIHAK GmbH Nimburger Str. 11 79276 Reute Germany
Test Institute:	TÜV Rheinland Energie und Umwelt GmbH

This is to certify that the AMS has been tested and found to comply with:

EN 15267-1: 2009, EN 15267-2: 2009, EN 15267-3: 2008 and EN 14181: 2004

Certification is awarded in respect of the conditions stated in this certificate (see also the following pages).

The present certificate replaces Certificate No. 0000025930_01 dated 02 August 2010

www.tuv.com TÜVRheinland® ID: 0000025930

- EN 15267-3 tested
- QAL1 certified
- TUV approved
- Annual inspection

Publication in the German Federal Gazette (BAnz.) of 02 March 2012

The certificate is valid until:
11 February 2015

Umweltbundesamt
Dessau, 16 March 2012

i. A. Dr. Hans-Joachim Hummel

TÜV Rheinland Energie und Umwelt GmbH
Köln, 15 March 2012

ppa. Dr. Peter Wilbring

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TÜV Rheinland Energie und Umwelt GmbH
Am Grauen Stein
51105 Köln

Accreditation according to EN ISO/IEC 17025 and certified according to ISO 9001:2008.

10221 2.08

Test report:	936/21217568/A of 18 October 2011
First certification:	12 February 2010
Validity ends:	11 February 2015
Publication:	BAnz. 02 March 2012, No. 36, p. 920, chapter I, No. 5.1

Approved application
The tested AMS is suitable for use at combustion plants according to EC directive 2001-80-EC, at waste incineration plants according to EC directive 2000-76-EC and other plants requiring official approval. The tested ranges have been chosen with respect to the wide application range of the AMS.

The suitability of the AMS for this application was assessed on the basis of a laboratory test and a field test at a municipal heat and power plant.

The AMS is approved for an ambient temperature range of +5 °C to +40 °C.

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 936/21211670/A dated 29 October 2009 of TÜV Rheinland Immissionsschutz und Energiesysteme GmbH
- test report 936/21211670/B dated 26 March 2010 of TÜV Rheinland Immissionsschutz und Energiesysteme GmbH
- test report 936/21217568/A dated 18 October 2011 of TÜV Rheinland Energie und Umwelt GmbH
- suitability announced by the German Environmental Agency (UBA) as the relevant body
- the ongoing surveillance of the product and the manufacturing process
- publication in the German Federal Gazette (BAnz. 02 March 2012, No. 36, p. 920, chapter I, No. 5.1, announcement by UBA from 23 February 2012)

AMS name:
Modular System MAC GMS800 for CO, NO, NO_2, SO_2, CH_4, N_2O, CO_2 and O_2

Manufacturer:
SICK MAIHAK GmbH, Reute

Field of application:
For measurements at plants requiring official approval (i. e. plants in 2000-76-EC, waste incineration directive and 2001-80-EC large combustion plants directive)

Measuring ranges during the suitability test:

Compo-nent	Module	Certification range	Supplementary measurement ranges		Unit
CO	MAC GMS800 UNOR for CO	0 – 75	0 – 750	0 – 3000	mg/m³
	MAC GMS800 MULTOR for CO	0 – 200	0 – 2000	–	mg/m³
NO	MAC GMS800 UNOR for NO	0 – 100	0 – 1000	0 – 2000	mg/m³
	MAC GMS800 MULTOR for NO	0 – 250	0 – 2500	–	mg/m³
	MAC GMS800 DEFOR for NO	0 – 50	0 – 1000	0 – 2000	mg/m³
NO_2	MAC GMS800 DEFOR for NO_2	0 – 50	0 – 500	–	mg/m³
NO_x	MAC GMS800 UNOR for NO_x	0 – 100	0 – 1000	0 – 2000	mg/m³
	MAC GMS800 MULTOR for NO_x	0 – 250	0 – 2500	–	mg/m³
SO_2	MAC GMS800 UNOR for SO_2	0 – 75	0 – 287	0 – 2000	mg/m³
	MAC GMS800 MULTOR for SO_2	0 – 250	0 – 2000	–	mg/m³
	MAC GMS800 DEFOR for SO_2	0 – 75	0 – 287	0 - 2000	mg/m³
CH_4	MAC GMS800 UNOR for CH_4	0 – 50	0 – 500	–	mg/m³
	MAC GMS800 MULTOR for CH_4	0 – 286	0 – 500	–	mg/m³
N_2O	MAC GMS800 UNOR for N_2O	0 – 50	0 – 500	–	mg/m³
CO_2	MAC GMS800 UNOR for CO_2	0 – 25	–	–	Vol.-%
	MAC GMS800 MULTOR for CO_2	0 – 25	–	–	Vol.-%
O_2	MAC GMS800 OXOR-P for O_2	0 – 25	–	–	Vol.-%
	MAC GMS800 OXOR-E for O_2	0 – 25	–	–	Vol.-%

Software versions:
T825_090707_1000
PC-Software: Sopas ET 2.22 Build 2938

Restrictions:
1. The correct function of the selected module combination shall be determined within the scope of the check on proper installation.
2. The maintenance interval shall be determined within the scope of the check on proper installation.

Notes:

1. Automatic calibration of zero point shall be carried out at least once a week for all components other than O_2 (OXOR-P and OXOR-E) by using humidified ambient air.
2. Automatic calibration of span point shall be carried out at least once a week for sensors OXOR-P and OXOR-E (O_2) by using humidified ambient air.
3. The measuring system fulfils minimum requirements even at an ambient air temperature of 50 °C due to the external climatisation unit.
4. The measuring system may be operated with cooler type MAK10-2 by AGT Thermotechnik as well as with cooler type CSS-V2SK by company M&C.
5. With weekly adjustment using the respective test gas cells or filters(NO_2 (DEFOR)), the maintenance interval can be extended as follows:
   - one year for the modules CO (UNOR), CH_4 (UNOR and MULTOR)
   - six months for the CO module (MULTOR), NO (MULTOR), SO_2 (DEFOR)
   - three months for the modules NO (UNOR) and NO_2 (DEFOR)
6. Supplementary test (extension of the maintenance interval using internal test gas cells) of the announcements of the Umweltbundesamt from 12 July 2010 (BAnz. p. 2597, chapter I, No. 2.1) and from 10 January 2011 (BAnz. p. 294, chapter IV, 2. and 30. notification).

Test report:

TÜV Rheinland Energie und Umwelt GmbH, Köln
Report-No.: 936/21217568/A dated 18 October 2011

Certified product

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

The multicomponent measuring system MAC GMS800 is a modular sensor system. The essential part is the instrument cabinet including the interface modules, measuring gas pump, test gas supply unit, electronic-unit and SCU/BCU control unit. It is possible to place up to three different measurement modules in this instrument cabinet. All gas sensors are able to work independently from other sensors.

Thus, the modular measurement system can be equipped according to different requirements, each with appropriate measurement modules.

The following gas senor modules have been certified so far: UNOR, MULTOR, DEFOR, OXOR.

All gas senor modules are controlled by a BUS-system. The data output and adjustment of all sensors can be observed with this system.

The following components are part of the complete system:

- heated probe (M&C SP 2000) with heated filter, test gas offering function and back-flush function,
- heated gas tube (a heated line with a length of 10 m was used during the laboratory investigations, during field investigations a heated line with a length of 50 m was used),
- instrument cabinet with interface modules, measuring gas pump, sample gas cooler, test gas supply unit, sensor modules with gas sensors, electronic-unit and SCU/BCU control unit.

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 Energie und Umwelt 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 can be applied to the product or used in publicity material for the certified product.

This document as well as the certification mark remains property of TÜV Rheinland Energie und Umwelt GmbH. With revocation of the publication the certificate looses its validity. After the expiration of the validity of the certificate and on requests of the TÜV Rheinland Energie und Umwelt GmbH this document shall be returned and the certificate mark must not be employed anymore.

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

Certification of Modular System MAC GMS800 for CO, NO, NO_2, SO_2, CH_4, N_2O, CO_2 and O_2 is based on the documents listed below and the regular, continuous monitoring of the Quality Management System of the manufacturer:

Initial certification according to EN 15267:

Certificate No. 0000025930: 12 February 2010

Validity of the certificate: 11 February 2015

Test report: 936/21211670/A of 29 October 2009,
TÜV Rheinland Immissionsschutz und Energiesysteme GmbH, Köln,

Publication: BAnz. 12 February 2010, No. 24, p. 552, chapter I, No. 1.2:
Announcement by UBA from 25 January 2010.

Supplementary testing according to EN 15267:

Certificate No. 0000025930_01: 28 July 2010

Validity of the certificate: 11 February 2015

Test report: 936/21211670/B of 26 March 2010,
TÜV Rheinland Immissionsschutz und Energiesysteme GmbH, Köln,

Publication: BAnz. 28 July 2010, No. 111, p. 2597, chapter I, No. 2.1:
Announcement by UBA from 12 July 2010.

Update of certification according to EN 15267:

Certificate No. 0000025930_01: 28 July 2010

Validity of the certificate: 11 February 2015

1st notification on changes to the certificate according to EN 15267:

Statement of TÜV Rheinland Energie und Umwelt GmbH, Köln from 24 September 2010

Publication: BAnz. 26 January 2011, No. 14, p. 295, chapter IV, notification 2:
publication by UBA from 10 January 2011.

Supplementary testing according to EN 15267:

Certificate No. 0000025930_02: 16 March 2010

Validity of the certificate: 11 February 2015

Test report: 936/21217568/A of 18 October 2011,
TÜV Rheinland Energie und Umwelt GmbH, Köln,

Publication: BAnz. 02 March 2012, No. 36, p. 920, chapter I, No. 5.1:
Announcement by UBA from 23 February 2012

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

Measuring system					
Manufacturer			Sick Maihak GmbH		
Name of measuring system			MAC GMS800 UNOR for CO		
Serial number of the candidates			TÜV 1 / TÜV 3		
Measuring principle			NDIR		
Test report			936/21217568/A		
Test laboratory			TÜV Rheinland		
Date of report			2011-10-18		
Measured component			CO		
Certification range			0 - 75	mg/m³	
Evaluation of the cross sensitivity (CS)					
(system with largest CS)					
Sum of positive CS at zero point			1.80	mg/m³	
Sum of negative CS at zero point			-1.30	mg/m³	
Sum of postive CS at reference point			1.07	mg/m³	
Sum of negative CS at reference point			0.00	mg/m³	
Maximum sum of cross sensitivities			1.80	mg/m³	
Uncertainty of cross sensitivity			1.039	mg/m³	

Calculation of the combined standard uncertainty

Tested parameter		u		u²	
Standard deviation from paired measurements under field conditions *	u_D	0.747	mg/m³	0.558	(mg/m³)²
Lack of fit	u_{lof}	0.289	mg/m³	0.084	(mg/m³)²
Zero drift from field test	$u_{d,z}$	0.346	mg/m³	0.120	(mg/m³)²
Span drift from field test	$u_{d,s}$	0.866	mg/m³	0.750	(mg/m³)²
Influence of ambient temperature at span	u_t	0.751	mg/m³	0.564	(mg/m³)²
Influence of supply voltage	u_v	0.115	mg/m³	0.013	(mg/m³)²
Cross sensitivity (interference)	u_i	1.039	mg/m³	1.080	(mg/m³)²
Influence of sample gas flow	u_p	-0.029	mg/m³	0.001	(mg/m³)²
Uncertainty of reference material at 70% of certification range	u_{rm}	0.606	mg/m³	0.368	(mg/m³)²

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

Combined standard uncertainty (u_C)	$u_c = \sqrt{\sum (u_{max,j})^2}$	1.88	mg/m³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	3.69	mg/m³

Relative total expanded uncertainty	**U in % of the ELV 50 mg/m³**	**7.4**
Requirement of 2000/76/EC and 2001/80/EC	**U in % of the ELV 50 mg/m³**	**10.0**
Requirement of EN 15267-3	U in % of the ELV 50 mg/m³	7.5

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

Measuring system			
Manufacturer			Sick Maihak GmbH
Name of measuring system			MAC GMS800 MULTOR for CO
Serial number of the candidates			TÜV 1 / TÜV 3
Measuring principle			NDIR
Test report			936/21217568/A
Test laboratory			TÜV Rheinland
Date of report			2011-10-18
Measured component			CO
Certification range			0 - 200 mg/m³

Evaluation of the cross sensitivity (CS)
(system with largest CS)

Sum of positive CS at zero point	0.00	mg/m³
Sum of negative CS at zero point	0.00	mg/m³
Sum of postive CS at reference point	6.76	mg/m³
Sum of negative CS at reference point	0.00	mg/m³
Maximum sum of cross sensitivities	6.76	mg/m³
Uncertainty of cross sensitivity	3.903	mg/m³

Calculation of the combined standard uncertainty

Tested parameter		u		u²	
Standard deviation from paired measurements under field conditions *	u_D	1.588	mg/m³	2.522	(mg/m³)²
Lack of fit	u_{lof}	1.155	mg/m³	1.334	(mg/m³)²
Zero drift from field test	$u_{d,z}$	0.924	mg/m³	0.854	(mg/m³)²
Span drift from field test	$u_{d,s}$	-3.002	mg/m³	9.012	(mg/m³)²
Influence of ambient temperature at span	u_t	2.406	mg/m³	5.789	(mg/m³)²
Influence of supply voltage	u_v	0.157	mg/m³	0.025	(mg/m³)²
Cross sensitivity (interference)	u_i	3.903	mg/m³	15.233	(mg/m³)²
Influence of sample gas flow	u_p	0.127	mg/m³	0.016	(mg/m³)²
Uncertainty of reference material at 70% of certification range	u_{rm}	1.617	mg/m³	2.613	(mg/m³)²

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

Combined standard uncertainty (u_C)	$u_c = \sqrt{\sum (u_{max,j})^2}$	6.12	mg/m³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	11.99	mg/m³

Relative total expanded uncertainty	**U in % of the ELV 160 mg/m³**	**7.5**
Requirement of 2000/76/EC and 2001/80/EC	**U in % of the ELV 160 mg/m³**	**10.0**
Requirement of EN 15267-3	U in % of the ELV 160 mg/m³	7.5

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

Measuring system			
Manufacturer	Sick Maihak GmbH		
Name of measuring system	MAC GMS800 UNOR for NO		
Serial number of the candidates	TÜV 1 / TÜV 3		
Measuring principle	NDIR		
Test report	936/21217568/A		
Test laboratory	TÜV Rheinland		
Date of report	2011-10-18		
Measured component	NO		
Certification range	0 - 100	mg/m³	

Evaluation of the cross sensitivity (CS)
(system with largest CS)

Sum of positive CS at zero point	1.56	mg/m³
Sum of negative CS at zero point	0.00	mg/m³
Sum of postive CS at reference point	2.46	mg/m³
Sum of negative CS at reference point	-0.73	mg/m³
Maximum sum of cross sensitivities	2.46	mg/m³
Uncertainty of cross sensitivity	1.420	mg/m³

Calculation of the combined standard uncertainty

Tested parameter		u		u²	
Standard deviation from paired measurements under field conditions *	u_D	1.191	mg/m³	1.418	(mg/m³)²
Lack of fit	u_{lof}	0.231	mg/m³	0.053	(mg/m³)²
Zero drift from field test	$u_{d,z}$	-1.212	mg/m³	1.469	(mg/m³)²
Span drift from field test	$u_{d,s}$	1.732	mg/m³	3.000	(mg/m³)²
Influence of ambient temperature at span	u_t	0.529	mg/m³	0.280	(mg/m³)²
Influence of supply voltage	u_v	0.142	mg/m³	0.020	(mg/m³)²
Cross sensitivity (interference)	u_i	1.420	mg/m³	2.017	(mg/m³)²
Influence of sample gas flow	u_p	-0.104	mg/m³	0.011	(mg/m³)²
Uncertainty of reference material at 70% of certification range	u_{rm}	0.808	mg/m³	0.653	(mg/m³)²

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

Combined standard uncertainty (u_C)	$u_c = \sqrt{\sum (u_{max,j})^2}$	2.99	mg/m³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	5.85	mg/m³

Relative total expanded uncertainty	**U in % of the ELV 50 mg/m³**	**11.7**
Requirement of 2000/76/EC and 2001/80/EC	**U in % of the ELV 50 mg/m³**	**20.0**
Requirement of EN 15267-3	U in % of the ELV 50 mg/m³	15.0

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

Measuring system			
Manufacturer	Sick Maihak GmbH		
Name of measuring system	MAC GMS800 MULTOR for NO		
Serial number of the candidates	TÜV 1 / TÜV 3		
Measuring principle	NDIR		
Test report	936/21217568/A		
Test laboratory	TÜV Rheinland		
Date of report	2011-10-18		
Measured component	NO		
Certification range	0 - 250	mg/m³	

Evaluation of the cross sensitivity (CS)
(system with largest CS)

Sum of positive CS at zero point	8.95	mg/m³
Sum of negative CS at zero point	-4.43	mg/m³
Sum of postive CS at reference point	3.45	mg/m³
Sum of negative CS at reference point	-3.65	mg/m³
Maximum sum of cross sensitivities	8.95	mg/m³
Uncertainty of cross sensitivity	5.167	mg/m³

Calculation of the combined standard uncertainty

Tested parameter		u		u²	
Standard deviation from paired measurements under field conditions *	u_D	2.241	mg/m³	5.022	(mg/m³)²
Lack of fit	u_{lof}	-1.155	mg/m³	1.334	(mg/m³)²
Zero drift from field test	$u_{d,z}$	2.742	mg/m³	7.519	(mg/m³)²
Span drift from field test	$u_{d,s}$	4.186	mg/m³	17.523	(mg/m³)²
Influence of ambient temperature at span	u_t	0.950	mg/m³	0.903	(mg/m³)²
Influence of supply voltage	u_v	0.737	mg/m³	0.543	(mg/m³)²
Cross sensitivity (interference)	u_i	5.167	mg/m³	26.701	(mg/m³)²
Influence of sample gas flow	u_p	0.277	mg/m³	0.077	(mg/m³)²
Uncertainty of reference material at 70% of certification range	u_{rm}	2.021	mg/m³	4.083	(mg/m³)²

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

Combined standard uncertainty (u_C)	$u_c = \sqrt{\sum (u_{max,j})^2}$	7.98	mg/m³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	15.64	mg/m³

Relative total expanded uncertainty	**U in % of the ELV 131 mg/m³**	**11.9**
Requirement of 2000/76/EC and 2001/80/EC	**U in % of the ELV 131 mg/m³**	**20.0**
Requirement of EN 15267-3	U in % of the ELV 131 mg/m³	15.0

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

Measuring system					
Manufacturer			Sick Maihak GmbH		
Name of measuring system			MAC GMS800 DEFOR for NO		
Serial number of the candidates			TÜV 2 / TÜV 4		
Measuring principle			UVRAS		
Test report			936/21217568/A		
Test laboratory			TÜV Rheinland		
Date of report			2011-10-18		
Measured component			NO		
Certification range			0 - 50	mg/m³	
Evaluation of the cross sensitivity (CS)					
(system with largest CS)					
Sum of positive CS at zero point			1.86	mg/m³	
Sum of negative CS at zero point			0.00	mg/m³	
Sum of postive CS at reference point			1.06	mg/m³	
Sum of negative CS at reference point			-0.94	mg/m³	
Maximum sum of cross sensitivities			1.86	mg/m³	
Uncertainty of cross sensitivity			1.074	mg/m³	

Calculation of the combined standard uncertainty

Tested parameter		u		u²	
Standard deviation from paired measurements under field conditions *	u_D	0.751	mg/m³	0.564	(mg/m³)²
Lack of fit	u_{lof}	-0.115	mg/m³	0.013	(mg/m³)²
Zero drift from field test	$u_{d,z}$	0.375	mg/m³	0.141	(mg/m³)²
Span drift from field test	$u_{d,s}$	0.866	mg/m³	0.750	(mg/m³)²
Influence of ambient temperature at span	u_t	0.153	mg/m³	0.023	(mg/m³)²
Influence of supply voltage	u_v	0.233	mg/m³	0.054	(mg/m³)²
Cross sensitivity (interference)	u_i	1.074	mg/m³	1.153	(mg/m³)²
Influence of sample gas flow	u_p	0.052	mg/m³	0.003	(mg/m³)²
Uncertainty of reference material at 70% of certification range	u_{rm}	0.404	mg/m³	0.163	(mg/m³)²

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

Combined standard uncertainty (u_C)	$u_c = \sqrt{\sum (u_{max,j})^2}$	1.69	mg/m³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	3.32	mg/m³

Relative total expanded uncertainty	**U in % of the ELV 30 mg/m³**	**11.1**
Requirement of 2000/76/EC and 2001/80/EC	**U in % of the ELV 30 mg/m³**	**20.0**
Requirement of EN 15267-3	U in % of the ELV 30 mg/m³	15.0

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

Measuring system			
Manufacturer			Sick Maihak GmbH
Name of measuring system			MAC GMS800 DEFOR for NO_2
Serial number of the candidates			TÜV 2 / TÜV 4
Measuring principle			UVRAS
Test report			936/21217568/A
Test laboratory			TÜV Rheinland
Date of report			2011-10-18
Measured component			NO_2
Certification range		0 - 50	mg/m³

Evaluation of the cross sensitivity (CS)
(system with largest CS)

Sum of positive CS at zero point	1.72	mg/m³
Sum of negative CS at zero point	0.00	mg/m³
Sum of postive CS at reference point	1.93	mg/m³
Sum of negative CS at reference point	-0.26	mg/m³
Maximum sum of cross sensitivities	1.93	mg/m³
Uncertainty of cross sensitivity	1.114	mg/m³

Calculation of the combined standard uncertainty

Tested parameter		u		u²	
Repeatability standard deviation at set point *	u_r	0.520	mg/m³	0.270	(mg/m³)²
Lack of fit	u_{lof}	-0.231	mg/m³	0.053	(mg/m³)²
Zero drift from field test	$u_{d,z}$	-0.693	mg/m³	0.480	(mg/m³)²
Span drift from field test	$u_{d,s}$	0.866	mg/m³	0.750	(mg/m³)²
Influence of ambient temperature at span	u_t	0.458	mg/m³	0.210	(mg/m³)²
Influence of supply voltage	u_v	0.110	mg/m³	0.012	(mg/m³)²
Cross sensitivity (interference)	u_i	1.114	mg/m³	1.242	(mg/m³)²
Influence of sample gas flow	u_p	0.030	mg/m³	0.001	(mg/m³)²
Uncertainty of reference material at 70% of certification range	u_{rm}	0.404	mg/m³	0.163	(mg/m³)²

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

Combined standard uncertainty (u_C)	$u_c = \sqrt{\sum (u_{max,j})^2}$	1.78	mg/m³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	3.50	mg/m³

Relative total expanded uncertainty	**U in % of the ELV 50 mg/m³**	**7.0**
Requirement of 2000/76/EC and 2001/80/EC	**U in % of the ELV 50 mg/m³**	**20.0**
Requirement of EN 15267-3	U in % of the ELV 50 mg/m³	15.0

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

Measuring system			
Manufacturer	Sick Maihak GmbH		
Name of measuring system	MAC GMS800 UNOR for SO_2		
Serial number of the candidates	TÜV 2 / TÜV 4		
Measuring principle	NDIR		
Test report	936/21217568/A		
Test laboratory	TÜV Rheinland		
Date of report	2011-10-18		
Measured component	SO_2		
Certification range	0 - 75	mg/m³	

Evaluation of the cross sensitivity (CS)
(system with largest CS)

Sum of positive CS at zero point	2.75	mg/m³
Sum of negative CS at zero point	-1.75	mg/m³
Sum of postive CS at reference point	2.30	mg/m³
Sum of negative CS at reference point	-1.82	mg/m³
Maximum sum of cross sensitivities	2.75	mg/m³
Uncertainty of cross sensitivity	1.585	mg/m³

Calculation of the combined standard uncertainty

Tested parameter		u		u²	
Standard deviation from paired measurements under field conditions *	u_D	1.228	mg/m³	1.508	(mg/m³)²
Lack of fit	u_{lof}	0.410	mg/m³	0.168	(mg/m³)²
Zero drift from field test	$u_{d,z}$	-1.212	mg/m³	1.469	(mg/m³)²
Span drift from field test	$u_{d,s}$	1.299	mg/m³	1.687	(mg/m³)²
Influence of ambient temperature at span	u_t	0.929	mg/m³	0.863	(mg/m³)²
Influence of supply voltage	u_v	0.227	mg/m³	0.052	(mg/m³)²
Cross sensitivity (interference)	u_i	1.585	mg/m³	2.512	(mg/m³)²
Influence of sample gas flow	u_p	0.057	mg/m³	0.003	(mg/m³)²
Uncertainty of reference material at 70% of certification range	u_{rm}	0.606	mg/m³	0.368	(mg/m³)²

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

Combined standard uncertainty (u_C)	$u_c = \sqrt{\sum (u_{max,j})^2}$	2.94	mg/m³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	5.76	mg/m³

Relative total expanded uncertainty	**U in % of the ELV 50 mg/m³**	**11.5**
Requirement of 2000/76/EC and 2001/80/EC	**U in % of the ELV 50 mg/m³**	**20.0**
Requirement of EN 15267-3	U in % of the ELV 50 mg/m³	15.0

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

Measuring system			
Manufacturer	Sick Maihak GmbH		
Name of measuring system	MAC GMS800 MULTOR for SO_2		
Serial number of the candidates	TÜV 1 / TÜV 3		
Measuring principle	NDIR		
Test report	936/21217568/A		
Test laboratory	TÜV Rheinland		
Date of report	2011-10-18		
Measured component	SO_2		
Certification range	0 - 250	mg/m³	

Evaluation of the cross sensitivity (CS)
(system with largest CS)

Sum of positive CS at zero point	9.63	mg/m³
Sum of negative CS at zero point	-2.65	mg/m³
Sum of postive CS at reference point	5.93	mg/m³
Sum of negative CS at reference point	-1.20	mg/m³
Maximum sum of cross sensitivities	9.63	mg/m³
Uncertainty of cross sensitivity	5.557	mg/m³

Calculation of the combined standard uncertainty

Tested parameter		u		u²	
Standard deviation from paired measurements under field conditions *	u_D	1.546	mg/m³	2.390	(mg/m³)²
Lack of fit	u_{lof}	-2.714	mg/m³	7.366	(mg/m³)²
Zero drift from field test	$u_{d,z}$	2.115	mg/m³	4.473	(mg/m³)²
Span drift from field test	$u_{d,s}$	-3.002	mg/m³	9.012	(mg/m³)²
Influence of ambient temperature at span	u_t	2.901	mg/m³	8.416	(mg/m³)²
Influence of supply voltage	u_v	0.839	mg/m³	0.704	(mg/m³)²
Cross sensitivity (interference)	u_i	5.557	mg/m³	30.880	(mg/m³)²
Influence of sample gas flow	u_p	-0.410	mg/m³	0.168	(mg/m³)²
Uncertainty of reference material at 70% of certification range	u_{rm}	2.021	mg/m³	4.083	(mg/m³)²

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

Combined standard uncertainty (u_C)	$u_c = \sqrt{\sum (u_{max,j})^2}$	8.22	mg/m³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	16.10	mg/m³

Relative total expanded uncertainty	**U in % of the ELV 150 mg/m³**	**10.7**
Requirement of 2000/76/EC and 2001/80/EC	**U in % of the ELV 150 mg/m³**	**20.0**
Requirement of EN 15267-3	U in % of the ELV 150 mg/m³	15.0

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

Measuring system			
Manufacturer	Sick Maihak GmbH		
Name of measuring system	MAC GMS800 DEFOR for SO_2		
Serial number of the candidates	TÜV 2 / TÜV 4		
Measuring principle	UVRAS		
Test report	936/21217568/A		
Test laboratory	TÜV Rheinland		
Date of report	2011-10-18		
Measured component	SO_2		
Certification range	0 - 75	mg/m³	

Evaluation of the cross sensitivity (CS)
(system with largest CS)

Sum of positive CS at zero point	0.00	mg/m³
Sum of negative CS at zero point	-0.81	mg/m³
Sum of postive CS at reference point	0.35	mg/m³
Sum of negative CS at reference point	-2.91	mg/m³
Maximum sum of cross sensitivities	-2.91	mg/m³
Uncertainty of cross sensitivity	-1.680	mg/m³

Calculation of the combined standard uncertainty

Tested parameter		u		u²	
Standard deviation from paired measurements under field conditions *	u_D	1.206	mg/m³	1.454	(mg/m³)²
Lack of fit	u_{lof}	-0.404	mg/m³	0.163	(mg/m³)²
Zero drift from field test	$u_{d,z}$	-0.606	mg/m³	0.367	(mg/m³)²
Span drift from field test	$u_{d,s}$	1.299	mg/m³	1.687	(mg/m³)²
Influence of ambient temperature at span	u_t	0.964	mg/m³	0.929	(mg/m³)²
Influence of supply voltage	u_v	0.067	mg/m³	0.004	(mg/m³)²
Cross sensitivity (interference)	u_i	-1.680	mg/m³	2.823	(mg/m³)²
Uncertainty of reference material at 70% of certification range	u_{rm}	0.606	mg/m³	0.368	(mg/m³)²

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

Combined standard uncertainty (u_C)	$u_c = \sqrt{\sum (u_{max,j})^2}$	2.79	mg/m³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	5.47	mg/m³

Relative total expanded uncertainty	**U in % of the ELV 50 mg/m³**	**10.9**
Requirement of 2000/76/EC and 2001/80/EC	**U in % of the ELV 50 mg/m³**	**20.0**
Requirement of EN 15267-3	U in % of the ELV 50 mg/m³	15.0

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

Measuring system					
Manufacturer			Sick Maihak GmbH		
Name of measuring system			MAC GMS800 UNOR for CH_4		
Serial number of the candidates			TÜV 2 / TÜV 4		
Measuring principle			NDIR		
Test report			936/21217568/A		
Test laboratory			TÜV Rheinland		
Date of report			2011-10-18		
Measured component			CH_4		
Certification range			0 - 50	mg/m³	
Evaluation of the cross sensitivity (CS)					
(system with largest CS)					
Sum of positive CS at zero point			0.48	mg/m³	
Sum of negative CS at zero point			-1.77	mg/m³	
Sum of postive CS at reference point			0.00	mg/m³	
Sum of negative CS at reference point			-0.63	mg/m³	
Maximum sum of cross sensitivities			-1.77	mg/m³	
Uncertainty of cross sensitivity			-1.022	mg/m³	

Calculation of the combined standard uncertainty

Tested parameter		u		u²	
Repeatability standard deviation at set point *	u_r	0.630	mg/m³	0.397	(mg/m³)²
Lack of fit	u_{lof}	0.231	mg/m³	0.053	(mg/m³)²
Zero drift from field test	$u_{d,z}$	0.520	mg/m³	0.270	(mg/m³)²
Span drift from field test	$u_{d,s}$	0.635	mg/m³	0.403	(mg/m³)²
Influence of ambient temperature at span	u_t	0.416	mg/m³	0.173	(mg/m³)²
Influence of supply voltage	u_v	0.306	mg/m³	0.094	(mg/m³)²
Cross sensitivity (interference)	u_i	-1.022	mg/m³	1.044	(mg/m³)²
Influence of sample gas flow	u_p	-0.035	mg/m³	0.001	(mg/m³)²
Uncertainty of reference material at 70% of certification range	u_{rm}	0.404	mg/m³	0.163	(mg/m³)²

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

Combined standard uncertainty (u_C)	$u_c = \sqrt{\sum (u_{max,j})^2}$	1.61	mg/m³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	3.16	mg/m³

Relative total expanded uncertainty	**U in % of the ELV 20 mg/m³**	**15.8**
Requirement of 2000/76/EC and 2001/80/EC	**U in % of the ELV 20 mg/m³**	**30.0**
Requirement of EN 15267-3	U in % of the ELV 20 mg/m³	22.5

** For this component no requirements in the EC-directives 2001/80/EG und 2000/76/EG are given.
The chosen value is recommended by the certification body.

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

Measuring system			
Manufacturer		Sick Maihak	
Name of measuring system		MAC GMS800 MULTOR for CH_4	
Serial number of the candidates		TÜV 2 / TÜV 4	
Measuring principle		NDIR	
Test report		936/21217568/A	
Test laboratory		TÜV Rheinland	
Date of report		2011-10-18	
Measured component		CH_4	
Certification range		0 - 286	mg/m³

Evaluation of the cross sensitivity (CS)
(system with largest CS)

Sum of positive CS at zero point	0.00	mg/m³
Sum of negative CS at zero point	0.00	mg/m³
Sum of postive CS at reference point	1.06	mg/m³
Sum of negative CS at reference point	-1.49	mg/m³
Maximum sum of cross sensitivities	-1.49	mg/m³
Uncertainty of cross sensitivity	-0.859	mg/m³

Calculation of the combined standard uncertainty

Tested parameter		u		u²	
Repeatability standard deviation at set point *	u_r	0.620	mg/m³	0.384	(mg/m³)²
Lack of fit	u_{lof}	-1.501	mg/m³	2.253	(mg/m³)²
Zero drift from field test	$u_{d,z}$	1.156	mg/m³	1.336	(mg/m³)²
Span drift from field test	$u_{d,s}$	-2.972	mg/m³	8.833	(mg/m³)²
Influence of ambient temperature at span	u_t	2.843	mg/m³	8.083	(mg/m³)²
Influence of supply voltage	u_v	0.532	mg/m³	0.283	(mg/m³)²
Cross sensitivity (interference)	u_i	-0.859	mg/m³	0.737	(mg/m³)²
Influence of sample gas flow	u_p	0.370	mg/m³	0.137	(mg/m³)²
Uncertainty of reference material at 70% of certification range	u_{rm}	2.312	mg/m³	5.344	(mg/m³)²

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

Combined standard uncertainty (u_C)	$u_c = \sqrt{\sum (u_{max,j})^2}$	5.23	mg/m³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	10.26	mg/m³

Relative total expanded uncertainty	**U in % of the ELV 100 mg/m³**	**10.3**
Requirement of 2000/76/EC and 2001/80/EC	**U in % of the ELV 100 mg/m³**	**30.0**
Requirement of EN 15267-3	U in % of the ELV 100 mg/m³	22.5

** For this component no requirements in the EC-directives 2001/80/EG und 2000/76/EG are given.
The chosen value is recommended by the certification body.

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

Measuring system			
Manufacturer	Sick Maihak GmbH		
Name of measuring system	MAC GMS800 UNOR for N_2O		
Serial number of the candidates	TÜV 2 / TÜV 4		
Measuring principle	NDIR		
Test report	936/21217568/A		
Test laboratory	TÜV Rheinland		
Date of report	2011-10-18		
Measured component	N_2O		
Certification range	0 - 50	mg/m³	

Evaluation of the cross sensitivity (CS)
(system with largest CS)

Sum of positive CS at zero point	0.93	mg/m³
Sum of negative CS at zero point	-1.41	mg/m³
Sum of postive CS at reference point	0.00	mg/m³
Sum of negative CS at reference point	-0.65	mg/m³
Maximum sum of cross sensitivities	-1.41	mg/m³
Uncertainty of cross sensitivity	-0.814	mg/m³

Calculation of the combined standard uncertainty

Tested parameter		u		u²	
Standard deviation from paired measurements under field conditions *	u_D	0.410	mg/m³	0.168	(mg/m³)²
Lack of fit	u_{lof}	0.231	mg/m³	0.053	(mg/m³)²
Zero drift from field test	$u_{d,z}$	-0.318	mg/m³	0.101	(mg/m³)²
Span drift from field test	$u_{d,s}$	0.866	mg/m³	0.750	(mg/m³)²
Influence of ambient temperature at span	u_t	0.436	mg/m³	0.190	(mg/m³)²
Influence of supply voltage	u_v	0.172	mg/m³	0.030	(mg/m³)²
Cross sensitivity (interference)	u_i	-0.814	mg/m³	0.663	(mg/m³)²
Influence of sample gas flow	u_p	0.052	mg/m³	0.003	(mg/m³)²
Uncertainty of reference material at 70% of certification range	u_{rm}	0.404	mg/m³	0.163	(mg/m³)²

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

Combined standard uncertainty (u_C)	$u_c = \sqrt{\sum (u_{max,j})^2}$	1.46	mg/m³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	2.85	mg/m³

Relative total expanded uncertainty	**U in % of the range 50 mg/m³**	**5.7**
Requirement of 2000/76/EC and 2001/80/EC	**U in % of the range 50 mg/m³**	**20.0**
Requirement of EN 15267-3	U in % of the range 50 mg/m³	15.0

** For this component no requirements in the EC-directives 2001/80/EG und 2000/76/EG are given.
The chosen value is recommended by the certification body.

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

Measuring system			
Manufacturer	Sick Maihak GmbH		
Name of measuring system	MAC GMS800 UNOR for CO_2		
Serial number of the candidates	TÜV 1 / TÜV 3		
Measuring principle	NDIR		
Test report	936/21217568/A		
Test laboratory	TÜV Rheinland		
Date of report	2011-10-18		
Measured component	CO_2		
Certification range	0 - 25	Vol.-%	

Evaluation of the cross sensitivity (CS)
(system with largest CS)

Sum of positive CS at zero point	0.00	Vol.-%
Sum of negative CS at zero point	-0.47	Vol.-%
Sum of postive CS at reference point	0.00	Vol.-%
Sum of negative CS at reference point	0.00	Vol.-%
Maximum sum of cross sensitivities	-0.47	Vol.-%
Uncertainty of cross sensitivity	-0.271	Vol.-%

Calculation of the combined standard uncertainty

Tested parameter		u		u²	
Standard deviation from paired measurements under field conditions *	u_D	0.156	Vol.-%	0.024	(Vol.-%)²
Lack of fit	u_{lof}	-0.144	Vol.-%	0.021	(Vol.-%)²
Zero drift from field test	$u_{d,z}$	-0.188	Vol.-%	0.035	(Vol.-%)²
Span drift from field test	$u_{d,s}$	0.346	Vol.-%	0.120	(Vol.-%)²
Influence of ambient temperature at span	u_t	0.300	Vol.-%	0.090	(Vol.-%)²
Influence of supply voltage	u_v	0.049	Vol.-%	0.002	(Vol.-%)²
Cross sensitivity (interference)	u_i	-0.271	Vol.-%	0.074	(Vol.-%)²
Influence of sample gas flow	u_p	0.017	Vol.-%	0.000	(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 span" or
"Standard deviation from paired measurements under field conditions"

Combined standard uncertainty (u_C)	$u_c = \sqrt{\sum (u_{max,j})^2}$	0.64	Vol.-%
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	1.25	Vol.-%

Relative total expanded uncertainty	**U in % of the ELV 25 Vol.-%**	**5.0**
Requirement of 2000/76/EC and 2001/80/EC	**U in % of the ELV 25 Vol.-%**	**10.0**
Requirement of EN 15267-3	U in % of the ELV 25 Vol.-%	7.5

** For this component no requirements in the EC-directives 2001/80/EG und 2000/76/EG are given.
The chosen value is recommended by the certification body.

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

Measuring system			
Manufacturer		Sick Maihak GmbH	
Name of measuring system		MAC GMS800 MULTOR for CO_2	
Serial number of the candidates		TÜV 2 / TÜV 4	
Measuring principle		NDIR	
Test report		936/21217568/A	
Test laboratory		TÜV Rheinland	
Date of report		2011-10-18	
Measured component		CO_2	
Certification range		0 - 25	Vol.-%

Evaluation of the cross sensitivity (CS)					
(system with largest CS)					
Sum of positive CS at zero point			0.00	Vol.-%	
Sum of negative CS at zero point			0.00	Vol.-%	
Sum of postive CS at reference point			0.10	Vol.-%	
Sum of negative CS at reference point			-0.09	Vol.-%	
Maximum sum of cross sensitivities			0.10	Vol.-%	
Uncertainty of cross sensitivity			0.058	Vol.-%	

Calculation of the combined standard uncertainty						
Tested parameter		u			u²	
Standard deviation from paired measurements under field conditions *	u_D	0.165	Vol.-%	0.027	(Vol.-%)²
Lack of fit	u_{lof}	-0.237	Vol.-%	0.056	(Vol.-%)²
Zero drift from field test	$u_{d,z}$	-0.188	Vol.-%	0.035	(Vol.-%)²
Span drift from field test	$u_{d,s}$	0.433	Vol.-%	0.187	(Vol.-%)²
Influence of ambient temperature at span	u_t	0.115	Vol.-%	0.013	(Vol.-%)²
Influence of supply voltage	u_v	0.015	Vol.-%	0.000	(Vol.-%)²
Cross sensitivity (interference)	u_i	0.058	Vol.-%	0.003	(Vol.-%)²
Influence of sample gas flow	u_p	0.029	Vol.-%	0.001	(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 span" or
"Standard deviation from paired measurements under field conditions"

Combined standard uncertainty (u_C)	$u_c = \sqrt{\sum (u_{max,j})^2}$	0.60	Vol.-%
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	1.18	Vol.-%

Relative total expanded uncertainty	**U in % of the ELV 25 Vol.-%**	**4.7**
Requirement of 2000/76/EC and 2001/80/EC	**U in % of the ELV 25 Vol.-%**	**10.0**
Requirement of EN 15267-3	U in % of the ELV 25 Vol.-%	7.5

** For this component no requirements in the EC-directives 2001/80/EG und 2000/76/EG are given.
The chosen value is recommended by the certification body.

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

Measuring system			
Manufacturer	Sick Maihak GmbH		
Name of measuring system	MAC GMS800 OXOR-P for O_2		
Serial number of the candidates	TÜV 1 / TÜV 3		
Measuring principle	paramagnetic		
Test report	936/21217568/A		
Test laboratory	TÜV Rheinland		
Date of report	2011-10-18		
Measured component	O_2		
Certification range	0 -	25	Vol.-%

Evaluation of the cross sensitivity (CS)
(system with largest CS)

Sum of positive CS at zero point	0.00	Vol.-%
Sum of negative CS at zero point	0.00	Vol.-%
Sum of postive CS at reference point	0.00	Vol.-%
Sum of negative CS at reference point	0.00	Vol.-%
Maximum sum of cross sensitivities	0.00	Vol.-%
Uncertainty of cross sensitivity	0.000	Vol.-%

Calculation of the combined standard uncertainty

Tested parameter		u		u²	
Standard deviation from paired measurements under field conditions *	u_D	0.084	Vol.-%	0.007	(Vol.-%)²
Lack of fit	u_{lof}	-0.040	Vol.-%	0.002	(Vol.-%)²
Zero drift from field test	$u_{d,z}$	0.120	Vol.-%	0.014	(Vol.-%)²
Span drift from field test	$u_{d,s}$	0.120	Vol.-%	0.014	(Vol.-%)²
Influence of ambient temperature at span	u_t	0.110	Vol.-%	0.012	(Vol.-%)²
Influence of supply voltage	u_v	0.003	Vol.-%	0.000	(Vol.-%)²
Cross sensitivity (interference)	u_i	0.000	Vol.-%	0.000	(Vol.-%)²
Influence of sample gas flow	u_p	-0.023	Vol.-%	0.001	(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 span" or
"Standard deviation from paired measurements under field conditions"

Combined standard uncertainty (u_C)	$u_c = \sqrt{\sum (u_{max,j})^2}$	0.30	Vol.-%
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	0.59	Vol.-%

Relative total expanded uncertainty	**U in % of the range 25 Vol.-%**	**2.4**
Requirement of 2000/76/EC and 2001/80/EC	**U in % of the range 25 Vol.-%**	**10.0**
Requirement of EN 15267-3	U in % of the range 25 Vol.-%	7.5

** For this component no requirements in the EC-directives 2001/80/EG und 2000/76/EG are given.
The chosen value is recommended by the certification body.

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

Measuring system			
Manufacturer	Sick Maihak GmbH		
Name of measuring system	MAC GMS800 OXOR-E for O_2		
Serial number of the candidates	TÜV 2 / TÜV 4		
Measuring principle	electrochemical cell		
Test report	936/21217568/A		
Test laboratory	TÜV Rheinland		
Date of report	2011-10-18		
Measured component	O_2		
Certification range	0 - 25	Vol.-%	

Evaluation of the cross sensitivity (CS)
(system with largest CS)

Sum of positive CS at zero point	0.00	Vol.-%
Sum of negative CS at zero point	0.00	Vol.-%
Sum of postive CS at reference point	0.33	Vol.-%
Sum of negative CS at reference point	0.00	Vol.-%
Maximum sum of cross sensitivities	0.33	Vol.-%
Uncertainty of cross sensitivity	0.191	Vol.-%

Calculation of the combined standard uncertainty

Tested parameter		u		u²	
Standard deviation from paired measurements under field conditions *	u_D	0.108	Vol.-%	0.012	(Vol.-%)²
Lack of fit	u_{lof}	0.058	Vol.-%	0.003	(Vol.-%)²
Zero drift from field test	$u_{d,z}$	0.120	Vol.-%	0.014	(Vol.-%)²
Span drift from field test	$u_{d,s}$	0.120	Vol.-%	0.014	(Vol.-%)²
Influence of ambient temperature at span	u_t	0.127	Vol.-%	0.016	(Vol.-%)²
Influence of supply voltage	u_v	0.030	Vol.-%	0.001	(Vol.-%)²
Cross sensitivity (interference)	u_i	0.191	Vol.-%	0.036	(Vol.-%)²
Influence of sample gas flow	u_p	0.029	Vol.-%	0.001	(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 span" or
"Standard deviation from paired measurements under field conditions"

Combined standard uncertainty (u_C)	$u_c = \sqrt{\sum (u_{max,j})^2}$	0.37	Vol.-%
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	0.73	Vol.-%

Relative total expanded uncertainty	**U in % of the range 25 Vol.-%**	**2.9**
Requirement of 2000/76/EC and 2001/80/EC	**U in % of the range 25 Vol.-%**	**10.0**
Requirement of EN 15267-3	U in % of the range 25 Vol.-%	7.5

** For this component no requirements in the EC-directives 2001/80/EG und 2000/76/EG are given.
The chosen value is recommended by the certification body.