

CERTIFICATE

of Product Conformity (QAL1)

Certificate No: 0000025930_05

Certified AMS: PowerCEMS100 for CO, NO, NO₂, N₂O, SO₂, CH₄, CO₂ and O₂

Manufacturer: Endress+Hauser SICK GmbH+Co.KG
Bergener Ring 27
01458 Ottendorf-Okrilla
Germany

Test Institute: TÜV Rheinland Energy & Environment GmbH

**This is to certify that the AMS has been tested
and found to comply with the standards
EN 15267-1 (2009), EN 15267-2 (2023), EN 15267-3 (2007)
as well as EN 14181 (2004).**

Certification is awarded in respect of the conditions stated in this certificate
(this certificate contains 30 pages).

The present certificate replaces certificate 0000025930_04 dated 12 February 2020.



Suitability Tested
EN 15267
QAL1 Certified
Regular
Surveillance


www.tuv.com
ID 0000025930

Publication in the German Federal Gazette
(BAnz) of 2 March 2012

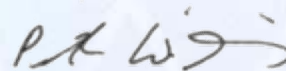
This certificate will expire on:
11 February 2030

German Environment Agency
Dessau, 10 February 2025

TÜV Rheinland Energy & Environment GmbH
Cologne, 9 February 2025



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51105 Köln

Test institute accredited to EN ISO/IEC 17025 by DAkkS (German Accreditation Body).
This accreditation is limited to the accreditation scope defined in the enclosure to the certificate D-PL-11120-02-00.

Test report:	936/21217568/A dated 18 October 2011
Initial certification:	12 February 2010
Expiry date:	11 February 2030
Certificate:	Renewal (of previous certificate 0000025930_04 of 12 February 2020 valid until 11 February 2025)
Publication:	BAnz. 02 March 2012, No. 36, p. 920, chapter I No. 5.1

Approved application

The tested AMS is suitable for use at plants according to Directive 2010/75/EC, chapter III (combustion plants / 13th BImSchV:2009), chapter IV (waste incineration plants / 17th BImSchV:2009), Directive 2015/2193/EC (44th BImSchV:2022), TA Luft:2002, 30th BImSchV:2009 and 27th BImSchV:1997. The measured ranges have been selected so as to ensure as broad a field of application as possible.

The suitability of the AMS for this application was assessed on the basis of a laboratory test and a 24 month field test at a power plant.

The AMS is approved for an ambient temperature range of +5 °C to 40 °C / with Air conditioning up to +50 °C.

The notification of suitability of the AMS, performance testing and the uncertainty calculation have been effected on the basis of the regulations applicable at the time of testing. As changes in legal provisions are possible, any potential user should ensure that this AMS is suitable for monitoring the emission limit values and oxygen concentration relevant to the application.

Any potential user should ensure, in consultation with the manufacturer, that this AMS is suitable for the installation at which it will be installed.

Note

The legal regulations mentioned correspond to the current state of legislation during certification. Each user should, if necessary, in consultation with the competent authority, ensure that this AMS meets the legal requirements for the intended use. In addition, it cannot be ruled out that legal regulations governing the use of a measuring device for emission monitoring may change during the lifetime of the certificate.

Basis of the certification

This certification is based on:

- Test report 936/21217568/A dated 18 October 2011 of TÜV Rheinland Energie und Umwelt GmbH
- Suitability announced by the German Federal Environment Agency (UBA) as the relevant body
- The ongoing surveillance of the product and the manufacturing process

Publication in the German Federal Gazette: BAnz. 02 March 2012, No. 36, p. 920, chapter I No. 5.1, Announcement by UBA dated 23 February 2012:

AMS designation:

Modular System MAC GMS800 for CO, NO, NO₂, SO₂, CH₄, N₂O, CO₂ and O₂

Manufacturer:

SICK MAIHAK GmbH, Reute

Field of application:

For plants requiring official approval and plants according to 27th BImSchV.

Measuring ranges during the performance test:

Component	Module	Certification range	supplementary measurement ranges		Unit
CO	MAC GMS800 UNOR for CO	0 – 75	0 – 750	0 – 3000	mg/m ³
	MAC GMS800 MULTOR for CO	0 – 200	0 – 2000	–	mg/m ³
NO	MAC GMS800 UNOR for NO	0 – 100	0 – 1000	0 – 2000	mg/m ³
	MAC GMS800 MULTOR for NO	0 – 250	0 – 2500	–	mg/m ³
	MAC GMS800 DEFOR for NO	0 – 50	0 – 1000	0 – 2000	mg/m ³
NO ₂	MAC GMS800 DEFOR for NO ₂	0 – 50	0 – 500	–	mg/m ³
NO _x	MAC GMS800 UNOR for NO _x	0 – 100	0 – 1000	0 – 2000	mg/m ³
	MAC GMS800 MULTOR for NO _x	0 – 250	0 – 2500	–	mg/m ³
SO ₂	MAC GMS800 UNOR for SO ₂	0 – 75	0 – 287	0 – 2000	mg/m ³
	MAC GMS800 MULTOR for SO ₂	0 – 250	0 – 2000	–	mg/m ³
	MAC GMS800 DEFOR for SO ₂	0 – 75	0 – 287	0 – 2000	mg/m ³
CH ₄	MAC GMS800 UNOR for CH ₄	0 – 50	0 – 500	–	mg/m ³
	MAC GMS800 MULTOR for CH ₄	0 – 286	0 – 500	–	mg/m ³
N ₂ O	MAC GMS800 UNOR for N ₂ O	0 – 50	0 – 500	–	mg/m ³
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. Functionality of the respective combination of modules shall be verified during the checks for proper installation.
2. The maintenance interval shall be determined during the check for proper installation.

Notes:

1. Automatic calibration of zero points shall be carried out with humidified ambient air for all components except for O₂ (OXOR-P and OXOR-E) once a week.
2. Automatic span point calibration for the OXOR-P and OXOR-E (O₂) sensors shall be carried out once a week with humidified ambient air.
3. With the help of external air conditioning the AMS also fulfils the requirements at an ambient air temperature of 50 °C.
4. The measuring system may be operated with cooler type MAK10-2 manufactured by AGT Thermotechnik as well as with type CSS-V2SK manufactured by M&C.
5. With weekly adjustments using the respective internal test gas cell or edge filter (NO₂ (DEFOR)), the maintenance intervals for the modules can be extended as follows:
 - one year for the modules CO (UNOR), CH₄ (UNOR and MULTOR)
 - half a year for the modules CO (MULTOR), NO (MULTOR), SO₂ (DEFOR)
 - three months for the modules NO (UNOR) und NO₂ (DEFOR)
6. Supplementary testing (extension of the maintenance interval by using internal test gas cells) as regards Federal Environment Agency notices of 12 July 2010 (BAnz. p. 2597, chapter I, No. 2.1) and of 10 January 2011 (BAnz. p. 294, chapter IV Notifications 2 and 30).

Test Institute: TÜV Rheinland Energie und Umwelt GmbH, Cologne

Report No.: 936/21217568/A dated 18 October 2011

Publication in the German Federal Gazette: BAnz AT 23.07.2013 B4, Chap. V notification 12, Announcement by UBA dated 3 July 2013:

12 Notification on announcements of the Federal Environment Agency (UBA) regarding performance tested AMS manufactured by SICK MAIHAK GmbH

Seq. no.	AMS / Manufacturer	Notice	Notification	Statement of test institute
12	MAC GMS800 / SICK AG	of 23 February 2012 (BAnz. p. 920, chapter I no. 5.1)	SICK MAIHAK GmbH merged with its parent company SICK AG as of 1 January 2013. The manufacturer is now registered as SICK AG.	Statement of TÜV Rheinland Energie und Umwelt GmbH of 25 März 2013

Publication in the German Federal Gazette: BAnz AT 23.07.2013 B4, Chap. V notification 13, Announcement by UBA dated 3 July 2013:

13 Notification on announcements of the Federal Environment Agency (UBA) regarding performance tested AMS manufactured by SICK Engineering GmbH and SICK AG

Seq. no.	AMS / Manufacturer	Notice	Notification	Statement of test institute
13	MAC GMS800 / SICK AG	as regards notification 12 (sequential no. 12) of this notice	The current software version of the SOPAS ET platform for optional AMS control is: SOPAS ET 2.38.	Statement of TÜV Rheinland Energie und Umwelt GmbH of 25 March 2013

Publication in the German Federal Gazette: BAnz AT 05.08.2014 B11, Chap. V notification 13, Announcement by UBA dated 17 July 2014:

13 Notification as regards Federal Environment Agency notices of 23 February 2012 (BAnz. p. 920, chapter 1, No. 5.1), of 3 July 2013 (BAnz AT 23 July 2013 B4, chapter V, notification 12 [no.12] and notification 13 [No. 13]) and of 27 February 2014 (BAnz AT 1 April 2014 B12, chapter V, correction 1)

The modular measuring system MAC GMS800 for CO, NO, NO₂, SO₂, CH₄, N₂O, CO₂ and O₂ manufactured by SICK AG may now also be equipped with the SCU-P100 display unit.

For the DEFOR module, an absorber cartridge is inserted into the measurement cell. The chopper motor S/N 6026930 is replaced by motor S/N 6030437.

The software versions for the individual modules of the MAC GMS800 modular measuring system for CO, NO, NO₂, SO₂, CH₄, N₂O, CO₂ and O₂ manufactured by SICK AG are:

BCU:	9150883_3.005 Y123
SCU-P100:	9158931_WI82
UNOR/MULTOR:	9137995_3.004 XN94
OXOR:	9138052_3.002 WM48
DEFOR:	9139736_3.003 WM48
Gas module:	9137582_3.002 WM48

Statement of TÜV Rheinland Energie und Umwelt GmbH of 2 April 2014

Publication in the German Federal Gazette: BAnz AT 14.03.2016 B7, Chap. V notification 34, Announcement by UBA dated 18 February 2016:

34 Notification as regards Federal Environment Agency (UBA) notices of 23 February 2012 (BAnz. p. 920, chapter I number 5.1) and of 17 July 2014 (BAnz AT 05.08.2014 B11, chapter V notification 13)

The modular measuring equipment MAC GMS800 for CO, NO, NO₂, SO₂, CH₄, N₂O, CO₂ and O₂ of SICK AG is now marketed under the name PowerCEMS100.

For standard applications of the PowerCEMS100, a 19"-rack-housing with (GMS810) or without integrated BCU (GMS811) is used.

In the modular PowerCEMS 100 system control of the entire measuring system will fully be realized via a central BCU as well as a central signal unit downstream. The separate measurement modules will no longer be connected to the SCU/BCU. They will separately be connected to the signal I/O-unit. The BCU is still connected to the measurement and I/O-modules via a CAN-bus.

Statement of TÜV Rheinland Energie und Umwelt GmbH of 9 October 2015

Publication in the German Federal Gazette: BAnz AT 15.03.2017 B6, Chap. V notification 25,
Announcement by UBA dated 22 February 2017:

**25 Notification as regards Federal Environment Agency (UBA) notices
of 23 February 2012 (BAnz. p. 920, chapter I number 5.1) and
of 18 February 2016 (BAnz AT 14.03.2016 B7, chapter V, notification 34)**

The BCU of the modular PowerCEMS100 measuring system for CO, NO, NO₂, SO₂, CH₄, N₂O, CO₂ and O₂ manufactured by SICK AG now provides a digital Modbus interface (RTU and TCP/IP) in accordance with VDI guideline 4201, parts 1 and 3. Test results are detailed in test report number 936/21236082/A of 10 October 2016 issued by TÜV Rheinland Energy GmbH.

The current BCU software version is
9150883_4.003 Aug 22 2016 1449.

Statement issued by TÜV Rheinland Energy GmbH dated 10 October 2016

Publication in the German Federal Gazette: BAnz AT 26.03.2018 B8, Chap. V notification 47,
Announcement by UBA dated 21 February 2018:

**47 Notification as regards Federal Environment Agency (UBA) notices
of 23 February 2012 (BAnz. p. 920, chapter I No. 5.1) and
of 22 February 2017 (BAnz AT 15.03.2017 B6, chapter V notification 25)**

The current software versions of the modular PowerCEMS100 measuring system for CO, NO, NO₂, SO₂, CH₄, N₂O, CO₂ and O₂ manufactured by SICK AG are as follows:

BCU:	9150883_4.003
SCU-P100:	9158931_YQK5
UNOR/MULTOR:	9137995_4.000
DEFOR:	9139736_4.002
OXOR	9138052_4.000
Gas module:	9134803_4.002

Statement issued by TÜV Rheinland Energy GmbH dated 2 October 2017

Publication in the German Federal Gazette: BAnz AT 26.03.2019 B7, Chap. IV
notification 59, Announcement by UBA dated 27 February 2019:

**59 Notification as regards Federal Environment Agency notices
of 23 February 2012 (BAnz. p. 920, chapter I number 5.1) and
of 21 February 2018 (BAnz AT 26.03.2018 B6, chapter V notification 47)**

The current software versions of the modular PowerCEMS100 measuring system
for CO, NO, NO₂, SO₂, CH₄, N₂O, CO₂ and O₂ manufactured by SICK AG are:

BCU:	9150883_4.003
UNOR/MULTOR:	9137995_4.001
DEFOR:	9139736_4.002
OXOR:	9138052_4.000
Gas module:	9134803_4.002

Statement issued by TÜV Rheinland Energy GmbH dated 2 October 2018

Publication in the German Federal Gazette: BAnz AT 24.03.2020 B7, Chap. IV
notification 61, Announcement by UBA dated 24 February 2020:

**61 Notification as regards Federal Environment Agency notices
of 23 February 2012 (BAnz. p. 920, chapter I number 5.1) and
of 27 February 2019 (BAnz AT 26.03.2019 B7, chapter IV notification 59)**

The current software versions of the modular PowerCEMS100 measuring system
for CO, NO, NO₂, SO₂, CH₄, N₂O, CO₂ and O₂ manufactured by SICK AG are:

BCU:	9150883_4.003
UNOR/MULTOR:	9137995_4.002
DEFOR:	9139736_4.002
OXOR:	9138052_4.000
Gasmodul:	9134803_4.002.

Statement issued by TÜV Rheinland Energy GmbH dated 19. September 2019

Publication in the German Federal Gazette: BAnz AT 03.05.2021 B9, Chap. III
notification 56, Announcement by UBA dated 31 March 2021:

**56 Notification as regards Federal Environment Agency (UBA) notices
of 23 February 2012 (BAnz. p. 920, chapter I number 5.1) and
of 27 February 2019 (BAnz AT 26.03.2019 B7, chapter IV notification 59)**

The PowerCEMS100 modular measuring system manufactured by SICK AG can, in future, be equipped with a housing flushing by means of inert gas or clean air for the measuring module GMS800 DEFOR when installed in areas with polluted ambient air. This flushing can be done either for the whole 19" housing or for the filter wheel housing. Corresponding constructive adjustments were made to the housings for the connection of the coil air.

Statement issued by TÜV Rheinland Energy GmbH dated 18 September 2020

Publication in the German Federal Gazette: BAnz AT 05.08.2021 B5, Chap. IV
notification 47, Announcement by UBA dated 29 June 2021:

**47 Notification as regards Federal Environment Agency (UBA) notices
of 23 February 2012 (BAnz. p. 920, chapter I number 5.1) and
of 31 March 2021 (BAnz AT 03.05.2021 B9, chapter III notification 56)**

The latest software versions of the Power-CEMS100 modular measuring system for CO, NO, NO₂, SO₂, CH₄, N₂O, CO₂ and O₂ manufactured by SICK AG are:

BCU:	9150883_4.004,
UNOR/MULTOR:	9137995_4.002,
DEFOR:	9139736_4.003,
OXOR:	9138052_4.001,
Gas module:	9134803_4.003

Statement issued by TÜV Rheinland Energy GmbH dated 03 May 2021

Publication in the German Federal Gazette: BAnz AT 28.07.2022 B4, Chap. III notification 28, Announcement by UBA dated 28 June 2022:

28 Notification as regards Federal Environment Agency (UBA) notices of 23 February 2012 (BAnz. p. 920, chapter I number 5.1) and of 29 June 2021 (BAnz AT 05.08.2021 B5, chapter IV notification 47)

The current software versions of the modular measuring device Power-CEMS100 for CO, NO, NO₂, SO₂, CH₄, N₂O, CO₂ and O₂ from SICK AG are:

BCU:	9150883_4.005
UNOR/MULTOR:	9137995_4.002
DEFOR:	9139736_4.003
OXOR:	9138052_4.001
Gas module:	9134803_4.003

Statement issued by TÜV Rheinland Energy GmbH dated 14 February 2022

Publication in the German Federal Gazette: BAnz AT 20.03.2023 B6, Chap. IV notification 44, Announcement by UBA dated 21 February 2023:

44 Notification as regards Federal Environment Agency (UBA) notices of 23 February 2012 (BAnz. p. 920, chapter I number 5.1) and of 28 June 2022 (BAnz AT 28.07.2022 B4, chapter III notification 28)

The current software versions of the Power-CEMS100 modular measuring system for CO, NO, NO₂, SO₂, CH₄, N₂O, CO₂ and O₂ from SICK AG are:

BCU:	9150883_4.006
UNOR/MULTOR:	9137995_4.002
DEFOR:	9139736_4.003
OXOR:	9138052_4.001
gas module:	9134803_4.003

Statement issued by TÜV Rheinland Energy GmbH dated 16 September 2022

Publication in the German Federal Gazette: BAnz AT 31.10.2024 B9, Chap. IV notification 40, Announcement by UBA dated 31 August 2024:

40 Notification as regards Federal Environment Agency (UBA) notices of 23 February 2012 (BAnz. p. 920, chapter I number 5.1) and of 21 February 2023 (BAnz AT 20.03.2023 B6, chapter IV notification 44))

The current software versions of the Power-CEMS100 modular measuring system for CO, NO, NO₂, SO₂, CH₄, N₂O, CO₂ and O₂ from SICK AG are:

BCU:	9150883_4.006
UNOR/MULTOR:	9137995_4.002
DEFOR:	9139736_4.004
OXOR:	9138052_4.001
Gasmodul:	9134803_4.003

In the future, the DEFOR module can also be equipped with alternative interference filters with the article numbers 5347371 and 5347372 for NO₂ measurement.

Statement issued by TÜV Rheinland Energy & Environment GmbH
dated 4 March 2024

Certified product

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

The multi-component measuring system PowerCEMS100 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 measuring system can be equipped according to different requirements, each with appropriate measurement modules.

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

All gas sensor modules are connected by a BUS-system. The BUS system continuously outputs the measured values determined. It also allows to activate control functions of the sensor modules or read and, where necessary, change sensor parameters.

The following components are part of the complete system:

- heated probe (M&C SP 2000) with heated filter, test gas supply function and back purging,
- heated sample gas line (a heated line with a length of 10 m was used during the laboratory test, during the field test 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 Energy & Environment GmbH must be notified at the address given on page 1.

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

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

The relevant version of this certificate and its expiration is also accessible on the internet: qal1.de.

History of documents

Certification of PowerCEMS100 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_00: 12 February 2010
Expiry date of the certificate: 11 February 2015
Test report: 936/21211670/A dated 29 October 2009
TÜV Rheinland Immissionsschutz und Energiesysteme GmbH
Publication: BAnz. 12 February 2010, No. 24, p. 553, chapter I number 1.2
UBA announcement dated 25 January 2010

Supplementary testing according to EN 15267

Certificate No. 0000025930_01: 2 August 2010
Expiry date of the certificate: 11 February 2015
Test report: 936/21211670/B dated 26 March 2010
TÜV Rheinland Immissionsschutz und Energiesysteme GmbH
Publication: BAnz. 28 July 2010, No. 111, p. 2597, chapter I number 2.1
UBA announcement dated 12 July 2010

Notifications

Statement issued by TÜV Rheinland Energie und Umwelt GmbH dated 24 September 2010
Publication: BAnz. 26 January 2011, No. 14, p. 294, chapter IV notification 2
UBA announcement dated 10 January 2011
(Changing system name + extension of components)

Statement issued by TÜV Rheinland Energie und Umwelt GmbH dated 8 November 2010
Publication: BAnz. 26 January 2011, No. 14, p. 294, chapter IV notification 30
UBA announcement dated 10 January 2011
(Software changes)

Supplementary testing according to EN 15267

Certificate No. 0000025930_02: 16 March 2012
Expiry date of the certificate: 12 February 2010
Test report: 936/21217568/A dated 18 October 2011
TÜV Rheinland Energie und Umwelt GmbH
Publication: BAnz. 02 March 2012, No. 36, p. 920, chapter I number 5.1
UBA announcement dated 23 February 2012

Notifications

Statement issued by TÜV Rheinland Energie und Umwelt GmbH dated 25 March 2013
Publication: BAnz AT 23.07.2013 B4, chapter V notification 12, Seq. No. 12
UBA announcement dated 3 July 2013
(New manufacturer name)

Statement issued by TÜV Rheinland Energie und Umwelt GmbH dated 25 March 2013
Publication: BAnz AT 23.07.2013 B4, chapter V notification 13, Seq. No. 13
UBA announcement dated 3 July 2013
(Software changes)

Statement issued by TÜV Rheinland Energie und Umwelt GmbH dated 2 April 2014
Publication: BAnz AT 05.08.2014 B11, chapter V notification 13
UBA announcement dated 17 July 2014
(Soft- and hardware changes)

Renewal of certificates

Certificate No. 0000025930_03: 2 February 2015
Expiry date of the certificate: 11 February 2020

Notifications

Statement issued by TÜV Rheinland Energie und Umwelt GmbH dated 9 October 2015
Publication: BAnz AT 14.03.2016 B7, chapter V notification 34
UBA announcement dated 18 February 2016
(Hardware changes and new system name)

Statement issued by TÜV Rheinland Energy GmbH dated 10 October 2016
Publication: BAnz AT 15.03.2017 B6, chapter V notification 25
UBA announcement dated 22 February 2017
(Software changes and extension for digital data communication - Modbus RTU and TCP/IP)

Statement issued by TÜV Rheinland Energy GmbH dated 2 October 2017
Publication: BAnz AT 26.03.2018 B8, chapter V notification 47
UBA announcement dated 21 February 2018
(Software changes)

Statement issued by TÜV Rheinland Energy GmbH dated 2 October 2018
Publication: BAnz AT 26.03.2019 B7, chapter IV notification 59
UBA announcement dated 27 February 2019
(software changes)

Renewal of certificates

Certificate No. 0000025930_04: 12 February 2020
Expiry date of the certificate: 11 February 2025

Notifications

Statement issued by TÜV Rheinland Energy GmbH dated 19 September 2019
Publication: BAnz AT 24.03.2020 B7, chapter IV notification 61
UBA announcement dated 24 February 2020
(Software changes)

Statement issued by TÜV Rheinland Energy GmbH dated 18 September 2020
Publication: BAnz AT 03.05.2021 B9, chapter III notification 56
UBA announcement dated 31 March 2021
(Hardware changes)

Statement issued by TÜV Rheinland Energy GmbH dated 3 May 2021
Publication: BAnz AT 05.08.2021 B5, chapter IV notification 47
UBA announcement dated 29 June 2021
(Software changes)

Statement issued by TÜV Rheinland Energy GmbH dated 14 February 2022
Publication: BAnz AT 28.07.2022 B4, chapter III notification 28
UBA announcement dated 28 June 2022
(Software changes)

Statement issued by TÜV Rheinland Energy GmbH dated 16 September 2022
Publication: BAnz AT 20.03.2023 B6, chapter IV notification 44
UBA announcement dated 21 February 2023
(Software changes)

Statement issued by TÜV Rheinland Energy & Environment GmbH dated 4 March 2024
Publication: BAnz AT 31.10.2025 B9, chapter IV notification 40
UBA announcement dated 1. Juli 2025
(Soft- and Hardware changes)

Renewal of certificates

Certificate No. 0000025930_05: 12 February 2025
Expiry date of the certificate: 11 February 2030

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

Test laboratory	936/21217568/A
Date of report	TÜV Rheinland
	2011-10-18

Measured component

Certification range	CO	0 - 75 mg/m ³
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Evaluation of the cross sensitivity (CS)

(system with largest CS)

Sum of positive CS at zero point	1.80 mg/m ³
Sum of negative CS at zero point	-1.30 mg/m ³
Sum of positive CS at reference point	1.07 mg/m ³
Sum of negative CS at reference point	0.00 mg/m ³
Maximum sum of cross sensitivities	1.80 mg/m ³
Uncertainty of cross sensitivity	1.039 mg/m ³

Calculation of the combined standard uncertainty

Tested parameter

	u	u ²
Standard deviation from paired measurements under field conditions *	u_D 0.747 mg/m ³	0.558 (mg/m ³) ²
Lack of fit	u_{lof} 0.289 mg/m ³	0.084 (mg/m ³) ²
Zero drift from field test	$u_{d,z}$ 0.346 mg/m ³	0.120 (mg/m ³) ²
Span drift from field test	$u_{d,s}$ 0.866 mg/m ³	0.750 (mg/m ³) ²
Influence of ambient temperature at span	u_t 0.751 mg/m ³	0.564 (mg/m ³) ²
Influence of supply voltage	u_v 0.115 mg/m ³	0.013 (mg/m ³) ²
Cross sensitivity (interference)	u_i 1.039 mg/m ³	1.080 (mg/m ³) ²
Influence of sample gas flow	u_b -0.029 mg/m ³	0.001 (mg/m ³) ²
Uncertainty of reference material at 70% of certification range	u_{rm} 0.606 mg/m ³	0.368 (mg/m ³) 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/m ³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	3.69 mg/m ³

Relative total expanded uncertainty

Requirement of 2000/76/EC and 2001/80/EC	U in % of the ELV 50 mg/m ³	7.4
Requirement of EN 15267-3	U in % of the ELV 50 mg/m ³	10.0
	U in % of the ELV 50 mg/m ³	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

Test laboratory	936/21217568/A TÜV Rheinland
Date of report	2011-10-18

Measured component

Certification range	CO 0 - 200 mg/m ³
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Evaluation of the cross sensitivity (CS)

(system with largest CS)

Sum of positive CS at zero point	0.00 mg/m ³
Sum of negative CS at zero point	0.00 mg/m ³
Sum of positive CS at reference point	6.76 mg/m ³
Sum of negative CS at reference point	0.00 mg/m ³
Maximum sum of cross sensitivities	6.76 mg/m ³
Uncertainty of cross sensitivity	3.903 mg/m ³

Calculation of the combined standard uncertainty

Tested parameter

	u	u ²
Standard deviation from paired measurements under field conditions *	u _D 1.588 mg/m ³	2.522 (mg/m ³) ²
Lack of fit	u _{lof} 1.155 mg/m ³	1.334 (mg/m ³) ²
Zero drift from field test	u _{d,z} 0.924 mg/m ³	0.854 (mg/m ³) ²
Span drift from field test	u _{d,s} -3.002 mg/m ³	9.012 (mg/m ³) ²
Influence of ambient temperature at span	u _t 2.406 mg/m ³	5.789 (mg/m ³) ²
Influence of supply voltage	u _v 0.157 mg/m ³	0.025 (mg/m ³) ²
Cross sensitivity (interference)	u _i 3.903 mg/m ³	15.233 (mg/m ³) ²
Influence of sample gas flow	u _b 0.127 mg/m ³	0.016 (mg/m ³) ²
Uncertainty of reference material at 70% of certification range	u _{rm} 1.617 mg/m ³	2.613 (mg/m ³) 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)

$$u_c = \sqrt{\sum (u_{max,j})^2} = 6.12 \text{ mg/m}^3$$

Total expanded uncertainty

$$U = u_c \cdot k = u_c \cdot 1.96 = 11.99 \text{ mg/m}^3$$

Relative total expanded uncertainty

Requirement of 2000/76/EC and 2001/80/EC
Requirement of EN 15267-3

U in % of the ELV 160 mg/m ³	7.5
U in % of the ELV 160 mg/m ³	10.0
U in % of the ELV 160 mg/m ³	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

Test laboratory	936/21217568/A TÜV Rheinland
Date of report	2011-10-18

Measured component

Certification range	NO 0 - 100 mg/m ³
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Evaluation of the cross sensitivity (CS)

(system with largest CS)

Sum of positive CS at zero point	1.56 mg/m ³
Sum of negative CS at zero point	0.00 mg/m ³
Sum of positive CS at reference point	2.46 mg/m ³
Sum of negative CS at reference point	-0.73 mg/m ³
Maximum sum of cross sensitivities	2.46 mg/m ³
Uncertainty of cross sensitivity	1.420 mg/m ³

Calculation of the combined standard uncertainty

Tested parameter

	u	u ²
Standard deviation from paired measurements under field conditions *	u _D 1.191 mg/m ³	1.418 (mg/m ³) ²
Lack of fit	u _{lor} 0.231 mg/m ³	0.053 (mg/m ³) ²
Zero drift from field test	u _{d,z} -1.212 mg/m ³	1.469 (mg/m ³) ²
Span drift from field test	u _{d,s} 1.732 mg/m ³	3.000 (mg/m ³) ²
Influence of ambient temperature at span	u _t 0.529 mg/m ³	0.280 (mg/m ³) ²
Influence of supply voltage	u _v 0.142 mg/m ³	0.020 (mg/m ³) ²
Cross sensitivity (interference)	u _i 1.420 mg/m ³	2.017 (mg/m ³) ²
Influence of sample gas flow	u _b -0.104 mg/m ³	0.011 (mg/m ³) ²
Uncertainty of reference material at 70% of certification range	u _{rm} 0.808 mg/m ³	0.653 (mg/m ³) 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)

$$u_c = \sqrt{\sum (u_{max,j})^2} \quad 2.99 \text{ mg/m}^3$$

Total expanded uncertainty

$$U = u_c * k = u_c * 1.96 \quad 5.85 \text{ mg/m}^3$$

Relative total expanded uncertainty

Requirement of 2000/76/EC and 2001/80/EC

Requirement of EN 15267-3

U in % of the ELV 50 mg/m³ 11.7

U in % of the ELV 50 mg/m³ 20.0

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

Test laboratory	936/21217568/A TÜV Rheinland
Date of report	2011-10-18

Measured component

Certification range	NO 0 - 250 mg/m ³
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Evaluation of the cross sensitivity (CS)

(system with largest CS)

Sum of positive CS at zero point	8.95 mg/m ³
Sum of negative CS at zero point	-4.43 mg/m ³
Sum of positive CS at reference point	3.45 mg/m ³
Sum of negative CS at reference point	-3.65 mg/m ³
Maximum sum of cross sensitivities	8.95 mg/m ³
Uncertainty of cross sensitivity	5.167 mg/m ³

Calculation of the combined standard uncertainty

Tested parameter

	u	u ²
Standard deviation from paired measurements under field conditions *	u_D 2.241 mg/m ³	5.022 (mg/m ³) ²
Lack of fit	u_{lof} -1.155 mg/m ³	1.334 (mg/m ³) ²
Zero drift from field test	$u_{d,z}$ 2.742 mg/m ³	7.519 (mg/m ³) ²
Span drift from field test	$u_{d,s}$ 4.186 mg/m ³	17.523 (mg/m ³) ²
Influence of ambient temperature at span	u_t 0.950 mg/m ³	0.903 (mg/m ³) ²
Influence of supply voltage	u_v 0.737 mg/m ³	0.543 (mg/m ³) ²
Cross sensitivity (interference)	u_i 5.167 mg/m ³	26.701 (mg/m ³) ²
Influence of sample gas flow	u_b 0.277 mg/m ³	0.077 (mg/m ³) ²
Uncertainty of reference material at 70% of certification range	u_{rm} 2.021 mg/m ³	4.083 (mg/m ³) 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)

$$u_c = \sqrt{\sum (u_{max,j})^2} = 7.98 \text{ mg/m}^3$$

Total expanded uncertainty

$$U = u_c \cdot k = u_c \cdot 1.96 = 15.64 \text{ mg/m}^3$$

Relative total expanded uncertainty

Requirement of 2000/76/EC and 2001/80/EC

Requirement of EN 15267-3

U in % of the ELV 131 mg/m³ 11.9

U in % of the ELV 131 mg/m³ 20.0

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

Test laboratory	936/21217568/A TÜV Rheinland
Date of report	2011-10-18

Measured component

Certification range	NO 0 - 50 mg/m ³
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Evaluation of the cross sensitivity (CS)

(system with largest CS)

Sum of positive CS at zero point	1.86 mg/m ³
Sum of negative CS at zero point	0.00 mg/m ³
Sum of positive CS at reference point	1.06 mg/m ³
Sum of negative CS at reference point	-0.94 mg/m ³
Maximum sum of cross sensitivities	1.86 mg/m ³
Uncertainty of cross sensitivity	1.074 mg/m ³

Calculation of the combined standard uncertainty

Tested parameter

	u	u ²
Standard deviation from paired measurements under field conditions *	u_D 0.751 mg/m ³	0.564 (mg/m ³) ²
Lack of fit	u_{lof} -0.115 mg/m ³	0.013 (mg/m ³) ²
Zero drift from field test	$u_{d,z}$ 0.375 mg/m ³	0.141 (mg/m ³) ²
Span drift from field test	$u_{d,s}$ 0.866 mg/m ³	0.750 (mg/m ³) ²
Influence of ambient temperature at span	u_t 0.153 mg/m ³	0.023 (mg/m ³) ²
Influence of supply voltage	u_v 0.233 mg/m ³	0.054 (mg/m ³) ²
Cross sensitivity (interference)	u_i 1.074 mg/m ³	1.153 (mg/m ³) ²
Influence of sample gas flow	u_b 0.052 mg/m ³	0.003 (mg/m ³) ²
Uncertainty of reference material at 70% of certification range	u_{rm} 0.404 mg/m ³	0.163 (mg/m ³) 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)

$$u_c = \sqrt{\sum (u_{max,j})^2} \quad 1.69 \text{ mg/m}^3$$

Total expanded uncertainty

$$U = u_c \cdot k = u_c \cdot 1.96 \quad 3.32 \text{ mg/m}^3$$

Relative total expanded uncertainty

Requirement of 2000/76/EC and 2001/80/EC

Requirement of EN 15267-3

U in % of the ELV 30 mg/m³ 11.1

U in % of the ELV 30 mg/m³ 20.0

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

Test laboratory	936/21217568/A TÜV Rheinland
Date of report	2011-10-18

Measured component

Certification range	NO ₂ 0 - 50 mg/m ³
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Evaluation of the cross sensitivity (CS)

(system with largest CS)

Sum of positive CS at zero point	1.72 mg/m ³
Sum of negative CS at zero point	0.00 mg/m ³
Sum of positive CS at reference point	1.93 mg/m ³
Sum of negative CS at reference point	-0.26 mg/m ³
Maximum sum of cross sensitivities	1.93 mg/m ³
Uncertainty of cross sensitivity	1.114 mg/m ³

Calculation of the combined standard uncertainty

Tested parameter

	u	u ²
Repeatability standard deviation at set point *	u _r 0.520 mg/m ³	0.270 (mg/m ³) ²
Lack of fit	u _{lof} -0.231 mg/m ³	0.053 (mg/m ³) ²
Zero drift from field test	u _{d,z} -0.693 mg/m ³	0.480 (mg/m ³) ²
Span drift from field test	u _{d,s} 0.866 mg/m ³	0.750 (mg/m ³) ²
Influence of ambient temperature at span	u _t 0.458 mg/m ³	0.210 (mg/m ³) ²
Influence of supply voltage	u _v 0.110 mg/m ³	0.012 (mg/m ³) ²
Cross sensitivity (interference)	u _i 1.114 mg/m ³	1.242 (mg/m ³) ²
Influence of sample gas flow	u _b 0.030 mg/m ³	0.001 (mg/m ³) ²
Uncertainty of reference material at 70% of certification range	u _{rm} 0.404 mg/m ³	0.163 (mg/m ³) 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)

$$u_c = \sqrt{\sum (u_{max,j})^2} \quad 1.78 \text{ mg/m}^3$$

Total expanded uncertainty

$$U = u_c \cdot k = u_c \cdot 1.96 \quad 3.50 \text{ mg/m}^3$$

Relative total expanded uncertainty

Requirement of 2000/76/EC and 2001/80/EC
Requirement of EN 15267-3

U in % of the ELV 50 mg/m ³	7.0
U in % of the ELV 50 mg/m ³	20.0
U in % of the ELV 50 mg/m ³	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

Test laboratory	936/21217568/A TÜV Rheinland
Date of report	2011-10-18

Measured component

Certification range	SO ₂ 0 - 75 mg/m ³
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Evaluation of the cross sensitivity (CS)

(system with largest CS)

Sum of positive CS at zero point	2.75 mg/m ³
Sum of negative CS at zero point	-1.75 mg/m ³
Sum of positive CS at reference point	2.30 mg/m ³
Sum of negative CS at reference point	-1.82 mg/m ³
Maximum sum of cross sensitivities	2.75 mg/m ³
Uncertainty of cross sensitivity	1.585 mg/m ³

Calculation of the combined standard uncertainty

Tested parameter

	u	u ²
Standard deviation from paired measurements under field conditions *	u _D 1.228 mg/m ³	1.508 (mg/m ³) ²
Lack of fit	u _{lof} 0.410 mg/m ³	0.168 (mg/m ³) ²
Zero drift from field test	u _{d,z} -1.212 mg/m ³	1.469 (mg/m ³) ²
Span drift from field test	u _{d,s} 1.299 mg/m ³	1.687 (mg/m ³) ²
Influence of ambient temperature at span	u _t 0.929 mg/m ³	0.863 (mg/m ³) ²
Influence of supply voltage	u _v 0.227 mg/m ³	0.052 (mg/m ³) ²
Cross sensitivity (interference)	u _i 1.585 mg/m ³	2.512 (mg/m ³) ²
Influence of sample gas flow	u _b 0.057 mg/m ³	0.003 (mg/m ³) ²
Uncertainty of reference material at 70% of certification range	u _{rm} 0.606 mg/m ³	0.368 (mg/m ³) 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)

$$u_c = \sqrt{\sum (u_{max,j})^2} \quad 2.94 \text{ mg/m}^3$$

Total expanded uncertainty

$$U = u_c * k = u_c * 1.96 \quad 5.76 \text{ mg/m}^3$$

Relative total expanded uncertainty

Requirement of 2000/76/EC and 2001/80/EC

Requirement of EN 15267-3

U in % of the ELV 50 mg/m³ 11.5

U in % of the ELV 50 mg/m³ 20.0

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

Test laboratory	936/21217568/A TÜV Rheinland
Date of report	2011-10-18

Measured component

Certification range	SO ₂ 0 - 250 mg/m ³
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Evaluation of the cross sensitivity (CS)

(system with largest CS)

Sum of positive CS at zero point	9.63 mg/m ³
Sum of negative CS at zero point	-2.65 mg/m ³
Sum of positive CS at reference point	5.93 mg/m ³
Sum of negative CS at reference point	-1.20 mg/m ³
Maximum sum of cross sensitivities	9.63 mg/m ³
Uncertainty of cross sensitivity	5.557 mg/m ³

Calculation of the combined standard uncertainty

Tested parameter

	u	u ²
Standard deviation from paired measurements under field conditions *	u _D 1.546 mg/m ³	2.390 (mg/m ³) ²
Lack of fit	u _{lof} -2.714 mg/m ³	7.366 (mg/m ³) ²
Zero drift from field test	u _{d,z} 2.115 mg/m ³	4.473 (mg/m ³) ²
Span drift from field test	u _{d,s} -3.002 mg/m ³	9.012 (mg/m ³) ²
Influence of ambient temperature at span	u _t 2.901 mg/m ³	8.416 (mg/m ³) ²
Influence of supply voltage	u _v 0.839 mg/m ³	0.704 (mg/m ³) ²
Cross sensitivity (interference)	u _i 5.557 mg/m ³	30.880 (mg/m ³) ²
Influence of sample gas flow	u _b -0.410 mg/m ³	0.168 (mg/m ³) ²
Uncertainty of reference material at 70% of certification range	u _{rm} 2.021 mg/m ³	4.083 (mg/m ³) 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)

$$u_c = \sqrt{\sum (u_{max,j})^2} \quad 8.22 \text{ mg/m}^3$$

Total expanded uncertainty

$$U = u_c \cdot k = u_c \cdot 1.96 \quad 16.10 \text{ mg/m}^3$$

Relative total expanded uncertainty

Requirement of 2000/76/EC and 2001/80/EC

Requirement of EN 15267-3

U in % of the ELV 150 mg/m³ **10.7**

U in % of the ELV 150 mg/m³ **20.0**

U in % of the ELV 150 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 SO ₂
Serial number of the candidates	TÜV 2 / TÜV 4
Measuring principle	UVRAS

Test report

Test laboratory	936/21217568/A TÜV Rheinland
Date of report	2011-10-18

Measured component

Certification range	SO ₂ 0 - 75 mg/m ³
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Evaluation of the cross sensitivity (CS)

(system with largest CS)

Sum of positive CS at zero point	0.00 mg/m ³
Sum of negative CS at zero point	-0.81 mg/m ³
Sum of positive CS at reference point	0.35 mg/m ³
Sum of negative CS at reference point	-2.91 mg/m ³
Maximum sum of cross sensitivities	-2.91 mg/m ³
Uncertainty of cross sensitivity	-1.680 mg/m ³

Calculation of the combined standard uncertainty

Tested parameter

	u	u ²
Standard deviation from paired measurements under field conditions *	u _D 1.206 mg/m ³	1.454 (mg/m ³) ²
Lack of fit	u _{lof} -0.404 mg/m ³	0.163 (mg/m ³) ²
Zero drift from field test	u _{d,z} -0.606 mg/m ³	0.367 (mg/m ³) ²
Span drift from field test	u _{d,s} 1.299 mg/m ³	1.687 (mg/m ³) ²
Influence of ambient temperature at span	u _t 0.964 mg/m ³	0.929 (mg/m ³) ²
Influence of supply voltage	u _v 0.067 mg/m ³	0.004 (mg/m ³) ²
Cross sensitivity (interference)	u _i -1.680 mg/m ³	2.823 (mg/m ³) ²
Uncertainty of reference material at 70% of certification range	u _{rm} 0.606 mg/m ³	0.368 (mg/m ³) 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)

$$u_c = \sqrt{\sum (u_{max,j})^2} \quad 2.79 \text{ mg/m}^3$$

Total expanded uncertainty

$$U = u_c \cdot k = u_c \cdot 1.96 \quad 5.47 \text{ mg/m}^3$$

Relative total expanded uncertainty

Requirement of 2000/76/EC and 2001/80/EC

Requirement of EN 15267-3

U in % of the ELV 50 mg/m³ 10.9

U in % of the ELV 50 mg/m³ 20.0

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

Test laboratory	936/21217568/A TÜV Rheinland
Date of report	2011-10-18

Measured component

Certification range	CH ₄ 0 - 50 mg/m ³
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Evaluation of the cross sensitivity (CS)

(system with largest CS)

Sum of positive CS at zero point	0.48 mg/m ³
Sum of negative CS at zero point	-1.77 mg/m ³
Sum of positive CS at reference point	0.00 mg/m ³
Sum of negative CS at reference point	-0.63 mg/m ³
Maximum sum of cross sensitivities	-1.77 mg/m ³
Uncertainty of cross sensitivity	-1.022 mg/m ³

Calculation of the combined standard uncertainty

Tested parameter

	u	u ²
Repeatability standard deviation at set point *	u _r 0.630 mg/m ³	0.397 (mg/m ³) ²
Lack of fit	u _{inf} 0.231 mg/m ³	0.053 (mg/m ³) ²
Zero drift from field test	u _{d,z} 0.520 mg/m ³	0.270 (mg/m ³) ²
Span drift from field test	u _{d,s} 0.635 mg/m ³	0.403 (mg/m ³) ²
Influence of ambient temperature at span	u _t 0.416 mg/m ³	0.173 (mg/m ³) ²
Influence of supply voltage	u _v 0.306 mg/m ³	0.094 (mg/m ³) ²
Cross sensitivity (interference)	u _i -1.022 mg/m ³	1.044 (mg/m ³) ²
Influence of sample gas flow	u _b -0.035 mg/m ³	0.001 (mg/m ³) ²
Uncertainty of reference material at 70% of certification range	u _{rm} 0.404 mg/m ³	0.163 (mg/m ³) 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/m ³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	3.16 mg/m ³

Relative total expanded uncertainty

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

** For this component no requirements in the EC-directives 2001/80/EG und 2000/76/EG are given.
A value of 30 % was used for this.

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

Test laboratory	936/21217568/A TÜV Rheinland
Date of report	2011-10-18

Measured component

Certification range	CH ₄ 0 - 286 mg/m ³
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Evaluation of the cross sensitivity (CS)

(system with largest CS)

Sum of positive CS at zero point	0.00 mg/m ³
Sum of negative CS at zero point	0.00 mg/m ³
Sum of positive CS at reference point	1.06 mg/m ³
Sum of negative CS at reference point	-1.49 mg/m ³
Maximum sum of cross sensitivities	-1.49 mg/m ³
Uncertainty of cross sensitivity	-0.859 mg/m ³

Calculation of the combined standard uncertainty

Tested parameter

	u	u ²
Repeatability standard deviation at set point *	u _r 0.620 mg/m ³	0.384 (mg/m ³) ²
Lack of fit	u _{lof} -1.501 mg/m ³	2.253 (mg/m ³) ²
Zero drift from field test	u _{dz} 1.156 mg/m ³	1.336 (mg/m ³) ²
Span drift from field test	u _{ds} -2.972 mg/m ³	8.833 (mg/m ³) ²
Influence of ambient temperature at span	u _t 2.843 mg/m ³	8.083 (mg/m ³) ²
Influence of supply voltage	u _v 0.532 mg/m ³	0.283 (mg/m ³) ²
Cross sensitivity (interference)	u _i -0.859 mg/m ³	0.737 (mg/m ³) ²
Influence of sample gas flow	u _n 0.370 mg/m ³	0.137 (mg/m ³) ²
Uncertainty of reference material at 70% of certification range	u _{rm} 2.312 mg/m ³	5.344 (mg/m ³) 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)	$u_c = \sqrt{\sum (u_{max,i})^2}$	5.23 mg/m ³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	10.26 mg/m ³

Relative total expanded uncertainty

Requirement of 2000/76/EC and 2001/80/EC

Requirement of EN 15267-3

U in % of the ELV 100 mg/m ³	10.3
U in % of the ELV 100 mg/m ³	30.0 **
U in % of the ELV 100 mg/m ³	22.5

** For this component no requirements in the EC-directives 2001/80/EG und 2000/76/EG are given.
A value of 30 % was used for this.

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 ₂ O
Serial number of the candidates	TÜV 2 / TÜV 4
Measuring principle	NDIR

Test report

Test laboratory	936/21217568/A
Date of report	TÜV Rheinland 2011-10-18

Measured component

Certification range	N ₂ O 0 - 50 mg/m ³
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Evaluation of the cross sensitivity (CS)

(system with largest CS)

Sum of positive CS at zero point	0.93 mg/m ³
Sum of negative CS at zero point	-1.41 mg/m ³
Sum of positive CS at reference point	0.00 mg/m ³
Sum of negative CS at reference point	-0.65 mg/m ³
Maximum sum of cross sensitivities	-1.41 mg/m ³
Uncertainty of cross sensitivity	-0.814 mg/m ³

Calculation of the combined standard uncertainty

Tested parameter

	u	u ²
Standard deviation from paired measurements under field conditions *	u _D 0.410 mg/m ³	0.168 (mg/m ³) ²
Lack of fit	u _{inf} 0.231 mg/m ³	0.053 (mg/m ³) ²
Zero drift from field test	u _{d,z} -0.318 mg/m ³	0.101 (mg/m ³) ²
Span drift from field test	u _{d,s} 0.866 mg/m ³	0.750 (mg/m ³) ²
Influence of ambient temperature at span	u _t 0.436 mg/m ³	0.190 (mg/m ³) ²
Influence of supply voltage	u _v 0.172 mg/m ³	0.030 (mg/m ³) ²
Cross sensitivity (interference)	u _i -0.814 mg/m ³	0.663 (mg/m ³) ²
Influence of sample gas flow	u _b 0.052 mg/m ³	0.003 (mg/m ³) ²
Uncertainty of reference material at 70% of certification range	u _{rm} 0.404 mg/m ³	0.163 (mg/m ³) 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)	$u_c = \sqrt{\sum (u_{max,i})^2}$	1.46 mg/m ³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	2.85 mg/m ³

Relative total expanded uncertainty

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

** For this component no requirements in the EC-directives 2001/80/EG und 2000/76/EG are given.
A value of 20 % was used for this.

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

Test laboratory	TÜV Rheinland
Date of report	2011-10-18

Measured component

Certification range	CO ₂	0 - 25 Vol.-%
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Evaluation of the cross sensitivity (CS)

(system with largest CS)

Sum of positive CS at zero point	0.00 Vol.-%
Sum of negative CS at zero point	-0.47 Vol.-%
Sum of positive 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	u ²
Standard deviation from paired measurements under field conditions *	u _D 0.156 Vol.-%	0.024 (Vol.-%) ²
Lack of fit	u _{inf} -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 _b 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)	$u_c = \sqrt{\sum (u_{max,i})^2}$	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.
A value of 10 % was used for this.

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

Test laboratory	936/21217568/A
Date of report	TÜV Rheinland
	2011-10-18

Measured component

Certification range	O ₂	0 - 25 Vol.-%
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Evaluation of the cross sensitivity (CS)

(system with largest CS)

Sum of positive CS at zero point	0.00 Vol.-%
Sum of negative CS at zero point	0.00 Vol.-%
Sum of positive CS at 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_b -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

Requirement of 2000/76/EC and 2001/80/EC

Requirement of EN 15267-3

U in % of the range 25 Vol.-%	2.4
U in % of the range 25 Vol.-%	10.0 **
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.

A value of 10 % was used for this .

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

Test laboratory	936/21217568/A TÜV Rheinland
Date of report	2011-10-18

Measured component

Certification range	O ₂ 0 - 25 Vol.-%
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Evaluation of the cross sensitivity (CS)

(system with largest CS)

Sum of positive CS at zero point	0.00 Vol.-%
Sum of negative CS at zero point	0.00 Vol.-%
Sum of positive CS at 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	u ²
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 _b 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

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

A value of 10 % was used for this.