

CERTIFICATE

of Product Conformity (QAL1)

Certificate No.: 0000062068

AMS designation: MCS200 HW for CO, NO, HCl, NH₃, CH₄, H₂O, CO₂, O₂ and TOC

Manufacturer: SICK AG
Rengoldshauser Str. 17 a
88662 Überlingen

Test Laboratory: TÜV Rheinland Energy 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: 2007
and EN 14181: 2014.

Certification is awarded in respect of the conditions stated in this certificate
(this certificate contains 14 pages).



Suitability Tested
EN 15267
QAL1 Certified
Regular Surveillance

www.tuv.com
ID 0000062068

Publication in the German Federal Gazette
(BAnz) of 26 March 2019

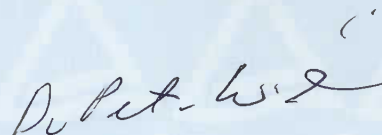
This certificate will expire on:
25 March 2024

German Federal Environment Agency
Dessau, 12 June 2019

TÜV Rheinland Energy GmbH
Cologne, 11 June 2019



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Test institute accredited to EN ISO/IEC 17025:2005 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: 936/21242470/A dated 8 October 2018
Initial certification: 26 March 2019
Expiry date: 25 March 2024
Publication: BAnz AT 26.03.2019 B7, chapter I number 2.2

Approved application

The tested AMS is suitable for use at combustion plants according to Directive 2010/75/EU, chapter III (13th BImSchV), at waste incineration plants according to Directive 2010/75/EU, chapter IV (17th BImSchV), the 27th and 30th BImSchV and TA Luft. 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 field test at a waste incineration plant over a period of more than seven months.

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

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

Basis of the certification

This certification is based on:

- Test report 936/21242470/A dated 8 October 2018 issued by TÜV Rheinland Energy GmbH
- Suitability announced by the German Federal Environment Agency (UBA) as the relevant body
- The ongoing surveillance of the product and the manufacturing process

Publication in the German Federal Gazette: BAnz AT 26.03.2019 B7, chapter I number 2.2,
UBA announcement dated 27 February 2019:

AMS designation: MCS200HW for CO, NO, HCl, NH₃, CH₄, H₂O, CO₂, O₂ and TOC

Manufacturer: SICK AG, Überlingen

Field of application: Modular measuring system for plants requiring official approval and for plants according to the 27th BImSchV

Measuring ranges during performance testing:

Component	Module name	Certification range	supplementary range	Unit	Maintenance interval
CO	"CO"	0–75	0–10 000	mg/m ³	3 months
NO	"NO"	0–150	0–2 500	mg/m ³	3 months
HCl	"HCl"	0–15	0–3 000	mg/m ³	3 months
NH ₃	"NH3"	0–10	0–500	mg/m ³	3 months
CH ₄	"CH4"	0–50	0–500	mg/m ³	3 months
CO ₂	"CO2"	0–25	-	vol.-%	3 months
H ₂ O	"H2O"	0–40	-	vol.-%	3 months
O ₂	"O2"	0–25	-	vol.-%	3 months
TOC	"TOC"	0–15	0–50/150/500	mg/m ³	3 months

Software versions: MCS200HW: 1.0.1
GMS811 FIDORi: 4.003

Restrictions: None

Notes:

1. The maintenance interval is three months.
2. Wet and dry test gases can be used to test HCl and NH₃.
3. It is possible to use an optional internal test cycle using adjustment cells for zero and span checks (QAL3) for the components measured with infrared spectroscopy and for the span check of the oxygen sensor instead of using test gases.
4. The measuring system performs a zero point check once every day. This requires suitable instrument air or synthetic air.
5. The integrated GMS811 FIDORi FID performs zero point checks once every day. An integrated zero air generator (version "i") produces the zero air required for this purpose.
6. The measuring system provides a digital Modbus interface (TCP/IP) in accordance with VDI guideline 4201, parts 1 and 3.
7. Required maintenance tasks must be spread over several days in order to keep outage times within the limits of the 13th and 17th BImSchV.

Test Report:

TÜV Rheinland Energy GmbH, Cologne
Report no.: 936/21242470/A dated 8 October 2018

Certified product

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

The modular MCS200 HW measuring system is a measurement rack equipped with a single-beam infrared photometer using the bi-frequency and gas filter correlation method. The MCS200 HW can measure up to 10 IR components present in the flue gas emitted by industrial combustion plants.

The MCS200 HW operates extractively: a sampling probe extracts flue gas from the duct which is then transported to the analyser via a sample line. All gas-carrying components from the sampling probe to the cell are heated above the dew point. An ejector pump transports the sample gas.

A zirconium dioxide sensor is used to measure oxygen alongside the IR components. As an option, a GMS811 FIDORi flame ionisation detector can be integrated to measure total organic carbon. The optional use of internal cells facilitates span point checks.

The AMS under test comprises the following individual components:

- Sampling probe, Sick sampling filter SFU-BF NI GL heated to 200 °C with zero gas and back purge connection,
- Sample gas filter made of metal mesh SilcoNert® covered,
- Heated sample line, inner diameter 6 mm, heated to 200 °C,
- Analyser rack manufactured by Rittal c/w:
 - Modular analyser comprising the heated sample gas cell with single-beam infra-red photometer with bi-frequency and gas filter correlation method as well as a zirconium dioxide to measure oxygen,
 - GMS811 FIDORi FID analyser for the determination of total organic carbon with integrated zero air conditioning at the inner door of the analyser rack with (optional) BCU control unit located underneath,
 - Display unit at the outer wall of the analyser rack, measured value display and operation of the analyser system,
 - Active fan unit installed in the rack door and air intake on top of the analyser rack,
 - Pressure reducer to adjust the instrument air,
 - Electronics unit with analogue interfaces for the output of measured signals and status signals,
 - the measuring system provides a digital Modbus interface (TCP/IP) in accordance with VDI guideline 4201, parts 1 and 3 (optional).

The data output is under standard conditions wet and without offsetting waste gas moisture.

General remarks

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 manufacturing process for 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 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 GmbH. Upon revocation of the publication the certificate loses its validity. After the expiration of the certificate and on request of TÜV Rheinland Energy GmbH this document shall be returned and the certificate mark must no longer be used.

The relevant version of this certificate and its expiration date are also accessible on the internet at gal1.de.

Document history

Certification of the MCS200 HW measuring system is based on the documents listed below and the regular, continuous surveillance of the manufacturer's quality management system.

Initial certification according to EN 15267

Certificate no.0000062068: 12 June 2019
Expiry date of the certificate: 25 March 2024
Test report 936/21242470/A dated 8 October 2018
TÜV Rheinland Energy GmbH, Cologne
Publication: BAnz AT 26.03.2019 B7, chapter I number 2.2
UBA announcement dated 27 February 2019

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

Measuring system

Manufacturer	SICK AG
AMS designation	MCS200 HW
Serial number of units under test	17160001 / 17160002
Measuring principle	Bifrequenz- und Gasfilterkorrelationsverfahren

Test report

Test laboratory	TÜV Rheinland
Date of report	2018-10-08

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	0.00 mg/m ³
Sum of negative CS at zero point	0.00 mg/m ³
Sum of positive CS at span point	0.40 mg/m ³
Sum of negative CS at span point	0.00 mg/m ³
Maximum sum of cross-sensitivities	0.40 mg/m ³
Uncertainty of cross-sensitivity	u_i 0.229 mg/m ³

Calculation of the combined standard uncertainty

Tested parameter

			u^2
Standard deviation from paired measurements under field conditions *	u_D	0.402 mg/m ³	0.162 (mg/m ³) ²
Lack of fit	u_{lof}	-0.117 mg/m ³	0.014 (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	$u_{d,s}$	-0.693 mg/m ³	0.480 (mg/m ³) ²
Influence of ambient temperature at span	u_t	0.608 mg/m ³	0.370 (mg/m ³) ²
Influence of supply voltage	u_v	0.070 mg/m ³	0.005 (mg/m ³) ²
Cross-sensitivity (interference)	u_i	0.229 mg/m ³	0.052 (mg/m ³) ²
Influence of sample gas flow	u_p	0.361 mg/m ³	0.130 (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 set point" or

"Standard deviation from paired measurements under field conditions"

Combined standard uncertainty (u_c)

$$u_c = \sqrt{\sum (u_{max,j})^2} \quad 1.30 \text{ mg/m}^3$$

Total expanded uncertainty

$$U = u_c * k = u_c * 1.96 \quad 2.56 \text{ mg/m}^3$$

Relative total expanded uncertainty

Requirement of 2010/75/EU

Requirement of EN 15267-3

U in % of the ELV 50 mg/m³ **5.1**

U in % of the ELV 50 mg/m³ **10.0**

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 AG
AMS designation	MCS200 HW
Serial number of units under test	17160001 / 17160002
Measuring principle	Bifrequenz- und Gasfilterkorrelationsverfahren

Test report

Test laboratory	TÜV Rheinland
Date of report	2018-10-08

Measured component

Certification range	NO 0 - 150 mg/m ³
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Evaluation of the cross-sensitivity (CS)

(system with largest CS)

Sum of positive CS at zero point	0.92 mg/m ³
Sum of negative CS at zero point	0.00 mg/m ³
Sum of positive CS at span point	1.20 mg/m ³
Sum of negative CS at span point	-3.20 mg/m ³
Maximum sum of cross-sensitivities	-3.20 mg/m ³
Uncertainty of cross-sensitivity	u_i -1.845 mg/m ³

Calculation of the combined standard uncertainty

Tested parameter

			u^2
Standard deviation from paired measurements under field conditions *	u_D	0.621 mg/m ³	0.386 (mg/m ³) ²
Lack of fit	u_{lof}	-0.580 mg/m ³	0.336 (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	$u_{d,s}$	1.905 mg/m ³	3.629 (mg/m ³) ²
Influence of ambient temperature at span	u_t	1.514 mg/m ³	2.292 (mg/m ³) ²
Influence of supply voltage	u_v	0.405 mg/m ³	0.164 (mg/m ³) ²
Cross-sensitivity (interference)	u_i	-1.845 mg/m ³	3.404 (mg/m ³) ²
Influence of sample gas flow	u_p	0.356 mg/m ³	0.127 (mg/m ³) ²
Uncertainty of reference material at 70% of certification range	u_{rm}	1.212 mg/m ³	1.470 (mg/m ³) ²

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

Combined standard uncertainty (u_c)	$u_c = \sqrt{\sum (u_{max, j})^2}$	3.48 mg/m ³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	6.81 mg/m ³

Relative total expanded uncertainty

Requirement of 2010/75/EU	U in % of the ELV 98 mg/m³	7.0
Requirement of EN 15267-3	U in % of the ELV 98 mg/m³	20.0
	U in % of the ELV 98 mg/m³	15.0

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

Measuring system

Manufacturer	SICK AG
AMS designation	MCS200 HW
Serial number of units under test	17160001 / 17160002
Measuring principle	Bifrequenz- und Gasfilterkorrelationsverfahren

Test report

Test laboratory	TÜV Rheinland
Date of report	2018-10-08

Measured component

Certification range	HCl	0 - 15 mg/m ³
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Evaluation of the cross-sensitivity (CS)

(system with largest CS)

Sum of positive CS at zero point	0.30 mg/m ³
Sum of negative CS at zero point	-0.15 mg/m ³
Sum of positive CS at span point	0.48 mg/m ³
Sum of negative CS at span point	-0.08 mg/m ³
Maximum sum of cross-sensitivities	0.48 mg/m ³
Uncertainty of cross-sensitivity	u_i 0.276 mg/m ³

Calculation of the combined standard uncertainty

Tested parameter

			u^2
Standard deviation from paired measurements under field conditions *	u_D	0.101 mg/m ³	0.010 (mg/m ³) ²
Lack of fit	u_{lof}	0.069 mg/m ³	0.005 (mg/m ³) ²
Zero drift from field test	$u_{d,z}$	-0.139 mg/m ³	0.019 (mg/m ³) ²
Span drift from field test	$u_{d,s}$	-0.251 mg/m ³	0.063 (mg/m ³) ²
Influence of ambient temperature at span	u_t	0.173 mg/m ³	0.030 (mg/m ³) ²
Influence of supply voltage	u_v	0.055 mg/m ³	0.003 (mg/m ³) ²
Cross-sensitivity (interference)	u_i	0.276 mg/m ³	0.076 (mg/m ³) ²
Influence of sample gas flow	u_p	0.043 mg/m ³	0.002 (mg/m ³) ²
Uncertainty of reference material at 70% of certification range	u_{rm}	0.121 mg/m ³	0.015 (mg/m ³) ²

* The larger value is used :

"Repeatability standard deviation at set point" or

"Standard deviation from paired measurements under field conditions"

Combined standard uncertainty (u_c)

$$u_c = \sqrt{\sum (u_{max,j})^2} \quad 0.47 \text{ mg/m}^3$$

Total expanded uncertainty

$$U = u_c * k = u_c * 1.96 \quad 0.93 \text{ mg/m}^3$$

Relative total expanded uncertainty

U in % of the ELV 10 mg/m³ 9.3

Requirement of 2010/75/EU

U in % of the ELV 10 mg/m³ 40.0

Requirement of EN 15267-3

U in % of the ELV 10 mg/m³ 30.0

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

Measuring system

Manufacturer	SICK AG
AMS designation	MCS200 HW
Serial number of units under test	17160001 / 17160002
Measuring principle	Bifrequenz- und Gasfilterkorrelationsverfahren

Test report

Test laboratory	TÜV Rheinland
Date of report	2018-10-08

Measured component

Certification range	NH ₃ 0 - 10 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	-0.06 mg/m ³
Sum of positive CS at span point	0.09 mg/m ³
Sum of negative CS at span point	-0.20 mg/m ³
Maximum sum of cross-sensitivities	-0.20 mg/m ³
Uncertainty of cross-sensitivity	u _i -0.115 mg/m ³

Calculation of the combined standard uncertainty

Tested parameter

			u ²
Standard deviation from paired measurements under field conditions *	u _D	0.057 mg/m ³	0.003 (mg/m ³) ²
Lack of fit	u _{lof}	0.058 mg/m ³	0.003 (mg/m ³) ²
Zero drift from field test	u _{d,z}	0.087 mg/m ³	0.008 (mg/m ³) ²
Span drift from field test	u _{d,s}	0.167 mg/m ³	0.028 (mg/m ³) ²
Influence of ambient temperature at span	u _t	0.100 mg/m ³	0.010 (mg/m ³) ²
Influence of supply voltage	u _v	0.066 mg/m ³	0.004 (mg/m ³) ²
Cross-sensitivity (interference)	u _i	-0.115 mg/m ³	0.013 (mg/m ³) ²
Influence of sample gas flow	u _p	-0.051 mg/m ³	0.003 (mg/m ³) ²
Uncertainty of reference material at 70% of certification range	u _{rm}	0.081 mg/m ³	0.007 (mg/m ³) ²

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

Combined standard uncertainty (u _c)	$u_c = \sqrt{\sum (u_{max,j})^2}$	0.28 mg/m ³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	0.55 mg/m ³

Relative total expanded uncertainty

Requirement of 2010/75/EU	U in % of the ELV 10 mg/m ³	5.5
Requirement of EN 15267-3	U in % of the ELV 10 mg/m ³	40.0 **
	U in % of the ELV 10 mg/m ³	30.0

** The EU-directive 2010/75/EU on industrial emissions provides no requirements for this component.
A value of 40.0 % was used for this.

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

Measuring system

Manufacturer	SICK AG
AMS designation	MCS200 HW
Serial number of units under test	17160001 / 17160002
Measuring principle	Bifrequenz- und Gasfilterkorrelationsverfahren

Test report

Test laboratory	TÜV Rheinland
Date of report	2018-10-08

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	0.00 mg/m ³
Sum of negative CS at zero point	0.00 mg/m ³
Sum of positive CS at span point	0.00 mg/m ³
Sum of negative CS at span point	0.00 mg/m ³
Maximum sum of cross-sensitivities	0.00 mg/m ³
Uncertainty of cross-sensitivity	u _i 0.000 mg/m ³

Calculation of the combined standard uncertainty

Tested parameter

			u ²
Standard deviation from paired measurements under field conditions *	u _D	0.058 mg/m ³	0.003 (mg/m ³) ²
Lack of fit	u _{lof}	-0.173 mg/m ³	0.030 (mg/m ³) ²
Zero drift from field test	u _{d,z}	0.173 mg/m ³	0.030 (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	0.551 mg/m ³	0.304 (mg/m ³) ²
Influence of supply voltage	u _v	0.212 mg/m ³	0.045 (mg/m ³) ²
Cross-sensitivity (interference)	u _i	0.000 mg/m ³	0.000 (mg/m ³) ²
Influence of sample gas flow	u _p	-0.150 mg/m ³	0.023 (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 set point" or
"Standard deviation from paired measurements under field conditions"

Combined standard uncertainty (u _c)	$u_c = \sqrt{\sum (u_{max, j})^2}$	1.00 mg/m ³
Total expanded uncertainty	U = u _c * k = u _c * 1.96	1.96 mg/m ³

Relative total expanded uncertainty

Requirement of 2010/75/EU	U in % of the range 50 mg/m³	3.9
Requirement of EN 15267-3	U in % of the range 50 mg/m³	30.0 **
	U in % of the range 50 mg/m³	22.5

** EU Directive 2010/75/EU does not define requirements for this component.
A value of 30.0% was used instead.

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

Measuring system

Manufacturer	SICK AG
AMS designation	MCS200 HW
Serial number of units under test	17160001 / 17160002
Measuring principle	Bifrequenz- und Gasfilterkorrelationsverfahren

Test report

Test laboratory	TÜV Rheinland
Date of report	2018-10-08

Measured component

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

(system with largest CS)

Sum of positive CS at zero point	0.00	Vol.-%
Sum of negative CS at zero point	0.00	Vol.-%
Sum of positive CS at span point	0.12	Vol.-%
Sum of negative CS at span point	0.00	Vol.-%
Maximum sum of cross-sensitivities	0.12	Vol.-%
Uncertainty of cross-sensitivity	u _i	0.069 Vol.-%

Calculation of the combined standard uncertainty

Tested parameter

				u ²
Standard deviation from paired measurements under field conditions *	u _D	0.029	Vol.-%	0.001 (Vol.-%) ²
Lack of fit	u _{lof}	-0.115	Vol.-%	0.013 (Vol.-%) ²
Zero drift from field test	u _{d,z}	0.029	Vol.-%	0.001 (Vol.-%) ²
Span drift from field test	u _{d,s}	0.072	Vol.-%	0.005 (Vol.-%) ²
Influence of ambient temperature at span	u _t	0.058	Vol.-%	0.003 (Vol.-%) ²
Influence of supply voltage	u _v	0.015	Vol.-%	0.000 (Vol.-%) ²
Cross-sensitivity (interference)	u _i	0.069	Vol.-%	0.005 (Vol.-%) ²
Influence of sample gas flow	u _p	0.060	Vol.-%	0.004 (Vol.-%) ²
Uncertainty of reference material at 70% of certification range	u _{rm}	0.202	Vol.-%	0.041 (Vol.-%) ²

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

Combined standard uncertainty (u _c)	$u_c = \sqrt{\sum (u_{max,j})^2}$	0.27	Vol.-%
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	0.53	Vol.-%

Relative total expanded uncertainty

Requirement of 2010/75/EU	U in % of the range 25 Vol.-%	2.1
Requirement of EN 15267-3	U in % of the range 25 Vol.-%	10.0 **
	U in % of the range 25 Vol.-%	7.5

** EU Directives 2010/75/EU does not define requirements for this component.
A value of 10.0% was used instead.

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

Measuring system

Manufacturer	SICK AG
AMS designation	MCS200 HW
Serial number of units under test	17160001 / 17160002
Measuring principle	Bifrequenz- und Gasfilterkorrelationsverfahren

Test report

Test laboratory	TÜV Rheinland
Date of report	2018-10-08

Measured component

Certification range	H ₂ O	0 - 40 Vol.-%
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Evaluation of the cross-sensitivity (CS)

(system with largest CS)

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

Calculation of the combined standard uncertainty

Tested parameter

			u ²
Repeatability standard deviation at set point *	u _r	0.160 Vol.-%	0.026 (Vol.-%) ²
Lack of fit	u _{lof}	-0.231 Vol.-%	0.053 (Vol.-%) ²
Zero drift from field test	u _{d,z}	-0.023 Vol.-%	0.001 (Vol.-%) ²
Span drift from field test	u _{d,s}	-0.139 Vol.-%	0.019 (Vol.-%) ²
Influence of ambient temperature at span	u _t	0.058 Vol.-%	0.003 (Vol.-%) ²
Influence of supply voltage	u _v	0.045 Vol.-%	0.002 (Vol.-%) ²
Cross-sensitivity (interference)	u _i	0.000 Vol.-%	0.000 (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}	0.323 Vol.-%	0.105 (Vol.-%) ²

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

Combined standard uncertainty (u _c)	$u_c = \sqrt{\sum (u_{max,j})^2}$	0.46	Vol.-%
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	0.90	Vol.-%

Relative total expanded uncertainty

Requirement of 2010/75/EU	U in % of the range 40 Vol.-%	2.2
Requirement of EN 15267-3	U in % of the range 40 Vol.-%	10.0 **
	U in % of the range 40 Vol.-%	7.5

** EU Directives 2010/75/EU does not define requirements for this component.
A value of 10.0% was used instead.

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

Measuring system

Manufacturer	SICK AG
AMS designation	MCS200 HW
Serial number of units under test	17160001 / 17160002
Measuring principle	Zirkondioxid

Test report

Test laboratory	TÜV Rheinland
Date of report	2018-10-08

Measured component

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

(system with largest CS)

Sum of positive CS at zero point	0.00	Vol.-%
Sum of negative CS at zero point	0.00	Vol.-%
Sum of positive CS at span point	0.11	Vol.-%
Sum of negative CS at span point	-0.11	Vol.-%
Maximum sum of cross-sensitivities	0.11	Vol.-%
Uncertainty of cross-sensitivity	u _i	0.064 Vol.-%

Calculation of the combined standard uncertainty

Tested parameter

				u ²
Standard deviation from paired measurements under field conditions *	u _D	0.045	Vol.-%	0.002 (Vol.-%) ²
Lack of fit	u _{lof}	-0.017	Vol.-%	0.000 (Vol.-%) ²
Zero drift from field test	u _{d,z}	0.052	Vol.-%	0.003 (Vol.-%) ²
Span drift from field test	u _{d,s}	-0.098	Vol.-%	0.010 (Vol.-%) ²
Influence of ambient temperature at span	u _t	0.115	Vol.-%	0.013 (Vol.-%) ²
Influence of supply voltage	u _v	0.006	Vol.-%	0.000 (Vol.-%) ²
Cross-sensitivity (interference)	u _i	0.064	Vol.-%	0.004 (Vol.-%) ²
Influence of sample gas flow	u _p	0.054	Vol.-%	0.003 (Vol.-%) ²
Uncertainty of reference material at 70% of certification range	u _{rm}	0.202	Vol.-%	0.041 (Vol.-%) ²

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

Combined standard uncertainty (u _c)	$u_c = \sqrt{\sum (u_{max,j})^2}$	0.28	Vol.-%
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	0.54	Vol.-%

Relative total expanded uncertainty

Requirement of 2010/75/EU	U in % of the range 25 Vol.-%	2.2
Requirement of EN 15267-3	U in % of the range 25 Vol.-%	10.0 **
	U in % of the range 25 Vol.-%	7.5

** EU Directives 2010/75/EU does not define requirements for this component.
A value of 10.0% was used instead.

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

Measuring system

Manufacturer	SICK AG
AMS designation	MCS200 HW (GMS811 FIDORi)
Serial number of units under test	00823523, 00823524 / 18290107, 18020076
Measuring principle	FID

Test report

Test laboratory	TÜV Rheinland
Date of report	2018-10-08

Measured component

Certification range	TOC 0 - 15 mg/m ³
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Evaluation of the cross-sensitivity (CS)

(system with largest CS)

Sum of positive CS at zero point	0.17 mg/m ³
Sum of negative CS at zero point	0.00 mg/m ³
Sum of positive CS at span point	0.00 mg/m ³
Sum of negative CS at span point	-0.44 mg/m ³
Maximum sum of cross-sensitivities	-0.44 mg/m ³
Uncertainty of cross-sensitivity	u_i -0.254 mg/m ³

Calculation of the combined standard uncertainty

Tested parameter

			u^2
Standard deviation from paired measurements under field conditions *	u_D	0.033 mg/m ³	0.001 (mg/m ³) ²
Lack of fit	u_{lof}	0.023 mg/m ³	0.001 (mg/m ³) ²
Zero drift from field test	$u_{d,z}$	-0.190 mg/m ³	0.036 (mg/m ³) ²
Span drift from field test	$u_{d,s}$	-0.249 mg/m ³	0.062 (mg/m ³) ²
Influence of ambient temperature at span	u_t	0.100 mg/m ³	0.010 (mg/m ³) ²
Influence of supply voltage	u_v	0.083 mg/m ³	0.007 (mg/m ³) ²
Cross-sensitivity (interference)	u_i	-0.254 mg/m ³	0.065 (mg/m ³) ²
Influence of sample gas flow	u_p	-0.094 mg/m ³	0.009 (mg/m ³) ²
Uncertainty of reference material at 70% of certification range	u_{rm}	0.121 mg/m ³	0.015 (mg/m ³) ²
Variation of response factors (TOC)	u_{rf}	0.000 mg/m ³	0.000 (mg/m ³) ²

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

Combined standard uncertainty (u_c)	$u_c = \sqrt{\sum (u_{max,i})^2}$	0.45 mg/m ³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	0.89 mg/m ³

Relative total expanded uncertainty

Requirement of 2010/75/EU	U in % of the ELV 10 mg/m³	8.9
Requirement of EN 15267-3	U in % of the ELV 10 mg/m³	30.0
	U in % of the ELV 10 mg/m³	22.5

Measured values highlighted in blue are taken from the most recent test report. All other values are taken from TÜV Rheinland test report number 936/21216085/B dated 10 October 2011 prepared by TÜV Rheinland regar