

CERTIFICATE

of Product Conformity (QAL1)

Certificate No.: 0000087854_00

Certified AMS: APSA-380 for sulphur dioxide

Manufacturer: HORIBA Europe GmbH
Hans-Mess-Str. 6
61440 Oberursel
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
VDI 4202-1 (2018), EN 14212 (2012), EN 14212 (2024)
as well as EN 15267-1 (2009) and EN 15267-2 (2023).**

Certification is awarded in respect of the conditions stated in this certificate
(this certificate contains 11 pages).



Suitability Tested
Complying with
2008/50/EC
EN 15267
Regular
Surveillance
www.tuv.com
ID 0000087854

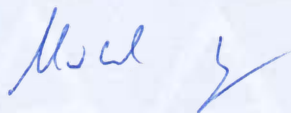
Publication in the German Federal Gazette
(BAnz) of 31 October 2025

German Environment Agency

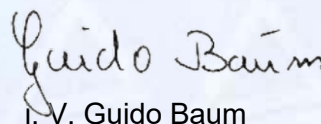
Dessau, 23 March 2026

This certificate will expire on:
23 March 2031

TÜV Rheinland
Energy & Environment GmbH
Cologne, 20 March 2026



Dr. Marcel Langner
Head of Section II 4



I. V. Guido Baum

www.umwelt-tuv.eu
qal1-info@tuv.com
Tel. + 49 221 806-5200

TÜV Rheinland Energy & Environment GmbH
Am Grauen Stein
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:	EuL/21262682/D dated 7 February 2025
Initial certification:	23 March 2026
Expiry date:	22 March 2031
Publication:	BAnz AT 31.10.2025 B5, chapter III No. 4.1

Approved application

The tested AMS is suitable for continuous ambient air measurement of SO₂ in stationary use.

The suitability of the AMS for this application was assessed on the basis of a laboratory test and a three-month field test at a location close to traffic.

The AMS is approved for an ambient temperature range of +0 °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 measured values relevant to the application.

Any potential user should ensure, in consultation with the manufacturer, that this AMS is suitable for the intended use.

Basis of the certification

This certification is based on:

- Test report EuL/21262682/D dated 7 February 2025 of TÜV Rheinland Energy & Environment 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 31.10.2025 B5, chapter III No. 4.1,
Announcement by UBA dated 27 August 2025:

AMS designation:

APSA-380 for sulphur dioxide

Manufacturer:

Horiba Europe GmbH, Oberursel Germany

Field of application:

For the continuous determination of ambient air concentrations of sulphur dioxide in outdoor air in stationary use

Measuring ranges during the performance test:

Component	Certification range	Unit
SO ₂	0 – 1,000	µg/m ³

Software versions:

A7: P2002638C 1.01
M4: P2002642B 1.00
Analyzer: P2002584C 1.02
FPGA: P2002759A 1.01

Restrictions:

None

Notes:

1. The measuring system also fulfils the requirements of EN 14212:2024.
2. The test report on the suitability test can be viewed on the internet at www.qal1.de.

Test Report:

TÜV Rheinland Energy & Environment GmbH, Cologne
Report No.: EuL/21262682/D dated 7 February 2025

Certified product

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

The APSA-380 ambient air monitoring system is a continuous sulphur dioxide analyser. The measuring principle is based on UV fluorescence. The device was developed for the continuous measurement of sulphur dioxide in ambient air.

The measurement method is based on the physical principle that fluorescence occurs when sulphur dioxide (SO₂) is excited by UV light with wavelengths in the range of 190 nm-230 nm (SO₂*). This reaction is a two-step process: The first step takes place when SO₂ molecules are hit by photons at the correct ultraviolet wavelength. In this analyser, a bandpass filter between the UV light source and the gas to be measured limits the wavelength of the light to about 214 nm. The SO₂ absorbs some of the energy of the UV light, which raises one of the electrons of the SO₂ molecule to a higher energy potential.



The second step of the reaction takes place when the SO₂ reaches its excited state (SO₂*). As the system always seeks to reach the lowest available stable energy state, the SO₂* molecule quickly returns to its ground state by emitting the excess energy in the form of a photon (h ν). The wavelength of this fluorescent light is also in the ultraviolet range, but with a longer (energetically lower) wavelength of about 330 nm.

The optical design of the measuring chamber optimises the fluorescence reaction between SO₂ and UV light and thus ensures that only the UV light generated by the decay of SO₂* to SO₂ is detected by the device's fluorescence detector.

The APSA-380 sulphur dioxide analyser determines the concentration of sulphur dioxide (SO₂) in a sample drawn into the instrument. The measurement and calibration gases must be supplied at atmospheric pressure to ensure a constant gas flow through the measuring chamber. In the measuring chamber, the sample gas is then exposed to ultraviolet light, which excites the SO₂ into an excited state (SO₂*). When the SO₂* molecules subsequently decay back to SO₂, they emit fluorescent light. The instrument measures the amount of fluorescence to determine the concentration of SO₂ present in the sample gas.

The sample gas first passes through a filter in which coarse dirt particles are filtered out. The sample gas is drawn in through the appropriate inlet. First, the sample air is passed through a hydrocarbon scrubber, in which any hydrocarbons present are removed. The SO₂ molecules remain unaffected by this. The sample then flows into the reaction chamber where it is irradiated with pulsed UV light in the wavelength range between 200 and 220 nm. This radiation energetically excites the SO₂ molecules. The four mirrors in front of the UV lamp allow only those wavelengths to pass through that excite the SO₂ molecules.

When the SO₂ molecules return to a lower energy state, they emit UV fluorescence in the wavelength range between 240 and 420 nm. Only this light passes through a filter to the photomultiplier (PMT). The PMT measures the UV emissions and converts them into an electrical signal. A photodetector at the end of the reaction chamber continuously measures the lamp radiation and, in the event of fluctuations, corrects the measurement result if necessary.

Technical data APSA-380

Measuring range:	Maximum 0 - 20 ppm (selectable)
Units:	ppb, ppm, mg/m ³ or µg/m ³
Measured compounds:	Sulphur dioxide
Sample flow:	Approx. 0.6 litres/min (during the test)
Outputs:	Ethernet TCP/IP Modbus Serial interface, RS232 0 - 1/5/10 Volt analogue 4 - 20 mA analogue USB INTERFACE
Input voltage:	100 V to 240 V, 50 Hz or 60 Hz
Power:	50 W; maximum 210 W
Dimensions (L x W x H)	568 x 430 x 221 mm
Weight:	Approx. 18 kg

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 request of 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 APSA-380 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. 0000087854_00: 23 March 2026
Expiry date of the certificate: 22 March 2031
Test report: EuL/21262682/D dated 7 February 2025
TÜV Rheinland Energy & Environment GmbH
Publication: BAnz AT 31.10.2025 B5, chapter III number 4.1
UBA announcement dated 27 August 2025

Overall uncertainty according to EN 14212 (2012)

Expanded uncertainty laboratory, system 1

Measuring device:		APSA 380		Serial-No.:		M22R82FL	
Measured component:		SO2		1h-limit value:		132 nmol/mol	
No.	Performance characteristic	Performance criterion	Result	Partial uncertainty		Square of partial uncertainty	
1	Repeatability standard deviation at zero	≤ 1.0 nmol/mol	0.120	$u_{r,z}$	0.02	0.0004	
2	Repeatability standard deviation at 1h-limit value	≤ 3.0 nmol/mol	0.330	$u_{r,h}$	0.05	0.0027	
3	"lack of fit" at 1h-limit value	≤ 4.0% of measured value	0.470	u_{lf}	0.36	0.1283	
4	Sensitivity coefficient of sample gas pressure at 1h-limit value	≤ 2.0 nmol/mol/kPa	0.470	u_{sp}	3.84	14.7282	
5	Sensitivity coefficient of sample gas temperature at 1h-limit value	≤ 1.0 nmol/mol/K	0.050	u_{gt}	0.41	0.1667	
6	Sensitivity coefficient of surrounding temperature at 1h-limit value	≤ 1.0 nmol/mol/K	0.103	u_{st}	0.84	0.7073	
7	Sensitivity coefficient of electrical voltage at 1h-limit value	≤ 0.30 nmol/mol/V	0.010	u_v	0.09	0.0089	
8a	Interferent H ₂ O with 19 nmol/mol	≤ 10 nmol/mol (Zero)	0.000	$u_{int,0}$	-2.69	7.2160	
		≤ 10 nmol/mol (Span)	-3.600				
8b	Interferent H ₂ S with 200 nmol/mol	≤ 5.0 nmol/mol (Zero)	0.080	$u_{int,pos}$	4.44	19.7120	
		≤ 5.0 nmol/mol (Span)	-0.780				
8c	Interferent NH ₃ with 200 nmol/mol	≤ 5.0 nmol/mol (Zero)	-0.240	or	4.44	19.7120	
		≤ 5.0 nmol/mol (Span)	1.180				
8d	Interferent NO with 500 nmol/mol	≤ 5.0 nmol/mol (Zero)	3.060	or	4.44	19.7120	
		≤ 5.0 nmol/mol (Span)	3.370				
8e	Interferent NO ₂ with 200 nmol/mol	≤ 5.0 nmol/mol (Zero)	0.000	$u_{int,neg}$	-0.38	0.1452	
		≤ 5.0 nmol/mol (Span)	1.100				
8f	Interferent m-Xylene with 1 µmol/mol	≤ 10 nmol/mol (Zero)	0.000	$u_{int,neg}$	-0.38	0.1452	
		≤ 10 nmol/mol (Span)	2.040				
9	Averaging effect	≤ 7.0% of measured value	-0.500	u_{av}	-0.38	0.1452	
18	Difference sample/calibration port	≤ 1.0%	0.110	u_{sc}	0.15	0.0211	
21	Uncertainty of test gas	≤ 3.0%	2.000	u_{tg}	1.32	1.7424	
Combined standard uncertainty				u_c		6.6768	nmol/mol
Expanded uncertainty				U		13.3535	nmol/mol
Relative expanded uncertainty				W		10.12	%
Maximum allowed expanded uncertainty				W_{req}		15	%

Expanded uncertainty laboratory, system 2

Measuring device:		APSA 380		Serial-No.:		USJ8SRJ8	
Measured component:		SO2		1h-limit value:		132 nmol/mol	
No.	Performance characteristic	Performance criterion	Result	Partial uncertainty		Square of partial uncertainty	
1	Repeatability standard deviation at zero	≤ 1.0 nmol/mol	0.070	$u_{r,z}$	0.01	0.0001	
2	Repeatability standard deviation at 1h-limit value	≤ 3.0 nmol/mol	0.300	$u_{r,h}$	0.05	0.0023	
3	"lack of fit" at 1h-limit value	≤ 4.0% of measured value	0.270	u_{lf}	0.21	0.0423	
4	Sensitivity coefficient of sample gas pressure at 1h-limit value	≤ 2.0 nmol/mol/kPa	0.480	u_{sp}	3.92	15.3616	
5	Sensitivity coefficient of sample gas temperature at 1h-limit value	≤ 1.0 nmol/mol/K	0.060	u_{gt}	0.49	0.2400	
6	Sensitivity coefficient of surrounding temperature at 1h-limit value	≤ 1.0 nmol/mol/K	0.402	u_{st}	3.28	10.7747	
7	Sensitivity coefficient of electrical voltage at 1h-limit value	≤ 0.30 nmol/mol/V	0.030	u_v	0.28	0.0805	
8a	Interferent H ₂ O with 19 nmol/mol	≤ 10 nmol/mol (Zero)	0.240	$u_{int,0}$	-2.40	5.7372	
		≤ 10 nmol/mol (Span)	-3.210				
8b	Interferent H ₂ S with 200 nmol/mol	≤ 5.0 nmol/mol (Zero)	0.240	$u_{int,pos}$	3.85	14.7852	
		≤ 5.0 nmol/mol (Span)	-1.800				
8c	Interferent NH ₃ with 200 nmol/mol	≤ 5.0 nmol/mol (Zero)	0.000	or	3.85	14.7852	
		≤ 5.0 nmol/mol (Span)	1.250				
8d	Interferent NO with 500 nmol/mol	≤ 5.0 nmol/mol (Zero)	2.350	or	3.85	14.7852	
		≤ 5.0 nmol/mol (Span)	2.820				
8e	Interferent NO ₂ with 200 nmol/mol	≤ 5.0 nmol/mol (Zero)	-0.160	$u_{int,neg}$	-0.53	0.2846	
		≤ 5.0 nmol/mol (Span)	1.020				
8f	Interferent m-Xylene with 1 µmol/mol	≤ 10 nmol/mol (Zero)	0.160	$u_{int,neg}$	-0.53	0.2846	
		≤ 10 nmol/mol (Span)	1.570				
9	Averaging effect	≤ 7.0% of measured value	-0.700	u_{av}	-0.53	0.2846	
18	Difference sample/calibration port	≤ 1.0%	0.080	u_{sc}	0.11	0.0112	
21	Uncertainty of test gas	≤ 3.0%	2.000	u_{tg}	1.32	1.7424	
Combined standard uncertainty				u_c		7.0044	nmol/mol
Expanded uncertainty				U		14.0089	nmol/mol
Relative expanded uncertainty				W		10.61	%
Maximum allowed expanded uncertainty				W_{req}		15	%

Combined uncertainty, laboratory and field, system 1

Measuring device:		APSA 380		Serial-No.:		M22R82FL	
Measured component:		SO2		1h-limit value:		132 nmol/mol	
No.	Performance characteristic	Performance criterion	Result	Partial uncertainty		Square of partial uncertainty	
1	Repeatability standard deviation at zero	≤ 1.0 nmol/mol	0.120	$U_{r,z}$	0.02	0.0004	
2	Repeatability standard deviation at 1h-limit value	≤ 3.0 nmol/mol	0.330	$U_{r,h}$	not considered, as $u_{r,h} = 0,05 < u_{r,f}$	-	
3	"lack of fit" at 1h-limit value	≤ 4.0% of measured value	0.470	U_{fit}	0.36	0.1283	
4	Sensitivity coefficient of sample gas pressure at 1h-limit value	≤ 2.0 nmol/mol/kPa	0.470	U_{sp}	3.84	14.7282	
5	Sensitivity coefficient of sample gas temperature at 1h-limit value	≤ 1.0 nmol/mol/K	0.050	U_{st}	0.41	0.1667	
6	Sensitivity coefficient of surrounding temperature at 1h-limit value	≤ 1.0 nmol/mol/K	0.103	U_{st}	0.84	0.7073	
7	Sensitivity coefficient of electrical voltage at 1h-limit value	≤ 0.30 nmol/mol/V	0.010	U_{sv}	0.09	0.0089	
8a	Interferent H ₂ O with 19 nmol/mol	≤ 10 nmol/mol (Zero) ≤ 10 nmol/mol (Span)	0.000 -3.600	$U_{int,CO}$	-2.69	7.2160	
8b	Interferent H ₂ S with 200 nmol/mol	≤ 5.0 nmol/mol (Zero) ≤ 5.0 nmol/mol (Span)	0.080 -0.780				
8c	Interferent NH ₃ with 200 nmol/mol	≤ 5.0 nmol/mol (Zero) ≤ 5.0 nmol/mol (Span)	1.180 3.060	or	4.44	19.7120	
8d	Interferent NO with 500 nmol/mol	≤ 5.0 nmol/mol (Zero) ≤ 5.0 nmol/mol (Span)	3.370 0.000				
8e	Interferent NO ₂ with 200 nmol/mol	≤ 5.0 nmol/mol (Zero) ≤ 5.0 nmol/mol (Span)	0.000 1.100	$U_{int,NEG}$			
8f	Interferent m-Xylene with 1 µmol/mol	≤ 10 nmol/mol (Zero) ≤ 10 nmol/mol (Span)	0.000 2.040				
9	Averaging effect	≤ 7.0% of measured value	-0.500	U_{av}	-0.38	0.1452	
10	Reproducibility standard deviation under field conditions	≤ 5.0% of average over 3 months	0.890	$U_{r,f}$	1.17	1.3802	
11	Long term drift at zero level	≤ 4.0 nmol/mol	0.330	$U_{d1,z}$	0.19	0.0363	
12	Long term drift at span level	≤ 5.0% of max. of certification range	-2.460	$U_{d1,h}$	-1.87	3.5148	
18	Difference sample/calibration port	≤ 1.0%	0.110	U_{sc}	0.15	0.0211	
21	Uncertainty of test gas	≤ 3.0%	2.000	U_{tg}	1.32	1.7424	
				Combined standard uncertainty		U_c	7.0362 nmol/mol
				Expanded uncertainty		U	14.0723 nmol/mol
				Relative expanded uncertainty		W	10.66 %
				Maximum allowed expanded uncertainty		W_{max}	15 %

Combined uncertainty, laboratory and field, system 2

Measuring device:		APSA 380		Serial-No.:		USJ8SRJ8	
Measured component:		SO2		1h-limit value:		132 nmol/mol	
No.	Performance characteristic	Performance criterion	Result	Partial uncertainty		Square of partial uncertainty	
1	Repeatability standard deviation at zero	≤ 1.0 nmol/mol	0.070	$U_{r,z}$	0.01	0.0001	
2	Repeatability standard deviation at 1h-limit value	≤ 3.0 nmol/mol	0.300	$U_{r,h}$	not considered, as $u_{r,h} = 0,04 < u_{r,f}$	-	
3	"lack of fit" at 1h-limit value	≤ 4.0% of measured value	0.270	U_{fit}	0.21	0.0423	
4	Sensitivity coefficient of sample gas pressure at 1h-limit value	≤ 2.0 nmol/mol/kPa	0.480	U_{sp}	3.92	15.3616	
5	Sensitivity coefficient of sample gas temperature at 1h-limit value	≤ 1.0 nmol/mol/K	0.060	U_{st}	0.49	0.2400	
6	Sensitivity coefficient of surrounding temperature at 1h-limit value	≤ 1.0 nmol/mol/K	0.402	U_{st}	3.28	10.7747	
7	Sensitivity coefficient of electrical voltage at 1h-limit value	≤ 0.30 nmol/mol/V	0.030	U_{sv}	0.28	0.0805	
8a	Interferent H ₂ O with 19 nmol/mol	≤ 10 nmol/mol (Zero) ≤ 10 nmol/mol (Span)	0.240 -3.210	$U_{int,CO}$	-2.40	5.7372	
8b	Interferent H ₂ S with 200 nmol/mol	≤ 5.0 nmol/mol (Zero) ≤ 5.0 nmol/mol (Span)	0.240 -1.800				
8c	Interferent NH ₃ with 200 nmol/mol	≤ 5.0 nmol/mol (Zero) ≤ 5.0 nmol/mol (Span)	0.000 1.250	or	3.85	14.7852	
8d	Interferent NO with 500 nmol/mol	≤ 5.0 nmol/mol (Zero) ≤ 5.0 nmol/mol (Span)	2.350 2.820				
8e	Interferent NO ₂ with 200 nmol/mol	≤ 5.0 nmol/mol (Zero) ≤ 5.0 nmol/mol (Span)	-0.160 1.020	$U_{int,NEG}$			
8f	Interferent m-Xylene with 1 µmol/mol	≤ 10 nmol/mol (Zero) ≤ 10 nmol/mol (Span)	0.160 1.570				
9	Averaging effect	≤ 7.0% of measured value	-0.700	U_{av}	-0.53	0.2846	
10	Reproducibility standard deviation under field conditions	≤ 5.0% of average over 3 months	0.890	$U_{r,f}$	1.17	1.3802	
11	Long term drift at zero level	≤ 4.0 nmol/mol	0.240	$U_{d1,z}$	0.14	0.0192	
12	Long term drift at span level	≤ 5.0% of max. of certification range	-1.600	$U_{d1,h}$	-1.22	1.4868	
18	Difference sample/calibration port	≤ 1.0%	0.080	U_{sc}	0.11	0.0112	
21	Uncertainty of test gas	≤ 3.0%	2.000	U_{tg}	1.32	1.7424	
				Combined standard uncertainty		U_c	7.2074 nmol/mol
				Expanded uncertainty		U	14.4147 nmol/mol
				Relative expanded uncertainty		W	10.92 %
				Maximum allowed expanded uncertainty		W_{max}	15 %

Overall uncertainty according to EN 14212 (2024)

Expanded uncertainty laboratory, system 1

Measuring device:		APSA 380		Serial-No.:		M22R82FL	
Measured component:		SO2		1h-limit value:		132 nmol/mol	
No.	Performance characteristic	Performance criterion	Result	Partial uncertainty		Square of partial uncertainty	
1	Repeatability standard deviation at zero	≤ 1.0 nmol/mol	0.120	$u_{r,z}$	0.02	0.0004	
2	Repeatability standard deviation at 1h-limit value	≤ 3.0 nmol/mol	0.330	$u_{r,h}$	0.05	0.0027	
3	"lack of fit" at 1h-limit value	≤ 4.0% of measured value	1.340	u_{lf}	1.02	1.0429	
4	Sensitivity coefficient of sample gas pressure at 1h-limit value	≤ 2.0 nmol/mol/kPa	0.500	u_{sp}	2.72	7.4082	
5	Sensitivity coefficient of sample gas temperature at 1h-limit value	≤ 1.0 nmol/mol/K	0.090	u_{gt}	0.86	0.7351	
6	Sensitivity coefficient of surrounding temperature at 1h-limit value	≤ 1.0 nmol/mol/K	0.123	u_{st}	1.17	1.3730	
7	Sensitivity coefficient of electrical voltage at 1h-limit value	≤ 0.30 nmol/mol/V	0.010	u_v	0.09	0.0089	
8a	Interferent H ₂ O with 19 nmol/mol	≤ 10 nmol/mol (Zero)	0.000	$u_{int,0}$	-2.69	7.2160	
		≤ 10 nmol/mol (Span)	-3.600				
8b	Interferent H ₂ S with 200 nmol/mol	≤ 5.0 nmol/mol (Zero)	0.080	$u_{int,pos}$	4.44	19.7120	
		≤ 5.0 nmol/mol (Span)	-0.780				
8c	Interferent NH ₃ with 200 nmol/mol	≤ 5.0 nmol/mol (Zero)	-0.240	or	4.44	19.7120	
		≤ 5.0 nmol/mol (Span)	1.180				
8d	Interferent NO with 500 nmol/mol	≤ 5.0 nmol/mol (Zero)	3.060	or	4.44	19.7120	
		≤ 5.0 nmol/mol (Span)	3.370				
8e	Interferent NO ₂ with 200 nmol/mol	≤ 5.0 nmol/mol (Zero)	0.000	$u_{int,neg}$	-0.38	0.1452	
		≤ 5.0 nmol/mol (Span)	1.100				
8f	Interferent m-Xylene with 1 µmol/mol	≤ 10 nmol/mol (Zero)	0.000	$u_{int,neg}$	-0.38	0.1452	
		≤ 10 nmol/mol (Span)	2.040				
9	Averaging effect	≤ 7.0% of measured value	-0.500	u_{av}	-0.38	0.1452	
18	Difference sample/calibration port	≤ 1.0%	0.110	u_{sc}	0.15	0.0211	
21	Uncertainty of test gas	≤ 3.0%	2.000	u_{tg}	1.32	1.7424	
Combined standard uncertainty				u_c		6.2776	nmol/mol
Expanded uncertainty				U		12.5551	nmol/mol
Relative expanded uncertainty				W		9.51	%
Maximum allowed expanded uncertainty				W_{req}		15	%

Expanded uncertainty laboratory, system 2

Measuring device:		APSA 380		Serial-No.:		USJ8SRJ8	
Measured component:		SO2		1h-limit value:		132 nmol/mol	
No.	Performance characteristic	Performance criterion	Result	Partial uncertainty		Square of partial uncertainty	
1	Repeatability standard deviation at zero	≤ 1.0 nmol/mol	0.070	$u_{r,z}$	0.01	0.0001	
2	Repeatability standard deviation at 1h-limit value	≤ 3.0 nmol/mol	0.300	$u_{r,h}$	0.05	0.0023	
3	"lack of fit" at 1h-limit value	≤ 4.0% of measured value	1.290	u_{lf}	0.98	0.9665	
4	Sensitivity coefficient of sample gas pressure at 1h-limit value	≤ 2.0 nmol/mol/kPa	0.540	u_{sp}	2.94	8.6409	
5	Sensitivity coefficient of sample gas temperature at 1h-limit value	≤ 1.0 nmol/mol/K	0.090	u_{gt}	0.86	0.7351	
6	Sensitivity coefficient of surrounding temperature at 1h-limit value	≤ 1.0 nmol/mol/K	0.433	u_{st}	4.12	17.0146	
7	Sensitivity coefficient of electrical voltage at 1h-limit value	≤ 0.30 nmol/mol/V	0.030	u_v	0.28	0.0805	
8a	Interferent H ₂ O with 19 nmol/mol	≤ 10 nmol/mol (Zero)	0.240	$u_{int,0}$	-2.40	5.7372	
		≤ 10 nmol/mol (Span)	-3.210				
8b	Interferent H ₂ S with 200 nmol/mol	≤ 5.0 nmol/mol (Zero)	0.240	$u_{int,pos}$	3.85	14.7852	
		≤ 5.0 nmol/mol (Span)	-1.800				
8c	Interferent NH ₃ with 200 nmol/mol	≤ 5.0 nmol/mol (Zero)	0.000	or	3.85	14.7852	
		≤ 5.0 nmol/mol (Span)	1.250				
8d	Interferent NO with 500 nmol/mol	≤ 5.0 nmol/mol (Zero)	2.350	or	3.85	14.7852	
		≤ 5.0 nmol/mol (Span)	2.820				
8e	Interferent NO ₂ with 200 nmol/mol	≤ 5.0 nmol/mol (Zero)	-0.160	$u_{int,neg}$	-0.53	0.2846	
		≤ 5.0 nmol/mol (Span)	1.020				
8f	Interferent m-Xylene with 1 µmol/mol	≤ 10 nmol/mol (Zero)	0.160	$u_{int,neg}$	-0.53	0.2846	
		≤ 10 nmol/mol (Span)	1.570				
9	Averaging effect	≤ 7.0% of measured value	-0.700	u_{av}	-0.53	0.2846	
18	Difference sample/calibration port	≤ 1.0%	0.080	u_{sc}	0.11	0.0112	
21	Uncertainty of test gas	≤ 3.0%	2.000	u_{tg}	1.32	1.7424	
Combined standard uncertainty				u_c		7.0711	nmol/mol
Expanded uncertainty				U		14.1422	nmol/mol
Relative expanded uncertainty				W		10.71	%
Maximum allowed expanded uncertainty				W_{req}		15	%

Combined uncertainty, laboratory and field, system 1

Measuring device:		APSA 380		Serial-No.:		M22R82FL	
Measured component:		SO2		1h-limit value:		132 nmol/mol	
No.	Performance characteristic	Performance criterion	Result	Partial uncertainty		Square of partial uncertainty	
1	Repeatability standard deviation at zero	≤ 1.0 nmol/mol	0.120	$U_{r,z}$	0.02	0.0004	
2	Repeatability standard deviation at 1h-limit value	≤ 3.0 nmol/mol	0.330	$U_{r,h}$	not considered, as $u_{r,h} = 0.05 < u_{r,f}$	-	
3	"lack of fit" at 1h-limit value	≤ 4.0% of measured value	1.340	U_{fit}	1.02	1.0429	
4	Sensitivity coefficient of sample gas pressure at 1h-limit value	≤ 2.0 nmol/mol/kPa	0.500	U_{sp}	2.72	7.4082	
5	Sensitivity coefficient of sample gas temperature at 1h-limit value	≤ 1.0 nmol/mol/K	0.090	U_{st}	0.86	0.7351	
6	Sensitivity coefficient of surrounding temperature at 1h-limit value	≤ 1.0 nmol/mol/K	0.123	U_{st}	1.17	1.3730	
7	Sensitivity coefficient of electrical voltage at 1h-limit value	≤ 0.30 nmol/mol/V	0.010	U_{sv}	0.09	0.0089	
8a	Interferent H ₂ O with 19 nmol/mol	≤ 10 nmol/mol (Zero) ≤ 10 nmol/mol (Span)	0.000 -3.600	$U_{int,CO}$	-2.69	7.2160	
8b	Interferent H ₂ S with 200 nmol/mol	≤ 5.0 nmol/mol (Zero) ≤ 5.0 nmol/mol (Span)	0.080 -0.780				
8c	Interferent NH ₃ with 200 nmol/mol	≤ 5.0 nmol/mol (Zero) ≤ 5.0 nmol/mol (Span)	-0.240 1.180	or	4.44	19.7120	
8d	Interferent NO with 500 nmol/mol	≤ 5.0 nmol/mol (Zero) ≤ 5.0 nmol/mol (Span)	3.060 3.370				
8e	Interferent NO ₂ with 200 nmol/mol	≤ 5.0 nmol/mol (Zero) ≤ 5.0 nmol/mol (Span)	0.000 1.100	$U_{int,NO2}$			
8f	Interferent m-Xylene with 1 µmol/mol	≤ 10 nmol/mol (Zero) ≤ 10 nmol/mol (Span)	0.000 2.040				
9	Averaging effect	≤ 7.0% of measured value	-0.500	U_{av}	-0.38	0.1452	
10	Reproducibility standard deviation under field conditions	≤ 5.0% of average over 3 months	0.100	$U_{r,f}$	0.13	0.0174	
11	Long term drift at zero level	≤ 4.0 nmol/mol	0.330	$U_{d,z}$	0.19	0.0363	
12	Long term drift at span level	≤ 5.0% of max. of certification range	-2.460	$U_{d,h}$	-1.87	3.5148	
18	Difference sample/calibration port	≤ 1.0%	0.110	U_{sc}	0.15	0.0211	
21	Uncertainty of test gas	≤ 3.0%	2.000	U_{tg}	1.32	1.7424	
				Combined standard uncertainty		u_c	6.5554 nmol/mol
				Expanded uncertainty		U	13.1108 nmol/mol
				Relative expanded uncertainty		W	9.93 %
				Maximum allowed expanded uncertainty		W_{max}	15 %

Combined uncertainty, laboratory and field, system 2

Measuring device:		APSA 380		Serial-No.:		USJ8SRJ8	
Measured component:		SO2		1h-limit value:		132 nmol/mol	
No.	Performance characteristic	Performance criterion	Result	Partial uncertainty		Square of partial uncertainty	
1	Repeatability standard deviation at zero	≤ 1.0 nmol/mol	0.070	$U_{r,z}$	0.01	0.0001	
2	Repeatability standard deviation at 1h-limit value	≤ 3.0 nmol/mol	0.300	$U_{r,h}$	not considered, as $u_{r,h} = 0.04 < u_{r,f}$	-	
3	"lack of fit" at 1h-limit value	≤ 4.0% of measured value	1.290	U_{fit}	0.98	0.9665	
4	Sensitivity coefficient of sample gas pressure at 1h-limit value	≤ 2.0 nmol/mol/kPa	0.540	U_{sp}	2.94	8.6409	
5	Sensitivity coefficient of sample gas temperature at 1h-limit value	≤ 1.0 nmol/mol/K	0.090	U_{st}	0.86	0.7351	
6	Sensitivity coefficient of surrounding temperature at 1h-limit value	≤ 1.0 nmol/mol/K	0.433	U_{st}	4.12	17.0146	
7	Sensitivity coefficient of electrical voltage at 1h-limit value	≤ 0.30 nmol/mol/V	0.030	U_{sv}	0.28	0.0805	
8a	Interferent H ₂ O with 19 nmol/mol	≤ 10 nmol/mol (Zero) ≤ 10 nmol/mol (Span)	0.240 -3.210	$U_{int,CO}$	-2.40	5.7372	
8b	Interferent H ₂ S with 200 nmol/mol	≤ 5.0 nmol/mol (Zero) ≤ 5.0 nmol/mol (Span)	0.240 -1.800				
8c	Interferent NH ₃ with 200 nmol/mol	≤ 5.0 nmol/mol (Zero) ≤ 5.0 nmol/mol (Span)	0.000 1.250	or	3.85	14.7852	
8d	Interferent NO with 500 nmol/mol	≤ 5.0 nmol/mol (Zero) ≤ 5.0 nmol/mol (Span)	2.350 2.820				
8e	Interferent NO ₂ with 200 nmol/mol	≤ 5.0 nmol/mol (Zero) ≤ 5.0 nmol/mol (Span)	-0.160 1.020	$U_{int,NO2}$			
8f	Interferent m-Xylene with 1 µmol/mol	≤ 10 nmol/mol (Zero) ≤ 10 nmol/mol (Span)	0.160 1.570				
9	Averaging effect	≤ 7.0% of measured value	-0.700	U_{av}	-0.53	0.2846	
10	Reproducibility standard deviation under field conditions	≤ 5.0% of average over 3 months	0.100	$U_{r,f}$	0.13	0.0174	
11	Long term drift at zero level	≤ 4.0 nmol/mol	0.240	$U_{d,z}$	0.14	0.0192	
12	Long term drift at span level	≤ 5.0% of max. of certification range	-1.600	$U_{d,h}$	-1.22	1.4868	
18	Difference sample/calibration port	≤ 1.0%	0.080	U_{sc}	0.11	0.0112	
21	Uncertainty of test gas	≤ 3.0%	2.000	U_{tg}	1.32	1.7424	
				Combined standard uncertainty		u_c	7.1779 nmol/mol
				Expanded uncertainty		U	14.3557 nmol/mol
				Relative expanded uncertainty		W	10.88 %
				Maximum allowed expanded uncertainty		W_{max}	15 %