CERTIFICATE

of Product Conformity (QAL1)

Certificate No.: 0000040205_03

Certified AMS:	Serinus 50 for SO_2
Manufacturer:	ACOEM Australasia (Ecotech Pty Ltd) 1492 Ferntree Gully Road, Knoxfield, VIC, 3180 Australia
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), 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 16 pages).
The present certificate replaces certificate 0000040205_02 dated 1 July 2020.

TÜVRheinland® CERTIFIED
Suitability Tested
Complying with 2008/50/EC
EN 15267
Regular Surveillance
www.tuv.com
ID 0000040205

Publication in the German Federal Gazette (BAnz) of 1 April 2014

German Environment Agency

Dessau, 27 June 2025

This certificate will expire on:
30 June 2030

TÜV Rheinland Energy & Environment GmbH
Cologne, 30 June 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:	936/21221977/B dated 8 October 2013
Initial certification:	1 April 2014
Expiry date:	30 June 2030
Certificate:	Renewal (of previous certificate 0000040205_02 of 1 July 2020 valid until 30 June 2025)
Publication:	BAnz AT 01.04.2014 B12, chapter IV No. 3.1

Approved application

The tested AMS is suitable for continuous immission measurement of SO_2 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.

The AMS is approved for an ambient temperature range of 0 °C to 30 °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 936/21221977/B dated 8 October 2013
  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 AT 01.04.2014 B12, chapter IV No. 3.1, Announcement by UBA dated 27 February 2014:

AMS designation:
Serinus 50 for SO_2

Manufacturer:
Ecotech Pty Ltd., Knoxfield, Australia

Field of application:
Continuous measurement of sulphur dioxide concentration in ambient air (stationary operation)

Measuring ranges during the performance test:

Component	Certification range	Unit
Sulphur dioxide	0 – 1,000	µg/m³

Software version:
Firmware: 2.09.0005

Restrictions:
None

Notes:
1. The measuring system must be operated inside a lockable measuring cabinet or measurement container.
2. The test report on performance testing is available on the internet at www.qal1.de.

Test institute: TÜV Rheinland Energie und Umwelt GmbH, Cologne
Report No.: 936/21221977/B dated 8 October 2013

Publication in the German Federal Gazette: BAnz AT 02.04.2015 B5, Chap. IV notification 7, Announcement by UBA dated 25 February 2015:

7 Notification as regards Federal Environment Agency (UBA) notice of 27 February 2014 (BAnz AT 01.04.2014 B12, chapter IV number 3.1)

Hereafter, the Serinus 50 measuring system for SO_2, manufactured by Ecotech Pty Ltd., will be equipped with a new microprocessor board (CO10014). This results in modifications of the power plug as well as software changes.

The current two software versions are designated as follows:
2.20.0009 for systems using the old microprocessor board (C010001)
3.10.001 for systems using the new microprocessor board (C010014).

Statement by TÜV Rheinland Energie und Umwelt GmbH of 12 September 2014

Publication in the German Federal Gazette: BAnz AT 15.03.2017 B6, Chap. V notification 8, Announcement by UBA dated 22 February 2017:

8 Notification as regards Federal Environment Agency notices of 27 February 2014 (BAnz AT 01.04.2014 B12, chapter IV number 3.1) and of 25 February 2015 (BAnz AT 02.04.2015 B5 chapter IV notification 7)

The current software version of the Serinus 50 for SO_2 manufactured by Ecotech Pty Ltd. for systems with micro processor board (C010001) is:
V 2.31.0004.
The following software versions are approved for this instrument version:
V 2.21.0000, V 2.22.0000, V 2.23.0000, V 2.24.0000, V 2.25.0004, V 2.26.0000, V 2.27.0000, V 2.28.0000, V 2.29.0003 and V 2.30.0000.

The current software version of the Serinus 50 for SO_2 manufactured by Ecotech Pty Ltd. for systems with micro processor board (C010014) is: V 3.48.011.

The following software versions are approved for this instrument version:
V 3.13.000, V 3.14.001, V 3.15.010, V 3.16.001, V 3.18.003, V 3.20.000, V 3.22.000, V 3.23.015, V 3.24.000, V 3.26.000, V 3.27.000, V 3.28.000, V 3.29.013, V 3.30.005, V 3.31.002, V 3.32.003, V 3.33.004, V 3.34.000, V 3.35.004, V 3.36.000, V 3.37.004, V 3.38.006, V 3.39.000, V 3.40.001, V 3.41.004, V 3.42.000, V 3.43.000, V 3.44.004, V 3.45.011, V 3.46.002, V 3.47.006.

Statement by TÜV Rheinland Energy GmbH dated 13 October 2016

Publication in the German Federal Gazette: BAnz AT 26.03.2019 B7, Chap. IV notification 18, Announcement by UBA dated 27 February 2019:

18 Notification as regards Federal Environment Agency notices of 27 February 2014 (BAnz AT 01.04.2014 B12, chapter IV number 3.1) and of 22 February 2017 (BAnz AT 15.03.2017 B6, chapter IV notification 8)

The current software version of the Serinus 50 for SO_2 manufactured by Ecotech Pty Ltd. for systems with micro processor board (C010001) is: V 2.35.0001.
In addition, the following software versions have been approved for this instrument version: V 2.32.0000, V 2.33.0000, V 2.34.0000

The current software version of the Serinus 50 for SO_2 manufactured by Ecotech Pty Ltd. for systems with micro processor board (C010014) is: V 3.74.0003.
In addition, the following software versions have been approved for this instrument version:
V 3.49.0000, V 3.51.0011, V 3.52.0000, V 3.53.0012, V 3.54.0000, V 3.55.0000, V 3.56.0001, V 3.57.0002, V 3.58.0000, V 3.59.0004, V 3.60.0005, V 3.61.0000, V 3.62.0000, V 3.63.0001, V 3.64.0000, V 3.65.0001, V 3.66.0000, V 3.67.0003, V 3.68.0009, V 3.69.0001, V 3.70.0000, V 3.71.0000

The display of the measuring system shows the software version in the following format: 2.XX or 3.XX.

Statement by TÜV Rheinland Energy GmbH dated 10 October 2018

Publication in the German Federal Gazette: BAnz AT 24.03.2020 B7, Chap. IV notification 22, Announcement by UBA dated 24 February 2020:

22 Notification as regards Federal Environment Agency (UBA) notices of 27 February 2014 (BAnz AT 01.04.2014 B12, chapter IV number 3.1) and of 27 February 2019 (BAnz AT 26.03.2019 B7, chapter IV notification 18)

The latest software version of the Serinus 50 measuring system for SO_2 with microprocessor C010001 manufactured by Ecotech Pty Ltd. remains: V 2.35.0001.

The latest software version of the Serinus 50 measuring system for SO_2 with microprocessor C010014 manufactured by Ecotech Pty Ltd. is: V 3.87.0000.
Moreover, the following software version are approved for this instrument version:
V 3.75.0003, V 3.76.0004, V 3.77.0009, V 3.78.0000, V 3.79.0001, V 3.81.0000, V 3.83.0000, V 3.84.0000, V 3.85.0001, V 3.86.0000.
The instrument's display shows the software version in the following format: 2.XX or 3.XX.

Statement by TÜV Rheinland Energy GmbH dated 20 September 2019

Publication in the German Federal Gazette: BAnz AT 03.05.2021 B9, Chap. III notification 12, Announcement by UBA dated 31 March 2021:

12 Notification as regards Federal Environment Agency (UBA) notices of 27 February 2014 (BAnz AT 01.04.2014 B12, chapter IV number 3.1) and of 24 February 2020 (BAnz AT 24.03.2020 B7, chapter IV notification 22)

The latest software version of the Serinus 50 measuring system for SO_2 with microprocessor C010001 manufactured by Ecotech Pty Ltd. is:
V 2.35.0001.
The latest software version of the Serinus 50 measuring system for SO_2 with microprocessor C010014 manufactured by Ecotech Pty Ltd. is:
V 4.02.0000.
Furthermore, the following software versions are approved for this instrument version:
V 3.88.0000, V 3.89.0000, V 3.90.0002, V 4.00.0000, V 4.01.0000

The instrument's display shows the software version in the following format: 2.XX or 3.XX or 4.XX.
The Serinus Main Controller Board (PCB) received an update from Rev. N to Rev. P.

Statement by TÜV Rheinland Energy GmbH dated 14 July 2020

Publication in the German Federal Gazette: BAnz AT 11.04.2022 B10, Chap. VI notification 6, Announcement by UBA dated 9 March 2022:

6 Notification as regards Federal Environment Agency (UBA) notices of 27 February 2014 (BAnz AT 01.04.2014 B12, chapter IV number 3.1) and of 31 March 2021 (BAnz AT 03.05.2021 B9, chapter III notification 12)

The company name of Ecotech Pty. Ltd. changes to ACOEM Australasia.

The current software version of the measuring device Serinus 50 for SO_2 of the company ACOEM Australasia for devices with the microprocessor board (C010001) is unchanged: V 2.35.0001.

The current software version of the measuring device Serinus 50 for SO_2 of the company ACOEM Australasia for devices with the microprocessor board (C010014) is: V 4.13.0000.
Furthermore, the following software versions are approved for this instrument version: V 4.04.0000, V 4.06.0000, V 4.07.0000, V 4.08.0000, V 4.09.0000, V 4.10.0000, V 4.11.0000.

The software version number appears in the display of the measuring device in the format 2.XX or 3.XX or 4.XX.

Statement by TÜV Rheinland Energy GmbH dated 20 August 2021

Publication in the German Federal Gazette: BAnz AT 20.03.2023 B6, Chap. IV notification 60, Announcement by UBA dated 21 February 2023:

60 Notification as regards Federal Environment Agency (UBA) notices of 27 February 2014 (BAnz AT 01.04.2014 B12, chapter IV number 3.1) and of 9 March 2022 (BAnz AT 11.04.2022 B10, chapter VI notification 6)

The current software version of the Serinus 50 measuring system for SO_2 from the company ACOEM Australasia for devices with the microprocessor board (C010001) remains: V 2.35.0001

The current software version of the Serinus 50 measuring system for SO_2 from the company ACOEM Australasia for devices with the microprocessor board (C010014) is: V 4.18.0000.

Furthermore, the following software versions are approved for this device version: V 4.14.0000, V 4.15.0000, V 4.16.0000, V 4.17.0000

The software version number appears in the display of the measuring system in the format 2.XX or 3.XX or 4.XX.

Statement by TÜV Rheinland Energy GmbH dated 5 September 2022

Publication in the German Federal Gazette: BAnz AT 10.05.2024 B7, Chap. V notification 46, Announcement by UBA dated 19 March 2024:

46 Notification as regards Federal Environment Agency (UBA) notices of 27 February 2014 (BAnz AT 01.04.2014 B12, chapter IV number 3.1) and of 21 February 2023 (BAnz AT 20.03.2023 B6, chapter IV notification 60)

The current software version for the Serinus 50 measuring system for SO_2 from ACOEM Australasia is unchanged for systems with the microprocessor board (C010001): V 2.35.0001

The current software version for the Serinus 50 measuring system for SO_2 from ACOEM Australasia for systems with the microprocessor board (C010014) is V 4.22.0000.
The following software versions are also authorised for this device version: V 4.19.0000, V 4.20.0000, V 4.21.0000

The software version number appears on the display of the measuring system in the format 2.XX or 3.XX or 4.XX.

Statement by TÜV Rheinland Energy GmbH dated 10 August 2023

Publication in the German Federal Gazette: BAnz AT 19.05.2025 B3, Chap. IV notification 97, Announcement by UBA dated 2 April 2025:

97 Notification as regards Federal Environment Agency (UBA) notices of 27 February 2014 (BAnz AT 01.04.2014 B12, chapter IV number 3.1) and of 19 March 2024 (BAnz AT 10.05.2024 B7, chapter V notification 46)

The current software version of the Serinus 50 measuring system for SO2 from ACOEM Australasia is unchanged for devices with the microprocessor board (C010001):
V 2.35.0001

The current software version of the Serinus 50 measuring system for SO2 from ACOEM Australasia for devices with the microprocessor board is (C010014):
V 4.28.0000

The following software versions are also authorised for this device version: V 4.23.0000, V 4.24.0000, V 4.25.0000, V 4.26.0000, V 4.27.0000

The software version number appears on the display of the measuring device in the format 2.XX or 3.XX or 4.XX.

Statement issued by TÜV Rheinland Energy & Environment GmbH dated 28 September 2024

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

The Serinus 50 measuring system is a continuous sulphur dioxide monitor which uses the method of ultraviolet fluorescence. The instrument is designed for the continuous measuring of sulphur dioxide in ambient air.

Measurements are performed by means of the following components:

- Hydrocarbon kicker
- UV lamp
- fluorescence cell
- optical band-pass filter
- photomultiplier tube (PMT)

The SO_2 concentration is automatically corrected for gas temperature and pressure changes and referenced to 0°C, 20°C or 25°C at 1 atmosphere. This allows the Serinus 50 to sample in the most useful range of SO_2 ambient measurement (25–500 ppb SO_2 in the air).

The measurement of sulphur dioxide is based on classical fluorescence spectroscopy principles. Sulphur dioxide (SO_2) exhibits a strong ultraviolet (UV) absorption spectrum between 200 and 240 nm. When SO_2 absorbs UV from this wavelength, photon emission occurs (300–420 nm). The amount of fluorescence emitted is directly proportional to the SO_2 concentration.
The Serinus 50 follows these principles and measurement techniques:

- Sample air passes through a hydrocarbon kicker which removes hydrocarbons.
- UV energy from the zinc discharge lamp passes through a UV band-pass filter are used to produce radiation at 214 nm.
- The radiation is focused into the fluorescence cell where it is absorbed by the SO_2 molecules.
- The SO_2 molecules then emit photons (fluorescent light) uniformly in all directions.
- Wavelengths between 310–350 nm, which are specific to SO_2, pass through a band pass filter where they reach the photomultiplier and record a signal. The signal is recorded accordingly.
- A reference detector monitors the emission from the zinc lamp and is used to correct for fluctuations in lamp intensity.

Exhaust air is scrubbed with a charcoal scrubber to eliminate hydrocarbons and SO_2. This air is then clean enough for use in the hydrocarbon kicker to remove hydrocarbons from the incoming sample air.

The Serinus 50 sulphur dioxide analyser consists of five main assemblies:

- The pneumatics to transfer sample and exhaust gas,
- The sensors for the measurement of SO_2 (optical cell) and other relevant parameters,
- The control system which encompasses all circuit boards controlling sensors and pneumatic,
- The power supply which supplies power for all the instrument processors,
- The communication module to access data.

Particle filter:
The particulate filter is a Teflon 5 micron (µm) filter with a diameter of 47 mm. This filter eliminates all particles larger than 5 µm that could interfere with sample measurements.

Hydrocarbon scrubber
The hydrocarbon scrubber removes interfering hydrocarbons from the sample air. To this effect a counter current exchange is used, where an air with a lower concentration of hydrocarbons moves in an opposite direction to air with a higher concentration. The high concentrations of hydrocarbons diffuse through a selective permeation membrane to the low concentration exhaust air and are removed. Increasing the flow of the low concentration air also increases the rate of diffusion.

Sample gas pump
Manufacturer: Thomas, Type: 617CD22-194 C

During performance testing, the sample gas pump mentioned above was used for the laboratory as well as in the field test. As far as the models Serinus 10 (ozone), Serinus 30 (CO) and Serinus 50 (SO_2) are concerned, one pump can be operated with up to two analysers. However, operation of the Serinus 40 (NO_x) requires one sample gas pump per analyser.

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 Serinus 50 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. 0000040205_00: 29 April 2014
Expiry date of the certificate: 31 March 2019
Test report: 936/21221977/B dated 8 October 2013
TÜV Rheinland Energie und Umwelt GmbH
Publication: BAnz AT 01.04.2014 B12, chapter IV number 3.1
UBA announcement dated 27 February 2014

Notifications
Statement issued by TÜV Rheinland Energie und Umwelt GmbH dated 12 September 2014
Publication: BAnz AT 02.04.2015 B5, chapter IV notification 7
UBA announcement dated 25 February 2015
(Soft- and hardware changes)

Statement issued by TÜV Rheinland Energy GmbH dated 13 October 2016
Publication: BAnz AT 15.03.2017 B6, chapter V notification 8
UBA announcement dated 22 February 2017
(Software changes)

Renewal of certificates
Certificate No. 0000040205_01: 1 April 2019
Expiry date of the certificate: 30 June 2020

Notifications
Statement issued by TÜV Rheinland Energy GmbH dated 10 October 2018
Publication: BAnz AT 26.03.2019 B7, chapter IV notification 18
UBA announcement dated 27 February 2019
(Software changes)

Statement issued by TÜV Rheinland Energy GmbH dated 20 September 2019
Publication: BAnz AT 24.03.2020 B7, chapter IV notification 22
UBA announcement dated 24 February 2020
(Software changes)

Renewal of certificates
Certificate No. 0000040205_02: 1 July 2020
Expiry date of the certificate: 30 June 2025

Notifications
Statement issued by TÜV Rheinland Energy GmbH dated 14 July 2020
Publication: BAnz AT 03.05.2021 B9, chapter III notification 12
UBA announcement dated 31 March 2021
(Software changes)

Statement issued by TÜV Rheinland Energy GmbH dated 20 August 2021
Publication: BAnz AT 11.04.2022 B10, chapter VI notification 6
UBA announcement dated 9 March 2022
(Software changes and new producer name formerly Ecotech Pty. Ltd.)

Statement issued by TÜV Rheinland Energy GmbH dated 5 September 2022
Publication: BAnz AT 20.03.2023 B6, chapter IV notification 60
UBA announcement dated 21 February 2023
(Software changes)

Statement issued by TÜV Rheinland Energy GmbH dated 10 August 2023
Publication: BAnz AT 10.05.2024 B7, chapter V notification 46
UBA announcement dated 19 March 2024
(Software changes)

Renewal of certificates

Certificate No. 0000040205_03:	27 June 2025
Expiry date of the certificate:	30 June 2030

Measuring device:	Ecotech Serinus 50	Serial-No.:	13-0096 (Device 1)	
Measured component:	SO_2	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	0.050	$u_{r,z}$	0.02	0.0002	
2	Repeatability standard deviation at 1h-limit value	≤ 3.0 nmol/mol	0.240	$u_{r,h}$	0.07	0.0050	
3	"lack of fit" at 1h-limit value	≤ 4.0% of measured value	2.620	$u_{l,h}$	2.00	3.9868	
4	Sensitivity coefficient of sample gas pressure at 1h-limit value	≤ 2.0 nmol/mol/kPa	0.340	u_{gp}	2.70	7.2852	
5	Sensitivity coefficient of sample gas temperature at 1h-limit value	≤ 1.0 nmol/mol/K	0.050	u_{gt}	0.40	0.1609	
6	Sensitivity coefficient of surrounding temperature at 1h-limit value	≤ 1.0 nmol/mol/K	0.305	u_{st}	2.47	6.1146	
7	Sensitivity coefficient of electrical voltage at 1h-limit value	≤ 0.30 nmol/mol/V	0.027	u_V	0.25	0.0608	
8a	Interferent H_20 with 21 mmol/mol	≤ 10 nmol/mol (Zero)	0.010	u_{H2O}	2.25	5.0688	
		≤ 10 nmol/mol (Span)	3.040				
8b	Interferent H_2S with 200 nmol/mol	≤ 5.0 nmol/mol (Zero)	1.600	$u_{int,pos}$			
		≤ 5.0 nmol/mol (Span)	2.390				
8c	Interferent NH_3 with 200 nmol/mol	≤ 5.0 nmol/mol (Zero)	-0.290				
		≤ 5.0 nmol/mol (Span)	1.080				
8d	Interferent NO with 500 nmol/mol	≤ 5.0 nmol/mol (Zero)	3.420				
		≤ 5.0 nmol/mol (Span)	2.850	or	5.83	34.0086	
8e	Interferent NO_2 with 200 nmol/mol	≤ 5.0 nmol/mol (Zero)	0.100				
		≤ 5.0 nmol/mol (Span)	0.740				
8f	Interferent m-Xylene with 1 µmol/mol	≤ 10 nmol/mol (Zero)	1.250				
		≤ 10 nmol/mol (Span)	3.050	$u_{int,neg}$			
9	Averaging effect	≤ 7.0% of measured value	-2.930	u_{av}	-2.23	4.9861	
18	Difference sample/calibration port	≤ 1.0%	0.220	$u_{\Delta sc}$	0.29	0.0843	
21	Uncertainty of test gas	≤ 3.0%	2.000	u_{cg}	1.32	1.7424	

Combined standard uncertainty	u_c	7.9689	nmol/mol
Expanded uncertainty	U	15.9379	nmol/mol
Relative expanded uncertainty	W	12.07	%
Maximum allowed expanded uncertainty	W_{req}	15	%

Expanded uncertainty laboratory, system 2

Measuring device:	Ecotech Serinus 50	Serial-No.:	13-0097 (Device 2)		
Measured component	SO_2	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	0.000	u_{r_z}	0.00	0.0000	
2	Repeatability standard deviation at 1h-limit value	≤	3.0 nmol/mol	0.230	u_{r_lh}	0.07	0.0048	
3	"lack of fit" at 1h-limit value	≤	4.0% of measured value	1.590	u_{lh}	1.21	1.4683	
4	Sensitivity coefficient of sample gas pressure at 1h-limit value	≤	2.0 nmol/mol/kPa	0.270	u_{gp}	2.14	4.5625	
5	Sensitivity coefficient of sample gas temperature at 1h-limit value	≤	1.0 nmol/mol/K	0.030	u_{gt}	0.24	0.0587	
6	Sensitivity coefficient of surrounding temperature at 1h-limit value	≤	1.0 nmol/mol/K	0.152	u_{st}	1.24	1.5295	
7	Sensitivity coefficient of electrical voltage at 1h-limit value	≤	0.30 nmol/mol/V	0.028	u_V	0.26	0.0701	
8a	Interferent H_2O with 21 mmol/mol	≤	10 nmol/mol (Zero)	-0.510	u_{H2O}	2.11	4.4660	
		≤	10 nmol/mol (Span)	3.060				
8b	Interferent H_2S with 200 nmol/mol	≤	5.0 nmol/mol (Zero)	1.410	$u_{int,pos}$			
		≤	5.0 nmol/mol (Span)	2.210				
8c	Interferent NH_3 with 200 nmol/mol	≤	5.0 nmol/mol (Zero)	-0.310				
		≤	5.0 nmol/mol (Span)	0.230				
8d	Interferent NO with 500 nmol/mol	≤	5.0 nmol/mol (Zero)	3.670		5.48	30.0628	
		≤	5.0 nmol/mol (Span)	4.160	or			
8e	Interferent NO_2 with 200 nmol/mol	≤	5.0 nmol/mol (Zero)	1.000				
		≤	5.0 nmol/mol (Span)	0.310				
8f	Interferent m-Xylene with 1 µmol/mol	≤	10 nmol/mol (Zero)	0.860				
		≤	10 nmol/mol (Span)	2.660	$u_{int,neg}$			
9	Averaging effect	≤	7.0% of measured value	-2.620	u_{av}	-2.00	3.9868	
18	Difference sample/calibration port	≤	1.0%	0.280	u_{asc}	0.37	0.1366	
21	Uncertainty of test gas	≤	3.0%	2.000	u_{cg}	1.32	1.7424	

Combined standard uncertainty	u_c	6.9346	nmol/mol
Expanded uncertainty	U	13.8692	nmol/mol
Relative expanded uncertainty	W	10.51	%
Maximum allowed expanded uncertainty	W_{req}	15	%

Combined uncertainty, laboratory and field, system 1

Measuring device: Ecotech Serinus 50 | Serial-No.: 13-0096 (Device 1)

Measured component: SO_2 | 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	0.050	$u_{r,z}$	0.02	0.0002
2	Repeatability standard deviation at 1h-limit value	≤	3.0 nmol/mol	0.240	$u_{r,1h}$	not considered, as $u_{r,1h} = 0,07 < u_{r,f}$	-
3	"lack of fit" at 1h-limit value	≤	4.0% of measured value	2.620	u_{1h}	2.00	3.9868
4	Sensitivity coefficient of sample gas pressure at 1h-limit value	≤	2.0 nmol/mol/kPa	0.340	u_{gp}	2.70	7.2852
5	Sensitivity coefficient of sample gas temperature at 1h-limit value	≤	1.0 nmol/mol/K	0.050	u_{gt}	0.40	0.1609
6	Sensitivity coefficient of surrounding temperature at 1h-limit value	≤	1.0 nmol/mol/K	0.305	u_{st}	2.47	6.1146
7	Sensitivity coefficient of electrical voltage at 1h-limit value	≤	0.30 nmol/mol/V	0.027	u_V	0.25	0.0608
8a	Interferent H_2O with 21 mmol/mol	≤	10 nmol/mol (Zero)	0.010			
		≤	10 nmol/mol (Span)	3.040	$u_{I:H2O}$	2.25	5.0688
8b	Interferent H_2S with 200 nmol/mol	≤	5.0 nmol/mol (Zero)	1.600			
		≤	5.0 nmol/mol (Span)	2.390	$u_{int,pos}$		
8c	Interferent NH_3 with 200 nmol/mol	≤	5.0 nmol/mol (Zero)	-0.290			
		≤	5.0 nmol/mol (Span)	1.080			
8d	Interferent NO with 500 nmol/mol	≤	5.0 nmol/mol (Zero)	3.420			
		≤	5.0 nmol/mol (Span)	2.850	or	5.83	34.0086
8e	Interferent NO_2 with 200 nmol/mol	≤	5.0 nmol/mol (Zero)	0.100			
		≤	5.0 nmol/mol (Span)	0.740			
8f	Interferent m-Xylene with 1 µmol/mol	≤	10 nmol/mol (Zero)	1.250			
		≤	10 nmol/mol (Span)	3.050	$u_{int,neg}$		
9	Averaging effect	≤	7.0% of measured value	-2.930	u_{av}	-2.23	4.9861
10	Reproducibility standard deviation under field conditions	≤	5.0% of average over 3 months	3.740	$u_{r,f}$	4.94	24.3720
11	Long term drift at zero level	≤	4.0 nmol/mol	-0.940	$u_{d,Lz}$	-0.54	0.2945
12	Long term drift at span level	≤	5.0% of max. of certification range	3.810	$u_{d,Lh}$	2.90	8.4310
18	Difference sample/calibration port	≤	1.0%	0.220	u_{asc}	0.29	0.0843
21	Uncertainty of test gas	≤	3.0%	2.000	u_{tg}	1.32	1.7424
					Combined standard uncertainty	u_c	9.8283 nmol/mol
					Expanded uncertainty	U	19.6567 nmol/mol
					Relative expanded uncertainty	W	14.89 %
					Maximum allowed expanded uncertainty	W_{req}	15 %

Combined uncertainty, laboratory and field, system 2

Measuring device: Ecotech Serinus 50 — Serial-No.: 13-0097 (Device 2)

Measured component: SO_2 — 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	0.000	$u_{r,z}$	0.00	0.0000
2	Repeatability standard deviation at 1h-limit value	≤	3.0 nmol/mol	0.230	$u_{r,lh}$	not considered, as $u_{r,lh} = 0,06 < u_{r,f}$	-
3	"lack of fit" at 1h-limit value	≤	4.0% of measured value	1.590	$u_{lj,h}$	1.21	1.4683
4	Sensitivity coefficient of sample gas pressure at 1h-limit value	≤	2.0 nmol/mol/kPa	0.270	u_{gp}	2.14	4.5625
5	Sensitivity coefficient of sample gas temperature at 1h-limit value	≤	1.0 nmol/mol/K	0.030	u_{gt}	0.24	0.0587
6	Sensitivity coefficient of surrounding temperature at 1h-limit value	≤	1.0 nmol/mol/K	0.152	u_{st}	1.24	1.5295
7	Sensitivity coefficient of electrical voltage at 1h-limit value	≤	0.30 nmol/mol/V	0.028	u_V	0.26	0.0701
8a	Interferent H_2O with 21 mmol/mol	≤	10 nmol/mol (Zero)	-0.510			
		≤	10 nmol/mol (Span)	3.060	u_{H2O}	2.11	4.4660
8b	Interferent H_2S with 200 nmol/mol	≤	5.0 nmol/mol (Zero)	1.410			
		≤	5.0 nmol/mol (Span)	2.210	$u_{int,pos}$		
8c	Interferent NH_3 with 200 nmol/mol	≤	5.0 nmol/mol (Zero)	-0.310			
		≤	5.0 nmol/mol (Span)	0.230			
8d	Interferent NO with 500 nmol/mol	≤	5.0 nmol/mol (Zero)	3.670			
		≤	5.0 nmol/mol (Span)	4.160	or	5.48	30.0628
8e	Interferent NO_2 with 200 nmol/mol	≤	5.0 nmol/mol (Zero)	1.000			
		≤	5.0 nmol/mol (Span)	0.310			
8f	Interferent m-Xylene with 1 µmol/mol	≤	10 nmol/mol (Zero)	0.860			
		≤	10 nmol/mol (Span)	2.660	$u_{int,neg}$		
9	Averaging effect	≤	7.0% of measured value	-2.620	u_{av}	-2.00	3.9868
10	Reproducibility standard deviation under field conditions	≤	5.0% of average over 3 months	3.740	$u_{r,f}$	4.94	24.3720
11	Long term drift at zero level	≤	4.0 nmol/mol	1.470	$u_{d,lz}$	0.85	0.7203
12	Long term drift at span level	≤	5.0% of max. of certification range	3.540	$u_{d,ls}$	2.70	7.2784
18	Difference sample/calibration port	≤	1.0%	0.280	u_{sec}	0.37	0.1366
21	Uncertainty of test gas	≤	3.0%	2.000	u_{cg}	1.32	1.7424
					Combined standard uncertainty	u_c	8.9696	nmol/mol
					Expanded uncertainty	U	17.9393	nmol/mol
					Relative expanded uncertainty	W	13.59	%
					Maximum allowed expanded uncertainty	W_{req}	15	%