CERTIFICATE

of Product Conformity (QAL1)

Certificate No.: 0000040202_03

Certified AMS:	Serinus 10 for O_3
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 14625 (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 0000040202_02 dated 1 July 2020.

TÜVRheinland® CERTIFIED
Suitability Tested
Complying with 2008/50/EC
EN 15267
Regular Surveillance
www.tuv.com
ID 0000040202

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, 26 June 2025

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TÜV Rheinland Energy & Environment GmbH
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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/C dated 8 October 2013
Initial certification:	1 April 2014
Expiry date:	30 June 2030
Certificate:	Renewal (of previous certificate 0000040202_02 of 1 July 2020 valid until 30 June 2025)
Publication:	BAnz AT 01.04.2014 B12, chapter IV No. 1.1

Approved application

The tested AMS is suitable for continuous immission measurement of O_3 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/C 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. 1.1, Announcement by UBA dated 27 February 2014:

AMS designation:
Serinus 10 for Ozone

Manufacturer:
Ecotech Pty Ltd., Knoxfield, Australia

Field of application:
For continuous ambient air monitoring of ozone (stationary operation)

Measuring ranges during the performance test:

Component	Certification range	Unit
Ozone	0 - 500	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/C dated 8 October 2013

Publication in the German Federal Gazette: BAnz AT 02.04.2015 B5, Chap. IV notification 4, Announcement by UBA dated 25 February 2015:

4 Notification as regards Federal Environment Agency (UBA) notice of of 27 February 2014 (BAnz AT 01.04.2014 B12, chapter IV number 1.1)

Hereafter, the Serinus 10 measuring system for O_3, manufactured by Ecotech Pty Ltd., will be equipped with a new micro processor board (C010014).

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 of 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 5, Announcement by UBA dated 22 February 2017:

5 Notification as regards Federal Environment Agency notices of 27 February 2014 (BAnz AT 01.04.2014 B12, chapter IV number 1.1) and of 25 February 2015 (BAnz AT 02.04.2015 B5 chapter IV notification 4)

The current software version of the Serinus 10 for O_3 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 und V 2.30.0000.

The current software version of the Serinus 10 for O_3 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 15, Announcement by UBA dated 27 February 2019:

15 Notification as regards Federal Environment Agency notices of 27 February 2014 (BAnz AT 01.04.2014 B12, chapter IV number 1.1) and of 22 February 2017 (BAnz AT 15.03.2017 B6, chapter IV notification 5)

The current software version of the Serinus 10 for O_3 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 10 for O_3 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 19, Announcement by UBA dated 24 February 2020:

19 Notification as regards Federal Environment Agency (UBA) notices of 27 February 2014 (BAnz AT 01.04.2014 B12, chapter IV number 1.1) and of 27 February 2019 (BAnz AT 26.03.2019 B7, chapter IV notification 15)

The latest software version of the Serinus 10 measuring system for O_3 with microprocessor C010001 manufactured by Ecotech Pty Ltd. remains:
V 2.35.0001.
The latest software version of the Serinus 10 measuring system for O_3 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 9, Announcement by UBA dated 31 March 2021:

9 Notification as regards Federal Environment Agency (UBA) notices of 27 February 2014 (BAnz AT 01.04.2014 B12, chapter IV number 1.1) and of 24 February 2020 (BAnz AT 24.03.2020 B7, chapter IV notification 19)

The latest software version of the Serinus 10 measuring system for O_3 with microprocessor C010001 manufactured by Ecotech Pty Ltd. is:
V 2.35.0001.

The latest software version of the Serinus 10 measuring system for O_3 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 software version number in the format 2.XX or 3.XX or 4.XX appears in the display of the measuring device.

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 3, Announcement by UBA dated 9 March 2022:

3 Notification as regards Federal Environment Agency (UBA) notices of 27 February 2014 (BAnz AT 01.04.2014 B12, chapter IV number 1.1) and of 31 March 2021 (BAnz AT 03.05.2021 B9, chapter III notification 9)

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

The current software version of the measuring device Serinus 10 for O_3 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 10 for O_3 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 device 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 57, Announcement by UBA dated 21 February 2023:

57 Notification as regards Federal Environment Agency (UBA) notices of 27 February 2014 (BAnz AT 01.04.2014 B12, chapter IV number 1.1) and of 9 March 2022 (BAnz AT 11.04.2022 B10, chapter VI notification 3)

The current software version of the Serinus 10 measuring system for O_3 from the company ACOEM Australasia for devices with the microprocessor board (C010001) remains:
V 2.35.0001

The current software version of the Serinus 10 measuring system for O_3 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 system 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 05 September 2022

Publication in the German Federal Gazette: BAnz AT 10.05.2024 B7, Chap. V notification 43, Announcement by UBA dated 19 March 2024:

43 Notification as regards Federal Environment Agency (UBA) notices of 27 February 2014 (BAnz AT 01.04.2014 B12, chapter IV number 1.1) and of 21 February 2023 (BAnz AT 20.03.2023 B6, chapter IV notification 57)

The current software version for the Serinus 10 measuring system for O_3 from ACOEM Australasia is unchanged for systems with the microprocessor board (C010001): V 2.35.0001

The current software version for the Serinus 10 measuring system for O_3 from ACOEM Australasia for systems with the microprocessor board (C010014) is
V 4.22.0000.
The following software versions are also authorised for this system 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 94, Announcement by UBA dated 2 April 2025:

94 Notification as regards Federal Environment Agency (UBA) notices of 27 February 2014 (BAnz AT 01.04.2014 B12, chapter IV number 1.1) and of 19 March 2024 (BAnz AT 10.05.2024 B7, chapter V notification 43)

The current software version of the Serinus 10 measuring system for O3 from ACOEM Australasia is unchanged for devices with the microprocessor board (C010001):
V 2.35.0001

The current software version of the Serinus 10 measuring system for O3 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 10 measuring system is a continuous ozone monitor which uses the method of ultraviolet photometry. The instrument is designed for the continuous measurement of ozone concentrations in ambient air.

The UV photometer determines the ozone concentration (O_3) in the sample gas at ambient pressure by detecting absorption of UV radiation in a glass absorption tube.

The Serinus 10 works by the following principles and measurement methods:
- Ozone shows a strong absorption of UV light at a wavelength of 254 nm.
- Sample air is passed into the glass absorption tube (measurement cell).
- Within the measurement cell a single beam of UV radiation (from a mercury vapour lamp) passes through the sample and is absorbed by the O_3.
- The solar blind vacuum photodiode detects any UV that is not absorbed.
- The strength of the UV signal being detected is proportional to the amount of UV light being absorbed by O_3.
- The Serinus 10 analyser uses the Beer-Lambert relationship to calculate the ozone concentration.

The Beer-Lambert law (shown below) is used to calculate the concentration of ozone from the ratio of the two light intensities measured:

$$I/I_0 = \exp(-\alpha\, c\, d)$$

Where:
- I light intensity measured with ozone in the gas sample
- I_0 light intensity measured with no ozone in the gas sample
- α ozone absorption coefficient at 253.7 nm (1.44 x 10-5 m²/mg)
- c mass concentration of ozone in mg/m³
- d optical path length in m

- O_3 is not the only gas that absorbs UV (254 nm), SO_2 and aromatic compounds also absorb radiation at this wavelength. To eliminate interferences a second cycle is performed. Sample air is passed through an ozone scrubber, removing ozone but allowing all interfering gases through. It is thus possible to accurately measure the effect of interfering gases. This effect is then removed from the sample measurement signal which ensures accurate measurement of ozone without the influence of interferents.

The microprocessor and electronics of the Serinus 10 measuring system control, measure and correct for all the major external variables to ensure stable and reliable operation.

The Serinus 10 Ozone Analyser uses non-dispersive ultraviolet (UV) absorption technology to measure ozone to a sensitivity of 0.5 ppb in the range of 0–20 ppm. The Serinus 10 measures O_3 with the following components and techniques:
- Mercury vapour lamp – to provide detector input. (254 nm UV light source)

- Photodiode detector – to capture the measurement response.
  Detects the ratio of transmitted light, thereby giving the concentration of ozone.

- Ozone scrubber – to establish the background response. As ozone is not the only atmospheric gas that absorbs the particular wavelength of UV light.

- A microprocessor programmed with Serinus firmware monitors the detector response and many other parameters, so that the O_3 concentration is automatically corrected for gas temperature and pressure changes and referenced to 0 °C, 20 °C or 25 °C at 1 atmos-phere.

The major components of the Serinus 10 are described below:

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.

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 (NOx) 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 10 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. 0000040202_00: 29 April 2014
Expiry date of the certificate: 31 March 2019
Test report: 936/21221977/C dated 8 October 2013
TÜV Rheinland Energie und Umwelt GmbH
Publication: BAnz AT 01.04.2014 B12, chapter IV number 1.1
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 4
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 5
UBA announcement dated 22 February 2017
(Software changes)

Renewal of certificates
Certificate No. 0000040202_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 15
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 19
UBA announcement dated 24 February 2020
(Software changes)

Renewal of certificates
Certificate No. 0000040202_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 9
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 3
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 57
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 43
UBA announcement dated 19 March 2024
(Software changes)

Renewal of certificates

Certificate No. 0000040202_03:	27 June 2025
Expiry date of the certificate:	30 June 2030

Expanded uncertainty laboratory, system 1

Measuring device: Ecotech Serinus 10 Serial-No.: 13-0091 (Device 1)

Measured component: O_3 1h-alert threshold: 120 nmol/mol

No.	Performance characteristic		Perfomance criterion	Result	Partial uncertainty		Square of partial uncertainty
1	Repeatability standard deviation at zero	≤	1.0 nmol/mol	0.320	$u_{r,z}$	0.07	0.0055
2	Repeatability standard deviation at 1h-alert threshold	≤	3.0 nmol/mol	0.160	$u_{r,th}$	0.04	0.0014
3	"lack of fit" at 1h-alert threshold	≤	4.0% of measured value	1.380	$u_{l,th}$	0.96	0.9141
4	Sensitivity coefficient of sample gas pressure at 1h-alert threshold	≤	2.0 nmol/mol/kPa	0.060	u_{gp}	0.62	0.3811
5	Sensitivity coefficient of sample gas temperature at 1h-alert threshold	≤	1.0 nmol/mol/K	0.130	u_{gt}	1.49	2.2089
6	Sensitivity coefficient of surrounding temperature at 1h-alert threshold	≤	1.0 nmol/mol/K	0.421	u_{st}	3.15	9.9431
7	Sensitivity coefficient of electrical voltage at 1h-alert threshold	≤	0.30 nmol/mol/V	0.010	u_V	0.12	0.0152
8a	Interferent H_2O with 21 mmol/mol	≤	10 nmol/mol (Zero)	2.700	u_{H2O}	-0.40	0.1595
		≤	10 nmol/mol (Span)	-0.670			
8b	Interferent Toluene with 0,5 µmol/mol	≤	5.0 nmol/mol (Zero)	1.880	$u_{int,pos}$ or $u_{int,neg}$	2.83	8.0082
		≤	5.0 nmol/mol (Span)	0.380			
8c	Interferent Xylene with 0,5 µmol/mol	≤	5.0 nmol/mol (Zero)	2.510			
		≤	5.0 nmol/mol (Span)	4.530			
9	Averaging effect	≤	7.0% of measured value	-1.570	u_{av}	-1.09	1.1832
18	Difference sample/calibration port	≤	1.0%	-0.370	u_{ssc}	-0.44	0.1971
21	Uncertainty of test gas	≤	3.0%	2.000	u_{cg}	1.20	1.4400

Combined standard uncertainty	u_c	4.9454 nmol/mol
Expanded uncertainty	U	9.8909 nmol/mol
Relative expanded uncertainty	W	8.24 %
Maximum allowed expanded uncertainty	W_{req}	15 %

Expanded uncertainty laboratory, system 2

Measuring device: Ecotech Serinus 10 — Serial-No.: 13-0090 (Device 2)

Measured component: O_3 — 1h-alert threshold: 120 nmol/mol

No.	Performance characteristic		Performance criterion	Result	Partial uncertainty		Square of partial uncertainty
1	Repeatability standard deviation at zero	≤	1.0 nmol/mol	0.600	$u_{r,z}$	0.14	0.0188
2	Repeatability standard deviation at 1h-alert threshold	≤	3.0 nmol/mol	0.400	$u_{r,hv}$	0.09	0.0086
3	"lack of fit" at 1h-alert threshold	≤	4.0% of measured value	1.160	$u_{lf,hv}$	0.80	0.6459
4	Sensitivity coefficient of sample gas pressure at 1h-alert threshold	≤	2.0 nmol/mol/kPa	0.040	u_{gp}	0.41	0.1694
5	Sensitivity coefficient of sample gas temperature at 1h-alert threshold	≤	1.0 nmol/mol/K	0.140	u_{gt}	1.61	2.5931
6	Sensitivity coefficient of surrounding temperature at 1h-alert threshold	≤	1.0 nmol/mol/K	0.206	u_{st}	1.59	2.5147
7	Sensitivity coefficient of electrical voltage at 1h-alert threshold	≤	0.30 nmol/mol/V	0.020	u_V	0.25	0.0606
8a	Interferent H_2O with 21 mmol/mol	≤	10 nmol/mol (Zero)	-0.010	u_{H2O}	0.53	0.2791
		≤	10 nmol/mol (Span)	0.720			
8b	Interferent Toluene with 0,5 µmol/mol	≤	5.0 nmol/mol (Zero)	2.020	$u_{int,pos}$ or $u_{int,neg}$	2.70	7.3008
		≤	5.0 nmol/mol (Span)	0.820			
8c	Interferent Xylene with 0,5 µmol/mol	≤	5.0 nmol/mol (Zero)	2.680			
		≤	5.0 nmol/mol (Span)	3.860			
9	Averaging effect	≤	7.0% of measured value	-0.540	u_{av}	-0.37	0.1400
18	Difference sample/calibration port	≤	1.0%	0.220	$u_{Ds,c}$	0.26	0.0697
21	Uncertainty of test gas	≤	3.0%	2.000	ucg	1.20	1.4400

Combined standard uncertainty	u_c	3.9039 nmol/mol
Expanded uncertainty	U	7.8079 nmol/mol
Relative expanded uncertainty	W	6.51 %
Maximum allowed expanded uncertainty	W_{req}	15 %

Combined uncertainty, laboratory and field, system 1

Measuring device: Ecotech Serinus 10 | Serial-No.: 13-0091 (Device 1)

Measured component: O_3 | 1h-alert threshold: 120 nmol/mol

No.	Performance characteristic		Performance criterion	Result	Partial uncertainty		Square of partial uncertainty
1	Repeatability standard deviation at zero	≤	1.0 nmol/mol	0.320	$u_{r,z}$	0.07	0.0055
2	Repeatability standard deviation at 1h-alert threshold	≤	3.0 nmol/mol	0.160	$u_{r,lh}$	not considered, as $u_{r,lh} = 0.03 < u_{r,f}$	-
3	"lack of fit" at 1h-alert threshold	≤	4.0% of measured value	1.380	$u_{l,lh}$	0.96	0.9141
4	Sensitivity coefficient of sample gas pressure at 1h-alert threshold	≤	2.0 nmol/mol/kPa	0.060	u_{gp}	0.62	0.3811
5	Sensitivity coefficient of sample gas temperature at 1h-alert threshold	≤	1.0 nmol/mol/K	0.130	u_{gt}	1.49	2.2089
6	Sensitivity coefficient of surrounding temperature at 1h-alert threshold	≤	1.0 nmol/mol/K	0.421	u_{st}	3.15	9.9431
7	Sensitivity coefficient of electrical voltage at 1h-alert threshold	≤	0.30 nmol/mol/V	0.010	u_{sv}	0.12	0.0152
8a	Interferent H_2O with 21 mmol/mol	≤	10 nmol/mol (Zero)	2.700	u_{H2O}	-0.40	0.1595
		≤	10 nmol/mol (Span)	-0.670			
8b	Interferent Toluene with 0,5 µmol/mol	≤	5.0 nmol/mol (Zero)	1.880	$u_{int,pos}$ or $u_{int,neg}$	2.83	8.0082
		≤	5.0 nmol/mol (Span)	0.380			
8c	Interferent Xylene with 0,5 µmol/mol	≤	5.0 nmol/mol (Zero)	2.510			
		≤	5.0 nmol/mol (Span)	4.530			
9	Averaging effect	≤	7.0% of measured value	-1.570	u_{av}	-1.09	1.1832
10	Reproducibility standard deviation under field conditions	≤	5.0% of average over 3 months	1.950	$u_{r,f}$	2.34	5.4756
11	Long term drift at zero level	≤	5.0 nmol/mol	1.810	$u_{d,l,z}$	1.05	1.0920
12	Long term drift at span level	≤	5.0 % of max. of certification range	-2.250	$u_{d,l,lh}$	-1.56	2.4300
18	Difference sample/calibration port	≤	1.0%	-0.370	u_{asc}	-0.44	0.1971
21	Uncertainty of test gas	≤	3.0%	2.000	u_{cg}	1.20	1.4400

Combined standard uncertainty	u_c	5.7839	nmol/mol
Expanded uncertainty	U	11.5678	nmol/mol
Relative expanded uncertainty	W	9.64	%
Maximum allowed expanded uncertainty	W_{req}	15	%

Combined uncertainty, laboratory and field, system 2

Measuring device:	Ecotech Serinus 10			Serial-No.:	13-0090 (Device 2)		
Measured component:	O_3			1h-alert threshold:	120	nmol/mol	
No.	**Performance characteristic**		**Performance criterion**	**Result**	**Partial uncertainty**		**Square of partial uncertainty**
1	Repeatability standard deviation at zero	≤	1.0 nmol/mol	0.600	$u_{r,z}$	0.14	0.0188
2	Repeatability standard deviation at 1h-alert threshold	≤	3.0 nmol/mol	0.400	$u_{r,lh}$	not considered, as $u_{r,lh} = 0.09 < u_{r,f}$	-
3	"lack of fit" at 1h-alert threshold	≤	4.0% of measured value	1.160	$u_{l,lh}$	0.80	0.6459
4	Sensitivity coefficient of sample gas pressure at 1h-alert threshold	≤	2.0 nmol/mol/kPa	0.040	u_{gp}	0.41	0.1694
5	Sensitivity coefficient of sample gas temperature at 1h-alert threshold	≤	1.0 nmol/ mol/K	0.140	u_{gt}	1.61	2.5931
6	Sensitivity coefficient of surrounding temperature at 1h-alert threshold	≤	1.0 nmol/ mol/K	0.206	u_{st}	1.59	2.5147
7	Sensitivity coefficient of electrical voltage at 1h-alert threshold	≤	0.30 nmol/mol/V	0.020	u_V	0.25	0.0606
8a	Interferent H_20 with 21 mmol/mol	≤	10 nmol/mol (Zero)	-0.010	u_{H2O}	0.53	0.2791
		≤	10 nmol/mol (Span)	0.720			
8b	Interferent Toluene with 0.5 µmol/mol	≤	5.0 nmol/mol (Zero)	2.020	$u_{int,pos}$ or $u_{int,neg}$	2.70	7.3008
		≤	5.0 nmol/mol (Span)	0.820			
8c	Interferent Xylene with 0.5 µmol/mol	≤	5.0 nmol/mol (Zero)	2.680			
		≤	5.0 nmol/mol (Span)	3.860			
9	Averaging effect	≤	7.0% of measured value	-0.540	u_{av}	-0.37	0.1400
10	Reproducibility standard deviation under field conditions	≤	5.0% of average over 3 months	1.950	$u_{r,f}$	2.34	5.4756
11	Long term drift at zero level	≤	5.0 nmol/mol	1.470	$u_{d,l,z}$	0.85	0.7203
12	Long term drift at span level	≤	5.0% of max. of certification range	-2.440	$u_{d,l,lh}$	-1.69	2.8577
18	Difference sample/calibration port	≤	1.0%	0.220	$u_{\Delta sc}$	0.26	0.0697
21	Uncertainty of test gas	≤	3.0%	2.000	u_{cg}	1.20	1.4400
					Combined standard uncertainty	u_c	4.9281	nmol/mol
					Expanded uncertainty	U	9.8561	nmol/mol
					Relative expanded uncertainty	W	8.21	%
					Maximum allowed expanded uncertainty	W_{req}	15	%