



# CERTIFICATE

of Product Conformity (QAL1)

Certificate No.: 0000040205\_03

**Certified AMS:** 

Serinus 50 for SO<sub>2</sub>

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.



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

Dr. Marcel Langner Head of Section II 4 PXWS

ppa. Dr. Peter Wilbring

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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<sub>2</sub> 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<sub>2</sub>

#### 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<sub>2</sub>, 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:

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<sub>2</sub> 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:

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<sub>2</sub> 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:

 $\begin{array}{c} V\ 3.49.0000,\ V\ 3.51.0011,\ V\ 3.52.0000,\ V\ 3.53.0012,\ V\ 3.54.0000,\ V\ 3.55.0000,\ V\ 3.56.0001,\ V\ 3.57.0002,\ V\ 3.58.0000,\ V\ 3.59.0004,\ V\ 3.60.0005,\ V\ 3.61.0000,\ V\ 3.62.0000,\ V\ 3.63.0001,\ V\ 3.64.0000,\ V\ 3.65.0001,\ V\ 3.66.0000,\ V\ 3.66.0000,\ V\ 3.67.0003,\ V\ 3.68.0009,\ V\ 3.69.0001,\ V\ 3.70.0000,\ V\ 3.71.0000 \end{array}$ 

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:

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<sub>2</sub> 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<sub>2</sub> 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:

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:

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<sub>2</sub> 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:

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<sub>2</sub> 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<sub>2</sub> 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<sub>2</sub> molecules.
- The SO<sub>2</sub> molecules then emit photons (fluorescent light) uniformly in all directions.
- Wavelengths between 310–350 nm, which are specific to SO<sub>2</sub>, 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<sub>2</sub>. 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<sub>2</sub> (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 ( $\mu$ m) filter with a diameter of 47 mm. This filter eliminates all particles larger than 5  $\mu$ m 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<sub>2</sub>) are concerned, one pump can be operated with up to two analysers. However, operation of the Serinus 40 (NO<sub>x</sub>) 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





### Expanded uncertainty laboratory, system 1

Performance characteristic   Performance criterion   Reauth   Partial Interclainty   Square of partial uncertainty     Repeatability standard deviation at 12-pin   2	Measuring device:	Ecotech Serinus 50				Serial-No.:	13-0096 (Device 1)	
Repeatability standard deviation at zero   Performance criterion   Result   Partial uncertainty   Square of partial uncertainty   Capta   Ca	Measured component:	Š				1h-limit value:	132	lom/lomn
Repeatability standard deviation at zero   10 mmol/mol   0.050   u <sub>2</sub>   0.002	No.	Performance characteristic	Performance criterion	Result	Partial	uncertainty	Square of partial uncertainty	
Pepedabity standard deviation at th-limit value   \$ 4.0% of measured value   \$ 26.00   \$ 0.0650	1	Repeatability standard deviation at zero		0.050	urz	0.02	0.0002	
Sensitivity coefficient of sample gase pressure at 11-linitivalue   2 on moniform/likPa   2 on moniform/likP	2	Repeatability standard deviation at 1h-limit value		0.240	Ur,h	0.07	0.0050	
Sensitivity coefficient of sample gas pressure at 1h-limit value         \$ 2.0 mmol/mol/kPa         0.340         upp         270         7.2852           Sensitivity coefficient of sample gas temperature at 1h-limit value         \$ 1.0 mmol/mol/k         0.050         upp         0.40         0.1609           Sensitivity coefficient of sample gas temperature at 1h-limit value         \$ 1.0 mmol/mol/k         0.010         upp         2.47         6.1146           Sensitivity coefficient of electrical voltage at 1h-limit value         \$ 1.0 mmol/mol/k         0.010         upp         2.25         0.0608           Interferent H <sub>2</sub> with 20 mmol/mol         \$ 1.0 mmol/mol/k         0.000         upp         2.55         0.0608           Interferent H <sub>2</sub> with 200 mmol/mol         \$ 5.0 mmol/mol/k         0.000         upp         5.83         34.0086           Interferent NO with 500 mmol/mol         \$ 5.0 mmol/mol/k         0.000         upp         -2.25         6.08           Interferent NO, with 200 mmol/mol         \$ 5.0 mmol/mol/k         0.000         upp         -2.23         4.0086           Interferent NO, with 200 mmol/mol         \$ 5.0 mmol/mol/k         0.100         upp         -2.23         4.0086           Interferent M <sub>2</sub> with 200 mmol/mol         \$ 5.0 mmol/mol/k         0.100         upp         -2.23	3	"lack of fit" at 1h-limit value		2.620	U,h	2.00	3.9868	
Sensitivity coefficient of sample gas temperature at 1h-Imit value         ≤ 1.0 mmol/mol/Mol/Mol/Mol/Mol/Mol/Mol/Mol/Mol/Mol/M	4	Sensitivity coefficient of sample gas pressure at 1h-limit value		0.340	ugu	2.70	7.2852	
Sensitivity coefficient of surrounding temperature at 1h-Innt value         ≤ 1.0 nmol/mol/V         0.027         u <sub>1</sub> 247         6.146           Sensitivity coefficient of electrical voltage at 1h-Innt value         ≤ 0.30 mmol/mol/(Sen)         0.027         u <sub>1</sub> 0.25         0.0608           Interferent H <sub>2</sub> O with 21 mmol/mol         ≤ 10 mmol/mol (Sen)         1.600         u <sub>1</sub> cos         2.25         5.088           Interferent H <sub>2</sub> O with 20 mmol/mol         ≤ 50 mmol/mol (Sean)         2.390         u <sub>1</sub> cos         5.83         34.0086           Interferent N <sub>2</sub> with 200 mmol/mol         ≤ 50 mmol/mol (Sean)         2.250         u <sub>1</sub> cos         5.83         34.0086           Interferent N <sub>2</sub> with 200 mmol/mol         ≤ 50 mmol/mol (Sean)         2.250         u <sub>1</sub> cos         5.83         34.0086           Interferent N <sub>2</sub> with 200 mmol/mol         ≤ 50 mmol/mol (Sean)         2.250         u <sub>1</sub> cos         5.83         34.0086           Interferent N <sub>2</sub> with 200 mmol/mol         ≤ 50 mmol/mol (Sean)         2.250         u <sub>2</sub> cos         1.724           Interferent m-Xylene with 1 µmol/mol         ≤ 50 mmol/mol (Sean)         0.740         c.223         4.9861           Interferent m-Xylene with 1 µmol/mol         ≤ 50 mmol/mol (Sean)         0.740         u <sub>2</sub> cos         0.720         u <sub>2</sub> cos	5	Sensitivity coefficient of sample gas temperature at 1h-limit value		0.050	Ugt	0.40	0.1609	
Sensitivity coefficient of electrical votage at 11-Imit value   \$ 0.30 rmol/mol (Zero)   0.010   \$ 10 nmol/mol (Zero)   0.010   \$ 1.00 mmol/mol (Zero)   0.010   \$ 1.00 mmol/mol (Zero)   0.020   \$ 1.00 mmol/mol (Zero)   0.000   \$ 1.000	9	Sensitivity coefficient of surrounding temperature at 1h-limit value		0.305	Ust	2.47	6.1146	
Interferent H <sub>2</sub> 0 with 20 mmol/mol (Span)   3.040   U <sub>HcDS</sub>   2.25   5.0688     Interferent H <sub>2</sub> 0 with 200 mmol/mol   2.50 mmol/mol (Span)   3.040   U <sub>HcDS</sub>   2.50 mmol/mol (Span)   3.040   U <sub>HcDS</sub>   2.50 mmol/mol (Span)   3.050   U <sub>HcDS</sub>   2.50 mmol/mol (Span)   3.050   U <sub>HcDS</sub>   3.4.0086     Interferent NO with 500 mmol/mol   2.50 mmol/mol (Span)   0.740   0.100   1.250   U <sub>HcDS</sub>   2.50 mmol/mol (Span)   0.740   0.100   0.0043     Interferent m-Xylene with 1 µmol/mol   2.50 mmol/mol (Span)   0.250   U <sub>HcDS</sub>   0.0043   0.0043     Maximum allowed expanded uncertainty of lest gas   2.00 maximum allowed expanded uncertainty   0.0045	7	Sensitivity coefficient of electrical voltage at 1h-limit value		0.027	ηΛ	0.25	0.0608	
Interferent H <sub>2</sub> S with 200 rmol/mol   \$ 10 mmol/mol (Span)   3.040   Unitox   5.00 mmol/mol (Span)   2.390   Interferent MH <sub>2</sub> S with 200 rmol/mol   \$ 5.0 mmol/mol (Span)   2.390   Unitox   5.00 mmol/mol (Span)   3.050   Unitox   5.00 mmol/mol/mol/mol/mol/mol/mol/mol/mol/mol	833	Interferent H.O with 21 mml		0.010		2.05	8890 3	
Interferent H <sub>2</sub> S with 200 mmol/mol   5 5.0 mmol/mol (28na)   2.390   1.600   1.600   1.600   1.600   1.600   1.600   1.600   1.000	00	IIIKE IELETI 1720 WIUT ZI IIII DVII DI		3.040	OHEO	6.23	2.0008	
Interferent NH <sub>3</sub> with 200 rmol/mol   Interferent NH <sub>3</sub> with 200 rmol/mol   Interferent ND <sub>2</sub> with 200 rmol   Interferent ND	40	Interferent IJ S with 200 mm/lmm		1.600	Untpos			
Interferent NH₂ with 200 rmol/mol   2	00	IIIIEII EI EI IL 1723 WILLI 200 III IOMII DI		2.390				
Interferent NO with 500 nmol/mol   2 5.0 nmol/mol   2 850	00	months and Milliam Milliam I Market Milliam		-0.290				
Interferent NO with 500 nmol/mol   S 5.0 nmol/mol (Span)   2.850	20	ILICITED FOR THE 13 WILLI ZOO THEIDIFLIDE		1.080				
Interferent NO <sub>2</sub> with 200 mm0/mol   Se 5.0 mm0/mol   Cero)   0.100   Se 5.0 mm0/mol   Cero)   0.100   Se 5.0 mm0/mol   Cero)   0.100   Se 5.0 mm0/mol   Cero)   0.200   U <sub>storo</sub>   Cero   Ce	84	Interferent NO with 500 nmm/(mm)		3.420		5.83	34 0086	
Interferent NO₂ with 200 nmol/mol   S = 5.0 nmol/mol   San D   S = 5.0 nmol/mol   S = 5.0 nmol/mol/mol   S = 5.0 nmol/mol/mol   S = 5.0 nmol/mol/mol/mol/mol/mol/mol/mol/mol/mol/	00	Inches of the control		2.850	or	0.00	0000:10	
Interferent m-Xylene with 1 µmol/mol   Second   1.250   1.250   1.250   1.250   1.250   1.250   1.250   1.250   1.250   1.250   1.250   1.250   1.250   1.250   1.350   1.350   1.320   1.7424   1.360   1.32   1.7424   1.360   1.32   1.7424   1.360   1.32   1.7424   1.360   1.32   1.7424   1.360   1.32   1.7424   1.360   1.32   1.7424   1.360   1.32   1.7424   1.360   1.32   1.7424   1.360   1.32   1.7424   1.360   1.32   1.7424   1.360   1.32   1.7424   1.360   1.32   1.7424   1.360   1.32   1.7424   1.360   1.	80	Interferent MO, with 200 mm//mml		0.100	Ī			
Interferent m-Xylene with 1 µmol/mol   2 10 nmol/mol (Span)   3.050   U <sub>integ</sub>   2.23   4.9861	30	IIICH GICH NO2 WILL 200 III BITH BI		0.740				
Maximum allowed expanded uncertainty of test gas   2 10 nmol/mol (Span)   3.050   Untreg   2.23   4.9861   4	90	manufacture of the control of the control		1.250				
Averaging effect         ≤ 7.0% of measured value         -2.930         u <sub>sv</sub> -2.23         4.9861           Difference sample/calibration port         ≤ 1.0%         0.20         u <sub>sv</sub> 0.29         0.0843           Uncertainty of test gas         ≤ 3.0%         2.000         u <sub>sp</sub> 1.32         1.7424           Combined standard standard standard uncertainty         u <sub>c</sub> 7.9689           Felative expanded uncertainty         W <sub>req</sub> 15.977	OI	III. BEI EI E		3.050	Untneg			
Difference sample/calibration port   S   1.0%   0.29   0.0843	9	Averaging effect		-2.930	Uav	-2.23	4.9861	
Uncertainty of test gas   ≤ 3.0%   2.000   u <sub>op</sub>   1.32   1.7424	18	Difference sample/calibration port		0.220	U <sub>Asc</sub>	0.29	0.0843	
u <sub>c</sub> 7.9689           U         15.9379           W         12.07           W <sub>req</sub> 15	21	Uncertainty of test gas		2.000	Uog	1.32	1.7424	
U 15.9379 W 12.07 Wreq 15			Combined	standard un	ncertainty	Uc	7.9689	lom/lomn
W 12.07 W <sub>ieq</sub> 15				Expanded un	ncertainty	n	15.9379	lom/lomn
Wreq 15			Relative	expanded un	ncertainty	W	12.07	%
			Maximum allowed	expanded un	ncertainty	Wreq	15	%





### Expanded uncertainty laboratory, system 2

Measuring device:	Ecotech Serinus 50			1		Serial-No.:	13-0097 (Device 2)	ı,
Measured component	čos					1h-limit value:	132	lam/lamn
No.	Performance characteristic	Performance criterion	criterion	Result	Partial u	Partial uncertainty	Square of partial uncertainty	
1	Repeatability standard deviation at zero	≤ 1.0 nr	1.0 nmol/mol	0.000	Urz	0.00	0.0000	
2	Repeatability standard deviation at 1h-limit value	≤ 3.0 nr	3.0 nmm/mml	0.230	Ur.h	0.07	0.0048	
3	"lack of fit" at 1h-limit value	≤ 4.0% of me	4.0% of measured value	1.590	UI,Ih	1.21	1.4683	
4	Sensitivity coefficient of sample gas pressure at 1h-limit value	≤ 2.0 nmo	2.0 nmol/mol/kPa	0.270	ugp	2.14	4.5625	
5	Sensitivity coefficient of sample gas temperature at 1h-limit value	≤ 1.0 nm	1.0 nmol/mol/K	0.030	Ugt	0.24	0.0587	Į.
9	Sensitivity coefficient of surrounding temperature at 1h-limit value	≥ 1.0 nm	1.0 nmol/mol/K	0.152	Ust	1.24	1.5295	
7	Sensitivity coefficient of electrical voltage at 1h-limit value	≤ 0.30 nn	0.30 nmol/mol/V	0.028	ηΛ	0.26	0.0701	
83	Interferent H.0 with 21 mmol/mol	10 nmoV	10 nmol/mol (Zero)	-0.510	-	211	4 4860	
Od	III CHELCIELL 120 WILL ZI III DILLIDI	≤ 10 nmol/r	10 nmol/mol (Span)	3.060	nH2O	7.11	1.4000	
88	Interferent H.S. with 200 mm/mm	≤ 5.0 nmol/	5.0 nmol/mol (Zero)	1.410	Uintpos			
OD.	HIGHER CHETZO WILL ZOO HILDIII DI	5.0 nmol/l	5.0 nmol/mol (Span)	2.210				
00	Implement ODC chies LIM terrangental	≤ 5.0 nmol/	5.0 nmol/mol (Zero)	-0.310				
90	HILEHER SHILINGS WALL ZOO HILDHILD	≤ 5.0 nmol/l	5.0 nmol/mol (Span)	0.230				
Po	pres/former OOF them OIV teconoproduct	≤ 5.0 nmol/	5.0 nmol/mol (Zero)	3.670		6.40	30 0630	
00	THE TELETICISM TO WILL SOO THE BUTTON	5.0 nmol/l	5.0 nmol/mol (Span)	4.160	or	0.40	90.0028	
8	Interferent NO. with 200 nmm/(rm)	≤ 5.0 nmol/	5.0 nmol/mol (Zero)	1.000				
20	THE COLUMN SAME SOOT THE STATE OF THE STATE	5.0 nmol/l	5.0 nmol/mol (Span)	0.310				
90	longlower b office and low transferral	10 nmol/	10 nmol/mol (Zero)	0.860				
O	IIII III III III III III III III III I	10 nmol/r	10 nmol/mol (Span)	2.660	Uint,neg			
6	Averaging effect	7.0% of me	7.0% of measured value	-2.620	Usv	-2.00	3.9868	
18	Difference sample/calibration port	≤ 1.	1.0%	0.280	U <sub>Asc</sub>	0.37	0.1366	
21	Uncertainty of test gas	≤ 3.	3.0%	2.000	Uog	1.32	1.7424	
			Combined	Combined standard uncertainty	ncertainty	n	6.9346	lam/lamn
				Expanded uncertainty	ncertainty	n	13.8692	lam/lamn
			Relative	Relative expanded uncertainty	ncertainty	W	10.51	%
		Ma	Maximum allowed expanded uncertainty	expanded un	ncertainty	Wreq	15	%





### Combined uncertainty, laboratory and field, system 1

Measuring device:	Ec otec h Serinus 50				ŀ	Serial-No.:	13-0096 (Device 1)	
Measured component:	<sup>2</sup> Os					1h-limit value:	132	nmol/mol
No.	Performance characteristic	L	Performance criterion	Result	Par	Partial uncertainty	Square of partial uncertainty	
-	Repeatability standard deviation at zero	VI	1.0 nmol/mol	0.050	Urz	0.02	0.0002	
2	Repeatability standard deviation at 1h-limit value	VI	3.0 nmol/mol	0.240	ď, h	not considered, as ur,lh = 0,07 < ur,f		
6	"lack of fit" at 1h-limit value	VI	4.0% of measured value	2.620	u'h	2.00	3.9868	
4	Sensitivity coefficient of sample gas pressure at 1h-limit value	VI	2.0 nmol/mol/kPa	0.340	en e	2.70	7.2852	
5	Sensitivity coefficient of sample gas temperature at 1h-limit value	VI	1.0 nmol/moVK	0.050	r <sup>‡t</sup>	0.40	0.1609	
9	Sensitivity coefficient of surrounding temperature at 1h-limit value	VI	1.0 nmol/moVK	0.305	n <sup>st</sup>	2.47	6.1146	
7	Sensitivity coefficient of electrical voltage at 1h-limit value	VI	0.30 nmol/mol/V	0.027	'n	0.25	0.0608	
d		VI	10 nmol/mol (Zero)	0.010				
œ	Interferent H <sub>2</sub> 0 With 21 mmo/mol	VI	10 nmol/mol (Span)	3.040		30.0	0000	
		VI	5.0 nmol/mol (Zero)	1.600	07Hn	67.7	0.0000	
QS S	Interferent H <sub>2</sub> S with 200 nmol/mol	VI	5.0 nmol/mol (Span)	2.390	Untpos			
ő	Incollerance OCC affirm IIIA demonstration I	VI	5.0 nmol/mol (Zero)	-0.290				
30	ITILETIEFERINAS WILLI ZOO TIITIO/ITIO	VI	5.0 nmol/mol (Span)	1.080				
700	bai/load 003 dim ON taorotrotal	VI	5.0 nmol/mol (Zero)	3.420				
no		VI	5.0 nmol/mol (Span)	2.850	ю	5.83	34.0086	
00	low/page 000 dim -OM proported	VI	5.0 nmol/mol (Zero)	0.100				
20	III CHI CHI I I I I I I I I I I I I I I	VI	5.0 nmol/mol (Span)	0.740				
8	low/lower by office conclus, on fearing-adeal	VI	10 nmol/mol (Zero)	1.250				
О	III EI EI EI II EA YELE WILL I DIIOVIII OI	VI	10 nmol/mol (Span)	3.050	Untneg			
6	Averaging effect	VI	7.0% of measured value	-2.930	Uav	-2.23	4.9861	
10	Reproducibility standard deviation under field conditions	VI	5.0% of average over 3 months	3.740	Urf	4.94	24.3720	
11	Long term drift at zero level	VI	4.0 nmol/mol	-0.940	z),bU	-0.54	0.2945	
12	Long term drift at span level	VI	5.0% of max of certification range	3.810	Udih	2.90	8.4310	
18	Difference sample/calibration port	VI	1.0%	0.220	Uasc	0.29	0.0843	
21	Uncertainty of test gas	VI	3.0%	2.000	Uag	1.32	1.7424	
			Combine	Combined standard uncertainty	ncertainty	ne	9.8283	nmol/mol
				Expanded uncertainty	ncertainty		19.6567	nmol/mol
			Relative	Relative expanded uncertainty	ncertainty	W	14.89	%
			A designation of the second second		1	100		





### Combined uncertainty, laboratory and field, system 2

Measuring device:	Ecotech Serinus 50			×		Serial-No.:	13-0097 (Device 2)	
Measured component:	ŠOS					1h-limit value:	132	nmoVmol
No.	Performance characteristic		Performance criterion	Result	Parti	Partial uncertainty	Square of partial uncertainty	
1	Repeatability standard deviation at zero	VI	1.0 nmol/mol	0.000	Ur,z	00.00	0.0000	
2	Repeatability standard deviation at 1h-limit value	VI	3.0 nmol/mol	0.230	, F	not considered, as ur,lh = 0,06 < ur,f		
က	"lack of fit" at 1h-limit value	VI	4.0% of measured value	1.590	n'h	1.21	1.4683	ķ
4	Sensitivity coefficient of sample gas pressure at 1h-limit value	VI	2.0 nmol/mol/kPa	0.270	ugh	2.14	4.5625	
5	Sensitivity coefficient of sample gas temperature at 1h-limit value	VI	1.0 nmol/mol/K	0.030	Ugt	0.24	0.0587	
9	Sensitivity coefficient of surrounding temperature at 1h-limit value	VI	1.0 nmol/mol/K	0.152	Ust	1.24	1.5295	
7	Sensitivity coefficient of electrical voltage at 1h-limit value	VI	0.30 nmol/mol/V	0.028	Λ'n	0.26	0.0701	
		VI	10 nmol/mol (Zero)	-0.510				
Sa	Interferent H <sub>2</sub> 0 with 21 mmo/mol	VI	10 nmol/mol (Span)	3.060		2 44	4 4660	
		VI	5.0 nmol/mol (Zero)	1.410	OH n	7.11	4.4000	
Q8	Interrerent H <sub>2</sub> S with 200 nmovmol	VI	5.0 nmol/mol (Span)	2.210	Untpos			
d		VI	5.0 nmol/mol (Zero)	-0.310				
38	Interferent NH3 With 200 nmovimol	VI	5.0 nmol/mol (Span)	0.230				
Po	local locate OO3 office OIA faccas facched	VI	5.0 nmol/mol (Zero)	3.670				
no		VI	5.0 nmol/mol (Span)	4.160	JO	5.48	30.0628	
00	low/lower OC office ON transferral	VI	5.0 nmol/mol (Zero)	1.000				
20	Interior in NO2 with 200 Hillowing	VI	5.0 nmol/mol (Span)	0.310				
50	localization by their smalley or propositional	VI	10 nmol/mol (Zero)	0.860				
5		VI	10 nmol/mol (Span)	2.660	Unt,neg			
6	Averaging effect	VI	7.0% of measured value	-2.620	Uav	-2.00	3.9868	
10	Reproducibility standard deviation under field conditions	VI	5.0% of average over 3 months	3.740	u, f	4.94	24.3720	
11	Long term drift at zero level	VI	4.0 nmol/mol	1.470	Udilz	0.85	0.7203	
12	Long term drift at span level	VI	5.0% of max. of certification range	3.540	n'i'P	2.70	7.2784	
18	Difference sample/calibration port	VI	1.0%	0.280	UASC	0.37	0.1366	
21	Uncertainty of test gas	VI	3.0%	2.000	nog	1.32	1.7424	
			Combined standard uncertainty	standard un	ncertainty	ำ	8.9696	nmol/mol
				Expanded uncertainty	nc entainty	Π	17.9393	nmol/mol
			Relative e	Relative expanded uncertainty	ncertainty	M	13.59	%
		ŧ	Maximum allowed expanded uncertainty	xpanded un	certainty	Wred	15	%