

CERTIFICATE

of Product Conformity (QAL1)

Certificate No.: 0000040204

Certified AMS: Serinus 40 for NO, NO₂ and NO_x

Manufacturer: Ecotech Pty Ltd.
1492 Ferntree Gully Road
Knoxfield, VIC, 3180
Australia

Test Institute: TÜV Rheinland Energie und Umwelt GmbH

**This is to certify that the AMS has been tested
and found to comply with:**

**VDI 4202-1: 2010, VDI 4203-3: 2010, EN 14211: 2012,
EN 15267-1: 2009 and EN 15267-2: 2009**

Certification is awarded in respect of the conditions stated in this certificate
(see also the following pages).



Suitability Tested
Complying with
2008/50/EC
EN 15267
Regular
Surveillance

www.tuv.com
ID 0000040204

Publication in the German Federal Gazette
(BAnz.) of 01 April 2014

German Federal Environment Agency
Dessau, 29 April 2014



i. A. Dr. Marcel Langner

This certificate will expire on:
31 March 2019

TÜV Rheinland Energie und Umwelt GmbH
Cologne, 28 April 2014



ppa. Dr. Peter Wilbring

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TÜV Rheinland Energie und Umwelt GmbH
Am Grauen Stein
51105 Cologne

Accreditation according to EN ISO/IEC 17025 and certified according to ISO 9001:2008.

Certificate:
0000040204 / 29 April 2014

Test report: 936/21221977/A of 08 October 2013
Initial certification: 01 April 2014
Date of expiry: 31 March 2019
Publication: BAnz AT 01 April 2014 B12, chapter IV, No. 4.1

Approved application

The tested AMS is suitable for the continuous measurement of concentrations of nitrogen oxides in ambient air (stationary operation).

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 a temperature range of 0 °C to +30 °C.

Any potential user should ensure, in consultation with the manufacturer, that this AMS is suitable for ambient air applications at which it will be installed.

Basis of the certification

This certification is based on:

- test report 936/21221977/A of 08 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 April 2014 B12, chapter IV, No. 4.1
Announcement by UBA from 27 February 2014

AMS designation:

Serinus 40 for NO, NO₂ and NO_x

Manufacturer:

Ecotech Pty Ltd., Knoxfield, Australia

Field of application:

Continuous measurement of concentrations of nitrogen oxides in ambient air (stationary operation)

Measuring range during the performance test:

Component	Certification range	Unit
Nitrogen monoxide	0 - 1200	µg/m ³
Nitrogen dioxide	0 - 500	µg/m ³

Software version:

Firmware: 2.09.0005

Restrictions:

None

Notes:

1. The measuring system has to be operated in a lockable measuring cabinet or container.
2. The test report on the performance test is available online at www.qal1.de.

Test institute:

TÜV Rheinland Energie und Umwelt GmbH, Cologne
Report No.: 936/21221977/A of 8 October 2013

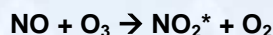
Certified product

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

The Serinus 40 ambient air measuring system continuously monitors concentrations of nitrogen oxides by means of the chemiluminescence method. The instrument is designed for the continuous measuring of NO, NO₂ and NO_x in ambient air.

Nitric oxides are measured on the basis of chemiluminescence detection of gas phases. Sample air enters the reaction cell via two separate (alternating) paths; the NO and NO_x channels.

In the first path, NO reacts with ozone as follows:



In the second path, the gas first passes through the delay coil and then through the NO₂/NO converter so that it reaches the reaction cell after the gas in the first path. At that time NO_x (total concentration of NO and NO₂) is measured.

The NO₂ concentration is then calculated by subtracting the NO value from the measured NO_x value.

This reaction releases energy in the form of chemiluminescent radiation at a wavelength of 1100 nm, which is filtered by the optical band-pass filter and detected by the photomultiplier tube (PMT).

The detected level of chemiluminescence is directly proportional to the NO concentration in the sample.

The nitrogen oxides analyser consists of five main modules:

- pneumatics for channelling sample and exhaust gas (incl. valve manifolds)
- sensors for measuring nitrogen oxides (reaction cell module) and other relevant parameters
- control unit consisting of printed circuit boards for the control of sensors and pneumatics
- power supply for all processes in the analyser
- communication module for data access

Particulate filter

The particle filter is a 5 µm Teflon filter with a diameter of 47 mm. This filter removes all particles > 5 µm, which might affect the measurements.

Permeation dryer for drying the sample gas

After the particle filter there are two serially-connected permeation dryers in the sample gas line. During performance testing, these dryers were integrated into the analyser and therefore shall be considered as part of the tested measuring system. The dryers remove moisture from the sample gas and thereby reduce the amount of interference caused by moisture.

Sample gas pump

Manufacturer: Thomas, type: 617CD22-194 C

During performance testing the above-mentioned sample gas pump was used in the laboratory as well as in the field test. As far as the models Serinus 10 (ozone), Serinus 30 (CO) and Serinus 50 (SO₂) are concerned, one pump can be operated with up to two analysers. However, for the Serinus 40 (NO_x) one sample gas pump per analyser is required.

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 Energie und Umwelt 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 can be applied to the product or used in publicity material for the certified product is presented on page 1 of this certificate.

This document as well as the certification mark remains property of TÜV Rheinland Energie und Umwelt GmbH. With revocation of the publication the certificate loses its validity. After the expiration of the certificate and on requests of the TÜV Rheinland Energie und Umwelt GmbH this document shall be returned and the certificate mark must not be employed anymore.

The relevant version of this certificate and the validity is also accessible on the internet: **qal1.de**.

Certification of Serinus 40 nitrogen oxide Analyzer 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. 0000040204: 29 April 2014

Validity of the certificate until: 31 March 2019

Test report: 936/21221977/A of 08 October 2013
TÜV Rheinland Energie und Umwelt GmbH, Cologne

Publication: BAnz AT 01 April 2014 B12, chapter IV, No. 4.1
Announcement by UBA from 27 February 2014

Expanded uncertainty based on the results of the laboratory testing of Device 1

Measuring device:		Serial-No.:		13-0095 (Device 1)	
Measured component:		1h-limit value:		104.6	
Ecotech Serinus 40		NO ₂		nmol/mol	
No.	Performance characteristic	Performance criterion	Result	Partial uncertainty	Square of partial uncertainty
1	Repeatability standard deviation at zero	≤ 1.0 nmol/mol	0.310	u _{r,z}	0.0035
2	Repeatability standard deviation at 1h-limit value	≤ 3.0 nmol/mol	0.270	u _{r,1h}	0.0001
3	"lack of fit" at 1h-limit value	≤ 4.0% of measured value	0.720	u _{l,1h}	0.1891
4	Sensitivity coefficient of sample gas pressure at 1h-limit value	≤ 8.0 nmol/mol/kPa	1.290	u _{sp}	12.6928
5	Sensitivity coefficient of sample gas temperature at 1h-limit value	≤ 3.0 nmol/mol/K	0.040	u _{st}	0.0086
6	Sensitivity coefficient of surrounding temperature at 1h-limit value	≤ 3.0 nmol/mol/K	0.620	u _{st}	2.3938
7	Sensitivity coefficient of electrical voltage at 1h-limit value	≤ 0.30 nmol/mol/V	0.045	u _v	0.0171
8a	Interferent H ₂ O with 21 nmol/mol	≤ 10 nmol/mol (Zero) ≤ 10 nmol/mol (Span)	0.090 -0.300	u _{H2O}	0.0001
8b	Interferent CO ₂ with 500 µmol/mol	≤ 5.0 nmol/mol (Zero) ≤ 5.0 nmol/mol (Span)	-0.470 1.430	u _{CO2, pos} or	0.0086
8c	Interferent NH ₃ mit 200 nmol/mol	≤ 5.0 nmol/mol (Zero) ≤ 5.0 nmol/mol (Span)	0.000 0.800	u _{NH3, neg}	
9	Averaging effect	≤ 7.0% of measured value	-1.350	u _{av}	0.6647
18	Difference sample/calibration port	≤ 1.0%	-0.260	u _{diff}	0.0740
21	Converter efficiency	≥ 98	98.90	u _{EC}	1.3239
23	Uncertainty of test gas	≤ 3.0%	2.000	u _{cg}	1.0941
Combined standard uncertainty				u _c	4.2981
Expanded uncertainty				U	8.5963
Relative expanded uncertainty				W	8.22
Maximum allowed expanded uncertainty				W _{req}	15

Expanded uncertainty based on the results of the laboratory testing of Device 2

Measuring device: Ecotech Serinus 40		Serial No.: 13-0094 (Device 2)		nmol/mol	
Measured component: NO ₂		1h-limit value: 104.6			
No.	Performance characteristic	Performance criterion	Result	Partial uncertainty	Square of partial uncertainty
1	Repeatability standard deviation at zero	≤ 1.0 nmol/mol	0.190	u _{r,z}	0.0014
2	Repeatability standard deviation at 1h-limit value	≤ 3.0 nmol/mol	0.190	u _{r,ph}	0.0001
3	"lack of fit" at 1h-limit value	≤ 4.0% of measured value	0.840	u _{lfh}	0.2573
4	Sensitivity coefficient of sample gas pressure at 1h-limit value	≤ 8.0 nmol/mol/kPa	1.970	u _{sp}	28.8054
5	Sensitivity coefficient of sample gas temperature at 1h-limit value	≤ 3.0 nmol/mol/K	0.450	u _{gt}	1.0438
6	Sensitivity coefficient of surrounding temperature at 1h-limit value	≤ 3.0 nmol/mol/K	0.240	u _{st}	0.3647
7	Sensitivity coefficient of electrical voltage at 1h-limit value	≤ 0.30 nmol/mol/V	0.006	u _v	0.0003
8a	Interferent H ₂ O with 21 mmol/mol	≤ 10 nmol/mol (Zero)	0.000	u _{H2O}	0.0700
8b	Interferent CO ₂ with 500 µmol/mol	≤ 10 nmol/mol (Span)	0.600	u _{CO2, pos} or	0.1434
		≤ 5.0 nmol/mol (Zero)	0.430		
8c	Interferent NH ₃ mit 200 nmol/mol	≤ 5.0 nmol/mol (Span)	-0.240	u _{CO2, neg}	
		≤ 5.0 nmol/mol (Zero)	1.410		
9	Averaging effect	≤ 7.0% of measured value	-1.310	u _{av}	0.6259
18	Difference sample/calibration port	≤ 1.0%	0.230	u _{asc}	0.0579
21	Converter efficiency	≥ 98	98.80	u _{cc}	1.5755
23	Uncertainty of test gas	≤ 3.0%	2.000	u _{cg}	1.0941
Combined standard uncertainty				u _c	5.8345
Expanded uncertainty				U	11.6690
Relative expanded uncertainty				W	11.16
Maximum allowed expanded uncertainty				W _{res}	15

Expanded uncertainty based on the results of the laboratory and field testing of Device 1

Measuring device: Ecotech Serinus 40		Serial No.: 13-0095 (Device 1)		nmol/mol	
Measured component: NO ₂		1h-limit value:		104.6	
No.	Performance characteristic	Performance criterion	Result	Partial uncertainty	Square of partial uncertainty
1	Repeatability standard deviation at zero	≤ 1.0 nmol/mol	0.310	U _{r,z}	0.0035
2	Repeatability standard deviation at 1h-limit value	≤ 3.0 nmol/mol	0.270	U _{r,h}	-
3	"lack of fit" at 1h-limit value	≤ 4.0% of measured value	0.720	U _{l,h}	0.1891
4	Sensitivity coefficient of sample gas pressure at 1h-limit value	≤ 8.0 nmol/mol/kPa	1.290	U _{sp}	12.6928
5	Sensitivity coefficient of sample gas temperature at 1h-limit value	≤ 3.0 nmol/mol/K	0.040	U _{st}	0.0086
6	Sensitivity coefficient of surrounding temperature at 1h-limit value	≤ 3.0 nmol/mol/K	0.620	U _{st}	2.3938
7	Sensitivity coefficient of electrical voltage at 1h-limit value	≤ 0.30 nmol/mol/V	0.045	U _v	0.0171
8a	Interferent H ₂ O with 21 nmol/mol	≤ 10 nmol/mol (Zero)	0.090	U _{H2O}	0.0001
		≤ 10 nmol/mol (Span)	-0.300		
8b	Interferent CO ₂ with 500 µmol/mol	≤ 5.0 nmol/mol (Zero)	-0.470	U _{CO2, pos}	
		≤ 5.0 nmol/mol (Span)	1.430	or	0.0086
8c	Interferent NH ₃ mit 200 nmol/mol	≤ 5.0 nmol/mol (Zero)	0.000	U _{NH3, neg}	
		≤ 5.0 nmol/mol (Span)	0.800		
9	Averaging effect	≤ 7.0% of measured value	-1.350	U _{av}	0.6647
10	Reproducibility standard deviation under field conditions	≤ 5.0% of average over 3 months	3.550	U _{r,f}	13.7886
11	Long term drift at zero level	≤ 5.0 nmol/mol	-0.510	U _{gl,z}	0.0867
12	Long term drift at span level	≤ 5.0% of max. of certification range	2.510	U _{gl,h}	2.2977
18	Difference sample/calibration port	≤ 1.0%	-0.260	U _{asc}	0.0740
21	Converter efficiency	≥ 98	98.900	U _{EC}	1.3239
23	Uncertainty of test gas	≤ 3.0%	2.000	U _{tg}	1.0941
Combined standard uncertainty				U _c	5.8861
Expanded uncertainty				U	11.7723
Relative expanded uncertainty				W	11.25
Maximum allowed expanded uncertainty				W _{leg}	15

Expanded uncertainty based on the results of the laboratory and field testing of Device 2

Measuring device: Ecotech Serinus 40		Serial-No.: 13-0094 (Device 2)		104.6		nmol/mol	
Measured component: NO ₂		1h-limit value:		Partial uncertainty		Square of partial uncertainty	
No.	Performance characteristic	Performance criterion	Result	U _{r,z}	U _{r,inh}	U _{r,z}	U _{r,inh}
1	Repeatability standard deviation at zero	≤ 1.0 nmol/mol	0.190	U _{r,z}	0.04	0.0014	
2	Repeatability standard deviation at 1h-limit value	≤ 3.0 nmol/mol	0.190	U _{r,inh}	not considered, as $\sqrt{2} \cdot u_{r,inh} = 0.01 < u_{r,f}$	-	
3	"lack of fit" at 1h-limit value	≤ 4.0% of measured value	0.840	U _{inh}	0.51	0.2573	
4	Sensitivity coefficient of sample gas pressure at 1h-limit value	≤ 8.0 nmol/mol/kPa	1.970	U _{gp}	5.37	28.8054	
5	Sensitivity coefficient of sample gas temperature at 1h-limit value	≤ 3.0 nmol/mol/K	0.450	U _{gt}	1.02	1.0438	
6	Sensitivity coefficient of surrounding temperature at 1h-limit value	≤ 3.0 nmol/mol/K	0.240	U _{st}	0.60	0.3647	
7	Sensitivity coefficient of electrical voltage at 1h-limit value	≤ 0.30 nmol/mol/V	0.006	U _v	0.02	0.0003	
8a	Interferent H ₂ O with 21 nmol/mol	≤ 10 nmol/mol (Zero)	-0.300	U _{h2o}	-0.26	0.0700	
		≤ 10 nmol/mol (Span)	-0.570				
8b	Interferent CO ₂ with 500 µmol/mol	≤ 5.0 nmol/mol (Zero)	0.600	U _{int,pos}			
		≤ 5.0 nmol/mol (Span)	0.430	or	0.38	0.1434	
8c	Interferent NH ₃ mit 200 nmol/mol	≤ 5.0 nmol/mol (Zero)	-0.240	U _{int,neg}			
		≤ 5.0 nmol/mol (Span)	1.410				
9	Averaging effect	≤ 7.0% of measured value	-1.310	U _{av}	-0.79	0.6259	
10	Reproducibility standard deviation under field conditions	≤ 5.0% of average over 3 months	3.550	U _{r,f}	3.71	13.7886	
11	Long term drift at zero level	≤ 5.0 nmol/mol	0.580	U _{d,z}	0.33	0.1121	
12	Long term drift at span level	≤ 5.0% of max. of certification range	2.550	U _{d,inh}	1.54	2.3715	
18	Difference sample/calibration port	≤ 1.0%	0.230	U _{asc}	0.24	0.0579	
21	Converter efficiency	≥ 98	98.800	U _{ec}	1.26	1.5755	
23	Uncertainty of test gas	≤ 3.0%	2.000	U _{cg}	1.05	1.0941	
Combined standard uncertainty			U _c		7.0932		nmol/mol
Expanded uncertainty			U		14.1864		nmol/mol
Relative expanded uncertainty			W		13.56		%
Maximum allowed expanded uncertainty			W _{req}		15		%

CONFIRMATION

Notification: 0000040204_00_01_rev1
on changes according to EN 15267 regarding certificate 0000040204 dated 29 April 2014

Measuring system: Serinus 40 for NO, NO₂ und NO_x

Manufacturer: Ecotech PTY Ltd.
1492 Ferntree Gully Road
Knoxfield, VIC, 3180
Australia

German Federal Environmental Agency (UBA)

Announcement about the uniform practice in
monitoring emissions and ambient air.
25 February 2015
Federal Gazette BAnz AT 02 April 2015 B5

IV. Notifications to the uniform practice for the continuous monitoring of
emission and ambient air:

6 Notification as regards Federal Environment Agency (UBA) notice of 27 February 2014
(Federal Gazette (BAnz) AT 1 April 2014 B12, chapter IV number 4.1)

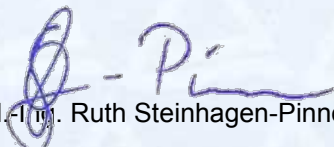
Hereafter, the Serinus 40 measuring system for NO, NO₂, and NO_x, manufactured by Ecotech Pty Ltd., will be equipped with a new microprocessor board (C010014). This results in modifications of the power plug as well as software changes.

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

TÜV Rheinland Energie und Umwelt GmbH
Cologne, 30. April 2015


i. A. Dipl.-Ing. Ruth Steinhagen-Pinnow


i. A. Dipl. Ing. Carsten Röllig

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TÜV Rheinland Energie und Umwelt GmbH
Am Grauen Stein
51105 Cologne

Test institute accredited to EN ISO/IEC 17025:2005 by DAkkS (German Accreditation Body. This accreditation is limited to the accreditation scope defined in the enclosure to the certificate D-PL-11120-02-00.

CONFIRMATION

Notification: 0000040204_00_02
on changes according to EN 15267 regarding certificate 0000040204_00 dated 29 April 2014

Measuring system: Serinus 40 for NO, NO₂ and NO_x

Manufacturer: Ecotech PTY Ltd.
1492 Ferntree Gully Road
Knoxfield, VIC, 3180
Australia

German Federal Environmental Agency (UBA)

**Announcement about the uniform practice in
monitoring emissions and ambient air
dated 22 February 2017
Federal Gazette: BAnz AT 15.03.2017 B6**

**V Notifications to the uniform practice for the continuous monitoring
of emission and ambient air:**

- 7 Notification as regards Federal Environment Agency notices
of 27 February 2014 (BAnz AT 01.04.2014 B12, chapter IV number 4.1) and
of 25 February 2015 (BAnz AT 02.04.2015 B5 chapter IV 6th notification)

The current software version of the Serinus 40 for NO, NO₂ and NO_x 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 40 for NO, NO₂ and NO_x manufactured by
Ecotech Pty Ltd. for systems with micro processor board (C010014) is: V 3.48.011.

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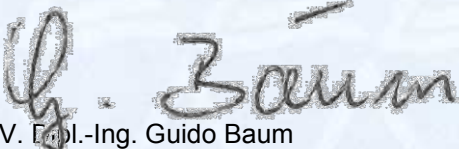
TÜV Rheinland Energy GmbH
Am Grauen Stein
51105 Cologne

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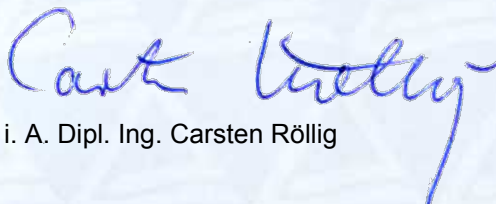
The following software versions are approved for this instrument version: V 3.13.000, V 3.14.001, V 3.15.010, V 3.16.001, V 3.18.003, V 3.20.000, V 3.22.000, V 3.23.015, V 3.24.000, V 3.26.000, V 3.27.000, V 3.28.000, V 3.29.013, V 3.30.005, V 3.31.002, V 3.32.003, V 3.33.004, V 3.34.000, V 3.35.004, 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 issued by TÜV Rheinland Energy GmbH dated 13 October 2016.

TÜV Rheinland Energy GmbH
Cologne, 28 March 2017



i. V. Dipl.-Ing. Guido Baum



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