

CERTIFICATE

of Product Conformity (QAL1)

Certificate No.: 0000040203_01

Certified AMS: Serinus 30 for CO

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

Test Institute: TÜV Rheinland Energy 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 14626: 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).

The present certificate replaces certificate 0000040203 of 29 April 2014.

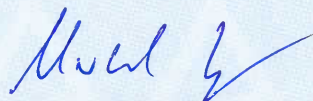


Suitability Tested
Complying with
2008/50/EC
EN 15267
Regular
Surveillance

www.tuv.com
ID 0000040203

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

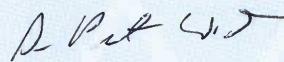
German Federal Environment Agency
Dessau, 1 April 2019



Dr. Marcel Langner
Head of Section II 4.1

This certificate will expire on:
30 June 2020

TÜV Rheinland Energy GmbH
Cologne, 31 March 2019



ppa. Dr. Peter Wilbring

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TÜV Rheinland Energy GmbH
Am Grauen Stein
51105 Cologne

Accreditation according to EN ISO/IEC 17025:2018 and certified according to ISO 9001:2015.

Certificate:
0000040203_01 / 1 April 2019

Test report: 936/21221977/D of 08 October 2013
Initial certification: 01 April 2014
Date of expiry: 30 June 2020
Publication: BAnz AT 01 April 2014 B12, chapter IV, No. 2.1

Approved application

The tested AMS is suitable for the continuous measurement of concentrations of carbon monoxide 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/D 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. 2.1
Announcement by UBA from 27 February 2014

AMS designation:

Serinus 30 for CO

Manufacturer:

Ecotech Pty Ltd., Knoxfield, Australia

Field of application:

Continuous measurement of concentrations of carbon monoxide in ambient air (stationary operation)

Measuring range during the performance test:

Component	Certification range	Unit
Carbon monoxide	0 - 100	mg/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/D of 8 October 2013

Certified product

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

The Serinus 30 measuring system is a continuous carbon monoxide monitor which uses the method of non-dispersive infrared photometry. The instrument is designed for the continuous measurement of carbon monoxide concentrations in ambient air.

Measurements are made by means of the following components:

- microprocessor control
- proven Gas Filter Correlation (Gfc)
- combined with Non-Dispersive Infrared Spectrophotometry (NDIR) technology

The CO 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 30 to accurately measure CO in all ambient applications.

Carbon monoxide is measured on the basis of the following principles and methods:

CO absorbs infrared radiation (IR) at a wavelength of approx. 4.7 µm. IR radiation (at 4.7 µm) passes through the sample air with the measurement path being 5 m. According to the Beer-Lambert law, the intensity of the received signal is proportional to the CO concentration within the sample. In order to make sure that only light at a wavelength of 4.7 µm is led through, a band-pass filter is attached to the signal detector.

The Beer-Lambert equation is used to calculate the gas concentration from the ratio of two measured light intensities:

$$I/I_0 = \exp(-acd)$$

where

- I is the light intensity measured with CO in the gas sample
- I_0 is the light intensity measured with no ozone in the gas sample
- a is the CO absorption coefficient at 253.7 nm
- c is the mass concentration of CO in mg/m^3
- d is the optical path length in m

The system includes a gas filter correlation wheel. It contains three parts which improve the accuracy of the measurements: CO-chamber, N₂-chamber and a mask.

- The CO window contains a certain saturation (40 %) of CO which acts as a reference beam – absorbing a known amount of light.
- The N₂ window, containing 100% N₂, does not absorb IR at 4.7 microns at all and is used during normal CO measurement.
- The mask totally blocks the light source and is used to determine background signals and the strength of other signals relative to each other and the background.

The carbon monoxide analyser consists of five main modules:

The pneumatics to transfer sample and exhaust gas.

The sensors for the measurement of carbon monoxide (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.

Particulate 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 measurement.

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 Energy 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 Energy 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 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 30 CO 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. 0000040203: 29 April 2014

Validity of the certificate until: 31 March 2019

Test report: 936/21221977/D of 08 October 2019

TÜV Rheinland Energie und Umwelt GmbH, Köln

Publication: BAnz AT 01 April 2014 B12, chapter IV, No. 2.1

Announcement by UBA from 27 February 2014

Renewal of the certificate according to EN 15267:

Certificate No. 0000040203_01: 1 April 2019

Validity of the certificate until: 30 June 2020

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

Measuring device:		Serial-No.:		µmol/mol		
Ecoltech Serinus 30		12-1183 (Device 1)		8.62		
Measured component:		8h-limit value:				
CO						
No.	Performance characteristic	Performance criterion	Result	Partial uncertainty	Square of partial uncertainty	
1	Repeatability standard deviation at zero	≤ 0.3 µmol/mol	0.020	u _{r,z}	0.0000	
2	Repeatability standard deviation at 8h-limit value	≤ 0.4 µmol/mol	0.030	u _r	0.0000	
3	"lack of fit" at 8h-limit value	≤ 4.0% of measured value	0.860	u _i	0.0018	
4	Sensitivity coefficient of sample gas pressure at 8h-limit value	≤ 0.7 µmol/mol/kPa	0.040	u _{sp}	0.0087	
5	Sensitivity coefficient of sample gas temperature at 8h-limit value	≤ 0.3 µmol/mol/K	0.000	u _{gt}	0.0000	
6	Sensitivity coefficient of surrounding temperature at 8h-limit value	≤ 0.3 µmol/mol/K	0.040	u _{st}	0.0083	
7	Sensitivity coefficient of electrical voltage at 8h-limit value	≤ 0.3 µmol/mol/V	0.001	u _v	0.0000	
8a	Interferent H ₂ O with 21 mmol/mol	≤ 1.0 µmol/mol (Zero)	0.100	u _{izo}	0.0055	
8b	Interferent CO ₂ with 500 µmol/mol	≤ 1.0 µmol/mol (Span)	0.230	u _{it,pos}	0.0039	
		≤ 0.5 µmol/mol (Zero)	-0.050			
8c	Interferent NO with 1 µmol/mol	≤ 0.5 µmol/mol (Span)	0.000	or	0.0039	
		≤ 0.5 µmol/mol (Zero)	0.010			
		≤ 0.5 µmol/mol (Span)	-0.110			
8d	Interferent N ₂ O with 50 nmol/mol	≤ 0.5 µmol/mol (Span)	0.010	u _{it,neg}		
9	Averaging effect	≤ 7.0% of measured value	-0.080	u _{av}	0.0000	
18	Difference sample/calibration port	≤ 1.0%	-0.090	u _{isc}	0.0001	
21	Uncertainty of test gas	≤ 3.0%	2.000	u _{cg}	0.0074	
Combined standard uncertainty				u _c	0.1892	µmol/mol
Expanded uncertainty				U	0.3784	µmol/mol
Relative expanded uncertainty				W	4.39	%
Maximum allowed expanded uncertainty				W _{req}	15	%

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

Measuring device: EcoTech Serinus 30		Serial No.: 13-0093 (Device 2)		8h-limit value: 8.62		µmol/mol	
Measured component: CO		Performance characteristic		Performance criterion	Result	Partial uncertainty	Square of partial uncertainty
No.						U _{i,z}	
1	Repeatability standard deviation at zero	≤	0.3 µmol/mol	≤	0.020	0.00	0.0000
2	Repeatability standard deviation at 8h-limit value	≤	0.4 µmol/mol	≤	0.000	0.00	0.0000
3	"lack of fit" at 8h-limit value	≤	4.0% of measured value	≤	0.930	0.05	0.0021
4	Sensitivity coefficient of sample gas pressure at 8h-limit value	≤	0.7 µmol/mol/kPa	≤	0.030	0.07	0.0049
5	Sensitivity coefficient of sample gas temperature at 8h-limit value	≤	0.3 µmol/mol/K	≤	0.000	0.00	0.0000
6	Sensitivity coefficient of surrounding temperature at 8h-limit value	≤	0.3 µmol/mol/K	≤	0.046	0.10	0.0109
7	Sensitivity coefficient of electrical voltage at 8h-limit value	≤	0.3 µmol/mol/V	≤	0.001	0.00	0.0000
8a	Interferent H ₂ O with 21 mmol/mol	≤	1.0 µmol/mol (Zero)	≤	-0.110	-0.07	0.0046
		≤	1.0 µmol/mol (Span)	≤	0.090		
8b	Interferent CO ₂ with 500 µmol/mol	≤	0.5 µmol/mol (Zero)	≤	0.050		
		≤	0.5 µmol/mol (Span)	≤	0.050		
8c	Interferent NO with 1 µmol/mol	≤	0.5 µmol/mol (Zero)	≤	0.080	0.06	0.0035
		≤	0.5 µmol/mol (Span)	≤	0.050		
8d	Interferent N ₂ O with 50 nmol/mol	≤	0.5 µmol/mol (Zero)	≤	0.000		
		≤	0.5 µmol/mol (Span)	≤	0.000		
9	Averaging effect	≤	7.0% of measured value	≤	-1.550	-0.08	0.0060
18	Difference sample/calibration port	≤	1.0%	≤	-0.170	-0.01	0.0002
21	Uncertainty of test gas	≤	3.0%	≤	2.000	0.09	0.0074
Combined standard uncertainty				U _c	0.1992		µmol/mol
Expanded uncertainty				U	0.3983		µmol/mol
Relative expanded uncertainty				W	4.62		%
Maximum allowed expanded uncertainty				W _{req}	15		%

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

Measuring device: Ecotech Serinus 30		Serial No.: 12-1183 (Device 1)		8h-limit value: 8.62		µmol/mol	
Measured component: CO		Performance characteristic		Partial uncertainty		Square of partial uncertainty	
No.	Performance characteristic	Result	Performance criterion	Partial uncertainty	Result	Partial uncertainty	Square of partial uncertainty
1	Repeatability standard deviation at zero	0.020	≤ 0.3 µmol/mol	u _{r,z}	0.020	0.00	0.0000
2	Repeatability standard deviation at 8h-limit value	0.030	≤ 0.4 µmol/mol	u _r	0.030	not considered, as u _r = 0 < u _{r,f}	-
3	"lack of fit" at 8h-limit value	0.860	≤ 4.0% of measured value	u _f	0.860	0.04	0.0018
4	Sensitivity coefficient of sample gas pressure at 8h-limit value	0.040	≤ 0.7 µmol/mol/kPa	u _{sp}	0.040	0.09	0.0087
5	Sensitivity coefficient of sample gas temperature at 8h-limit value	0.000	≤ 0.3 µmol/mol/K	u _{gt}	0.000	0.00	0.0000
6	Sensitivity coefficient of surrounding temperature at 8h-limit value	0.040	≤ 0.3 µmol/mol/K	u _{st}	0.040	0.09	0.0083
7	Sensitivity coefficient of electrical voltage at 8h-limit value	0.001	≤ 0.3 µmol/mol/V	u _v	0.001	0.00	0.0000
8a	Interferent H ₂ O with 21 mmol/mol	0.230	≤ 1.0 µmol/mol (Zero)	u _{h2o}	0.230	0.07	0.0055
8b	Interferent CO ₂ with 500 µmol/mol	-0.050	≤ 0.5 µmol/mol (Zero)	u _{h2o,pos}	-0.050		
8c	Interferent NO with 1 µmol/mol	0.000	≤ 0.5 µmol/mol (Span)		0.000		
8d	Interferent N ₂ O with 50 mmol/mol	0.010	≤ 0.5 µmol/mol (Zero)	or	0.010	0.06	0.0039
9	Averaging effect	0.010	≤ 0.5 µmol/mol (Span)	u _{h2o,neg}	0.010		
10	Reproducibility standard deviation under field conditions	-0.080	≤ 7.0% of measured value	u _{av}	-0.080	0.00	0.0000
11	Long term drift at zero level	3.450	≤ 5.0% of average over 3 months	u _{r,t}	3.450	0.30	0.0884
12	Long term drift at span level	-0.230	≤ 0.5 µmol/mol	u _{l,z}	-0.230	-0.13	0.0176
18	Difference sample/calibration port	0.640	≤ 5.0% of max. of certification range	u _{l,sh}	0.640	0.03	0.0010
21	Uncertainty of test gas	-0.090	≤ 1.0%	u _{isc}	-0.090	-0.01	0.0001
		2.000	≤ 3.0%	u _{cg}	2.000	0.09	0.0074
Combined standard uncertainty				u _c			0.3779
Expanded uncertainty				U			0.7559
Relative expanded uncertainty				W			8.77
Maximum allowed expanded uncertainty				W _{req}			15

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

Measuring device:		Serial-No.:		13-0093 (Device 2)		8.62		µmol/mol	
Measured component:		8h-limit value:		8h-limit value:		8.62		µmol/mol	
No.	Performance characteristic	Performance criterion	Result	Partial uncertainty	Square of partial uncertainty	Partial uncertainty	8h-limit value:	8.62	µmol/mol
1	Repeatability standard deviation at zero	≤ 0.3 µmol/mol	0.020	U _{r,z}	0.000	0.0000	0.00	0.0000	
2	Repeatability standard deviation at 8h-limit value	≤ 0.4 µmol/mol	0.000	U _r	not considered, as u _r = 0 < u _{r,f}	-			
3	"lack of fit" at 8h-limit value	≤ 4.0% of measured value	0.930	U _l	0.0021	0.0021	0.05	0.0021	
4	Sensitivity coefficient of sample gas pressure at 8h-limit value	≤ 0.7 µmol/mol/kPa	0.030	U _{sp}	0.0049	0.0049	0.07	0.0049	
5	Sensitivity coefficient of sample gas temperature at 8h-limit value	≤ 0.3 µmol/mol/K	0.000	U _{gt}	0.0000	0.0000	0.00	0.0000	
6	Sensitivity coefficient of surrounding temperature at 8h-limit value	≤ 0.3 µmol/mol/K	0.046	U _{st}	0.0109	0.0109	0.10	0.0109	
7	Sensitivity coefficient of electrical voltage at 8h-limit value	≤ 0.3 µmol/mol/V	0.001	U _v	0.0000	0.0000	0.00	0.0000	
8a	Interferent H ₂ O with 21 mmol/mol	≤ 1.0 µmol/mol (Zero)	0.090	U _{iso}	0.0046	0.0046	-0.07	0.0046	
		≤ 1.0 µmol/mol (Span)	-0.110	U _{iso}					
8b	Interferent CO ₂ with 500 µmol/mol	≤ 0.5 µmol/mol (Zero)	0.050	U _{interpos}					
		≤ 0.5 µmol/mol (Span)	0.050	U _{interpos}					
8c	Interferent NO with 1 µmol/mol	≤ 0.5 µmol/mol (Zero)	0.080	U _{interpos}	0.0035	0.0035	0.06	0.0035	
		≤ 0.5 µmol/mol (Span)	0.050	U _{interpos}					
8d	Interferent N ₂ O with 50 nmol/mol	≤ 0.5 µmol/mol (Zero)	0.000	U _{interpos}					
		≤ 0.5 µmol/mol (Span)	0.000	U _{interpos}					
9	Averaging effect	≤ 7.0% of measured value	-1.550	U _{av}	0.0060	0.0060	-0.08	0.0060	
10	Reproducibility standard deviation under field conditions	≤ 5.0% of average over 3 months	3.450	U _{r,f}	0.0884	0.0884	0.30	0.0884	
11	Long term drift at zero level	≤ 0.5 µmol/mol	-0.470	U _{l,z}	0.0736	0.0736	-0.27	0.0736	
12	Long term drift at span level	≤ 5.0% of max. of certification range	-0.900	U _{l,sh}	0.0020	0.0020	-0.04	0.0020	
18	Difference sample/calibration port	≤ 1.0%	-0.170	U _{asc}	0.0002	0.0002	-0.01	0.0002	
21	Uncertainty of test gas	≤ 3.0%	2.000	U _{sg}	0.0074	0.0074	0.09	0.0074	
				Combined standard uncertainty		U _c	0.4514		µmol/mol
				Expanded uncertainty		U	0.9028		µmol/mol
				Relative expanded uncertainty		W	10.47		%
				Maximum allowed expanded uncertainty		W _{req}	15		%