

CERTIFICATE

of Product Conformity (QAL1)

Certificate No.: 0000038501_01

Certified AMS: 100E / T100 for SO₂

Manufacturer: Teledyne Advanced Pollution Instrumentation
9480 Carroll Park Drive
San Diego
CA 92121-5201
USA

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: 2002, VDI 4203-2: 2004, EN 14212: 2012,
EN 15267-1: 2009, 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 No. 0000038501 of 22 March 2013



Suitability Tested
EN 15267
QAL1 Certified
Regular
Surveillance

www.tuv.com
ID 0000038501

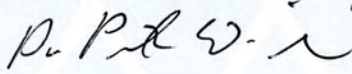
Publication in the German Federal Gazette
(BAnz.) of 06 November 2007

German Federal Environment Agency
Dessau, 20 August 2013


i. A. Dr. Marcel Langner

This certificate will expire on:
04 March 2018

TÜV Rheinland Energie und Umwelt GmbH
Cologne, 19 August 2013


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:
0000038501_01 / 20 August 2013

Test report: 936/21205926/B of 22 June 2007
Addendum 936/21219874/A of 11 October 2012
Addendum 936/21221556/A of 16 March 2013

Initial certification: 05 March 2013

Date of expiry: 04 March 2018

Publication: BAnz AT 23 July 2013 B4, chapter V, notification 15

Approved application

The certified AMS is suitable for continuous ambient air monitoring of SO₂ (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 the temperature range of +5 °C to +40 °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 936/21205926/B of 22 June 2007 of TÜV Rheinland Immissionsschutz und Energiesysteme GmbH, addendum 936/21219874/A of 11 October 2012 of TÜV Rheinland Energie und Umwelt GmbH and addendum 936/21221556/A of 16 March 2013 of TÜV Rheinland Energie und Umwelt GmbH
- suitability announced by the German Federal Environment Agency (UBA) as the relevant body
- the on-going surveillance of the product and the manufacturing process
- publication in the German Federal Gazette (BAnz. 06 November 2007, p. 7925, chapter II, No. 1.1)
- publication in the German Federal Gazette (BAnz. 26 January 2011, p. 294, chapter IV, notification 19 and 20)
- publication in the German Federal Gazette (BAnz AT 05 March 2013 B10, chapter V, notification 3)
- publication in the German Federal Gazette (BAnz AT 23 July 2013 B4, chapter V, notification 15)

AMS designation:

M100E for SO₂

Manufacturer:

Teledyne Advanced Pollution Instrumentation, San Diego, USA / EAS GmbH, Brunn, Austria

Field of application:

For continuous ambient air monitoring of SO₂ (stationary operation)

Measuring ranges during the performance test:

SO₂: 0 - 700 µg/m³
0 - 1000 µg/m³

Software version:

Revision C.3

Test report:

TÜV Rheinland Immissionsschutz und Energiesysteme GmbH, Cologne,
TÜV Rheinland Group, Cologne
Report No.: 936/21205926/B dated 22 June 2007

**19 Notification as regards Federal Environmental Agency notices of 23 September 2007
(BAnz. p. 7925, chapter II, No. 1.1)**

The current software version of the ambient air measuring system M100E for SO₂ of the company Teledyne Advanced Pollution Instrumentation is:

G.4 with Library Version 6.3

Opinion stated by TÜV Rheinland Energie und Umwelt GmbH of 29 September 2010

**20 Notification as regards Federal Environmental Agency notices of 23 September 2007
(BAnz. p. 7925, chapter II, No. 1.1)**

The measuring system M100E for SO₂ of the company Teledyne Advanced Pollution Instrumentation is manufactured in the old design M100E as well as in the new design Model T100. The new design differs from the old design only by a new display, a new front plate and extended possibilities for communication.

The current name of the new design of the measuring system is:

Model T100

The current software version of the new design of the measuring system is:

1.0.0 bld 54 with Library Version 7.0.0 bld 57

Opinion stated by TÜV Rheinland Energie und Umwelt GmbH of 29 September 2010

3 Notification as regards Federal Environmental Agency notices of 23 September 2007 (BAnz. p. 7925, chapter II, No. 1.1) and of 10 January 2011 (BAnz. p. 294, chapter IV, 19th and 20th notification)

The measuring system M100E respectively T100 for SO₂ of the company Teledyne Advanced Pollution Instrumentation fulfills the requirements of EN 14212 (issue June 2005). Furthermore the manufacturing and the quality management of the measuring system M100E respectively T100 for SO₂ fulfill the requirements of EN 15267.

The test report on the type approval with the report no. 936/21205926/B as well as an addendum to the test report with the report no. 936/21219874/A are available on the internet at www.qal1.de.

The current software version of the measuring system M100E is:

G.6 with Library Version 6.4

The current software version of the measuring system T100 is:

1.0.3 with Library Version 7.0.3

Opinion stated by TÜV Rheinland Energie und Umwelt GmbH of 11 October 2012

15 Notification on announcements of the Federal Environmental Agency of 23 September 2007 (BAnz. p. 7925, chapter II, no. 1.1) and of 12 February 2013 (BAnz. AT of 5 March 2013 B10, chapter V, 3rd notification)

The M100E / T100 measuring system for SO₂ manufactured by Teledyne Advanced Pollution Instrumentation fulfills the requirements of EN 14212 (November 2012). An addendum as integral part of the test report n° 936/21221556/A is available online at www.qal1.de.

The new designation of the M100E measuring system for SO₂ is 100E.

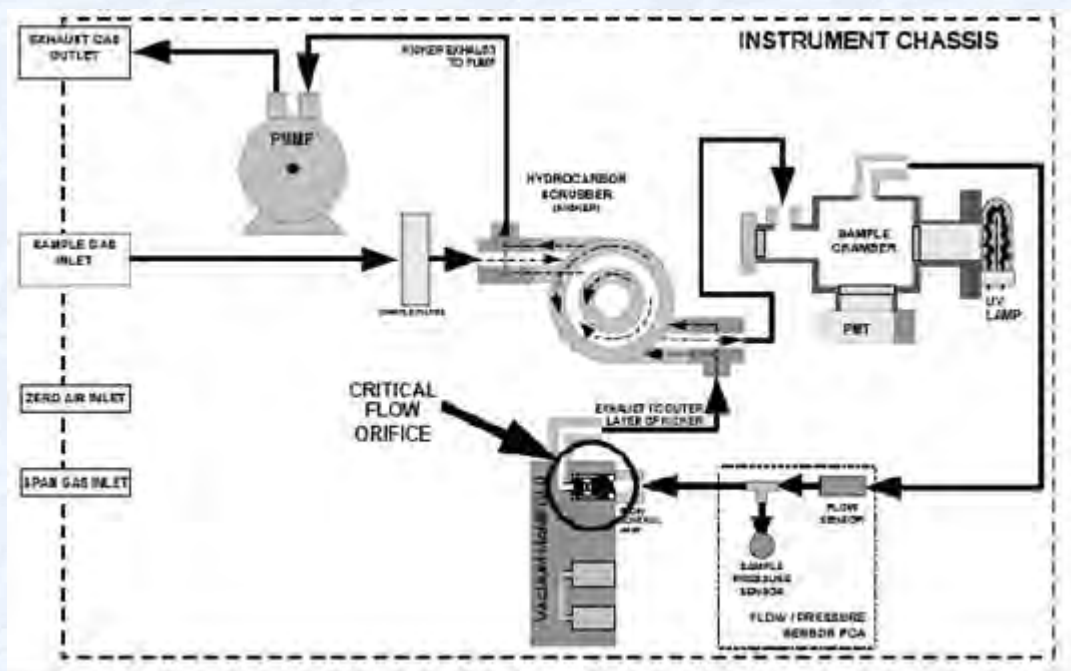
Statement of TÜV Rheinland Energie und Umwelt GmbH of 16 March 2013.

Certified product

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

The physical principle on which the measuring principle of the measuring system 100E respectively T100 underlies, is based on the fluorescence, which appears when sulphur dioxide (SO₂) is activated by UV-light with a wavelength in the range between 190 nm and 230 nm and thus complies with the reference method described in the standard EN 14212.

The schematic set-up / flow diagram of the measuring system 100E respectively T100 (with optional zero/span gas port) is as follows:



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 100E / T100 for SO₂ is based on the documents listed below and the regular, continuous monitoring of the Quality Management System of the manufacturer:

Basic test:

Test report: 936/21205926/B dated 22 June 2007
TÜV Rheinland Immissionsschutz und Energiesysteme GmbH, Cologne

Publication: BAnz. 6 November 2007, No. 206, p. 7925, chapter II, No. 1.1
Announcement by UBA from 23 September 2007

Notification:

Publication: BAnz. 26 January 2011, No. 14, p. 294, chapter IV, notification 19 and notification 20
Announcement by UBA from 10 January 2011 (*software change + design*)

Publication: BAnz AT 05 March 2013 B10, chapter V, notification 3
Announcement by UBA from 12 February 2013 (*standard change*)

Initial certification according to EN 15267:

Certificate No. 0000038501: 22 March 2013

Expiration date of the certificate: 04 March 2018

Test report: 936/21205926/B dated 22 June 2007
TÜV Rheinland Immissionsschutz und Energiesysteme GmbH, Cologne

Addendum: 936/21219874/A dated 11 October 2012
TÜV Rheinland Energie und Umwelt GmbH, Cologne

Statement of TÜV Rheinland Energie und Umwelt GmbH from 11 October 2012

Publication: BAnz AT 05 March 2013 B10, chapter V, notification 3
Announcement by UBA from 12 February 2013

Supplementary testing according to EN 15267:

Certificate No. 0000038501_01: 20 August 2013

Expiration date of the certificate: 04 March 2018

Test report: 936/21205926/B of 22 June 2007
TÜV Rheinland Immissionsschutz und Energiesysteme GmbH, Cologne

Addendum: 936/21219874/A of 11 October 2012 of TÜV Rheinland Energie und Umwelt GmbH
Addendum 936/21221556/A of 16 March 2013 of TÜV Rheinland Energie und Umwelt GmbH

Publication: BAnz AT 23 July 2013 B4, chapter V, notification 15
Announcement by UBA from 03 July 2013

Calculation of overall uncertainty (Device 1)

Measuring device: Teledyne API M100E / T100				Serial number: SN 1 (1177)			
Measured component: SO2				1h-Limit value: 132 nmol/mol			
No.	Performance characteristic	Performance criterion	Result	Partial uncertainty		Square of partial uncertainty	
1	Repeatability standard deviation at zero	≤ 1.0 nmol/mol	0.300	U _{r,z}	0.09	0.0079	
2	Repeatability standard deviation at 1h-limit value	≤ 3.0 nmol/mol	0.500	U _{r,1h}	0.15	0.0230	
3	"lack of fit" at 1h-limit value	≤ 4.0% of the meas. value	-0.400	U _{l,1h}	-0.30	0.0929	
4	Sensitivity coefficient of sample gas pressure at 1h-limit value	≤ 3.0 nmol/mol/kPa	0.020	U _{gp}	0.53	0.2846	
5	Sensitivity coefficient of sample gas temperature at 1h-limit value	≤ 1.0 nmol/mol/K	-0.013	U _{gt}	-0.10	0.0105	
6	Sensitivity coefficient of surrounding temperature at 1h-limit value	≤ 1.0 nmol/mol/K	0.050	U _{st}	0.39	0.1554	
7	Sensitivity coefficient of electrical voltage at 1h-limit value	≤ 0.30 nmol/mol/V	-0.010	U _v	-0.11	0.0117	
8a	Interferent H ₂ O with 21 nmol/mol	≤ 10 nmol/mol (Zero)	-0.400	U _{H2O}	-1.28	1.6472	
		≤ 10 nmol/mol (Span)	-1.700				
8b	Interferent H ₂ S with 200 nmol/mol	≤ 5.0 nmol/mol (Zero)	0.300	U _{int,pos}	3.45	11.8950	
		≤ 5.0 nmol/mol (Span)	0.900				
8c	Interferent NH ₃ with 200 nmol/mol	≤ 5.0 nmol/mol (Zero)	0.300	or	3.45	11.8950	
		≤ 5.0 nmol/mol (Span)	0.100				
8d	Interferent NO with 500 nmol/mol	≤ 5.0 nmol/mol (Zero)	0.500	or	3.45	11.8950	
		≤ 5.0 nmol/mol (Span)	3.200				
8e	Interferent NO ₂ with 200 nmol/mol	≤ 5.0 nmol/mol (Zero)	0.010	or	3.45	11.8950	
		≤ 5.0 nmol/mol (Span)	0.500				
8f	Intererent m-Xylene with 1 µmol/mol	≤ 10 nmol/mol (Zero)	0.000	U _{int,neg}	3.45	11.8950	
		≤ 10 nmol/mol (Span)	1.200				
9	Averaging effect	≤ 7.0% of the meas. value	2.400	U _{av}	1.83	3.3454	
18	Difference sample/calibration port	≤ 1%	0.000	U _{asc}	0.00	0.0000	
21	Uncertainty of test gas	≤ 3%	1.000	U _{cg}	0.66	0.4356	
Combined standard uncertainty				U _c	4.2319	nmol/mol	
Expanded uncertainty				U	8.4639	nmol/mol	
Relative expanded uncertainty				W	6.41	%	
Maximum allowed expanded uncertainty				W _{req}	15	%	

Measuring device: Teledyne API M100E / T100				Serial number: SN 1 (1177)			
Measured component: SO2				1h-Limit value: 132 nmol/mol			
No.	Performance characteristic	Performance criterion	Result	Partial uncertainty		Square of partial uncertainty	
1	Repeatability standard deviation at zero	≤ 1.0 nmol/mol	0.300	U _{r,z}	0.09	0.0079	
2	Repeatability standard deviation at 1h-limit value	≤ 3.0 nmol/mol	0.500	U _{r,1h}	not considered, as u _{r,1h} = 0.15 < u _{r,f}	-	
3	"lack of fit" at 1h-limit value	≤ 4.0% of the meas. value	-0.400	U _{l,1h}	-0.30	0.0929	
4	Sensitivity coefficient of sample gas pressure at 1h-limit value	≤ 3.0 nmol/mol/kPa	0.020	U _{gp}	0.53	0.2846	
5	Sensitivity coefficient of sample gas temperature at 1h-limit value	≤ 1.0 nmol/mol/K	-0.013	U _{gt}	-0.10	0.0105	
6	Sensitivity coefficient of surrounding temperature at 1h-limit value	≤ 1.0 nmol/mol/K	0.050	U _{st}	0.39	0.1554	
7	Sensitivity coefficient of electrical voltage at 1h-limit value	≤ 0.30 nmol/mol/V	-0.010	U _v	-0.11	0.0117	
8a	Interferent H ₂ O with 21 nmol/mol	≤ 10 nmol/mol (Zero)	-0.400	U _{H2O}	-1.28	1.6472	
		≤ 10 nmol/mol (Span)	-1.700				
8b	Interferent H ₂ S with 200 nmol/mol	≤ 5.0 nmol/mol (Span)	0.900	U _{int,pos}	3.45	11.8950	
		≤ 5.0 nmol/mol (Zero)	0.300				
8c	Interferent NH ₃ with 200 nmol/mol	≤ 5.0 nmol/mol (Zero)	0.100	or	3.45	11.8950	
		≤ 5.0 nmol/mol (Span)	0.500				
8d	Interferent NO with 500 nmol/mol	≤ 5.0 nmol/mol (Zero)	0.500	or	3.45	11.8950	
		≤ 5.0 nmol/mol (Span)	3.200				
8e	Interferent NO ₂ with 200 nmol/mol	≤ 5.0 nmol/mol (Zero)	0.010	or	3.45	11.8950	
		≤ 5.0 nmol/mol (Span)	0.500				
8f	Intererent m-Xylene with 1 µmol/mol	≤ 10 nmol/mol (Zero)	0.000	U _{int,neg}	3.45	11.8950	
		≤ 10 nmol/mol (Span)	1.200				
9	Averaging effect	≤ 7.0% of the meas. value	2.400	U _{av}	1.83	3.3454	
10	Reproducibility standard deviation under field conditions	≤ 5.0% of 3 month average	4.800	U _{r,f}	6.34	40.1449	
11	Long term drift at zero level	≤ 5.0 nmol/mol	1.060	U _{d,l,z}	0.61	0.3745	
12	Long term drift at 1h-limit value	≤ 5.0% of max. of cert. range	1.490	U _{d,l,1h}	1.14	1.2894	
18	Difference sample/calibration port	≤ 1%	0.000	U _{asc}	0.00	0.0000	
21	Uncertainty of test gas	≤ 3%	1.000	U _{cg}	0.66	0.4356	
Combined standard uncertainty				U _c	7.7263	nmol/mol	
Expanded uncertainty				U	15.4525	nmol/mol	
Relative expanded uncertainty				W	11.71	%	
Maximum allowed expanded uncertainty				W _{req}	15	%	

Calculation of overall uncertainty (Device 2)

Measuring device:		Teledyne API M100E / T100		Serial number:		SN 2 (1183)	
Measured component:		SO2		1h-Limit value:		132 nmol/mol	
No.	Performance characteristic	Performance criterion	Result	Partial uncertainty		Square of partial uncertainty	
1	Repeatability standard deviation at zero	≤ 1.0 nmol/mol	0.500	$U_{r,z}$	0.15	0.0222	
2	Repeatability standard deviation at 1h-limit value	≤ 3.0 nmol/mol	0.900	$U_{r,1h}$	0.27	0.0741	
3	"lack of fit" at 1h-limit value	≤ 4.0% of the meas. value	0.200	$U_{l,1h}$	0.15	0.0232	
4	Sensitivity coefficient of sample gas pressure at 1h-limit value	≤ 3.0 nmol/mol/kPa	0.060	U_{gp}	1.60	2.5613	
5	Sensitivity coefficient of sample gas temperature at 1h-limit value	≤ 1.0 nmol/mol/K	0.013	U_{gt}	0.10	0.0105	
6	Sensitivity coefficient of surrounding temperature at 1h-limit value	≤ 1.0 nmol/mol/K	0.030	U_{st}	0.24	0.0559	
7	Sensitivity coefficient of electrical voltage at 1h-limit value	≤ 0.30 nmol/mol/V	0.020	U_v	0.22	0.0467	
8a	Interferent H ₂ O with 21 mmol/mol	≤ 10 nmol/mol (Zero)	-0.100	U_{H_2O}	-1.21	1.4668	
		≤ 10 nmol/mol (Span)	-1.600				
8b	Interferent H ₂ S with 200 nmol/mol	≤ 5.0 nmol/mol (Zero)	0.400	$U_{int,pos}$			
		≤ 5.0 nmol/mol (Span)	0.400				
8c	Interferent NH ₃ with 200 nmol/mol	≤ 5.0 nmol/mol (Zero)	0.300	or	3.56	12.6928	
		≤ 5.0 nmol/mol (Span)	1.100				
8d	Interferent NO with 500 nmol/mol	≤ 5.0 nmol/mol (Zero)	0.400				
		≤ 5.0 nmol/mol (Span)	2.900				
8e	Interferent NO ₂ with 200 nmol/mol	≤ 5.0 nmol/mol (Zero)	0.100				
		≤ 5.0 nmol/mol (Span)	0.800				
8f	Interferent m-Xylene with 1 µmol/mol	≤ 10 nmol/mol (Zero)	0.300	$U_{int,neg}$			
		≤ 10 nmol/mol (Span)	0.900				
9	Averaging effect	≤ 7.0% of the meas. value	1.100	U_{av}	0.84	0.7028	
18	Difference sample/calibration port	≤ 1%	0.000	U_{asc}	0.00	0.0000	
21	Uncertainty of test gas	≤ 3%	1.000	U_{cg}	0.66	0.4356	
				Combined standard uncertainty		u_c	4.2535 nmol/mol
				Expanded uncertainty		U	8.5069 nmol/mol
				Relative expanded uncertainty		W	6.44 %
				Maximum allowed expanded uncertainty		W_{req}	15 %

Measuring device:		Teledyne API M100E / T100		Serial number:		SN 2 (1183)	
Measured component:		SO2		1h-Limit value:		132 nmol/mol	
No.	Performance characteristic	Performance criterion	Result	Partial uncertainty		Square of partial uncertainty	
1	Repeatability standard deviation at zero	≤ 1.0 nmol/mol	0.500	$U_{r,z}$	0.15	0.0222	
2	Repeatability standard deviation at 1h-limit value	≤ 3.0 nmol/mol	0.900	$U_{r,1h}$	not considered, as $u_{r,1h} = 0.27 < u_{r,f}$	-	
3	"lack of fit" at 1h-limit value	≤ 4.0% of the meas. value	0.200	$U_{l,1h}$	0.15	0.0232	
4	Sensitivity coefficient of sample gas pressure at 1h-limit value	≤ 3.0 nmol/mol/kPa	0.060	U_{gp}	1.60	2.5613	
5	Sensitivity coefficient of sample gas temperature at 1h-limit value	≤ 1.0 nmol/mol/K	0.013	U_{gt}	0.10	0.0105	
6	Sensitivity coefficient of surrounding temperature at 1h-limit value	≤ 1.0 nmol/mol/K	0.030	U_{st}	0.24	0.0559	
7	Sensitivity coefficient of electrical voltage at 1h-limit value	≤ 0.30 nmol/mol/V	0.020	U_v	0.22	0.0467	
8a	Interferent H ₂ O with 21 mmol/mol	≤ 10 nmol/mol (Zero)	-0.100	U_{H_2O}	-1.21	1.4668	
		≤ 10 nmol/mol (Span)	-1.600				
8b	Interferent H ₂ S with 200 nmol/mol	≤ 5.0 nmol/mol (Zero)	0.400	$U_{int,pos}$			
		≤ 5.0 nmol/mol (Span)	1.100				
8c	Interferent NH ₃ with 200 nmol/mol	≤ 5.0 nmol/mol (Zero)	0.300	or	3.56	12.6928	
		≤ 5.0 nmol/mol (Span)	1.100				
8d	Interferent NO with 500 nmol/mol	≤ 5.0 nmol/mol (Zero)	0.400				
		≤ 5.0 nmol/mol (Span)	2.900				
8e	Interferent NO ₂ with 200 nmol/mol	≤ 5.0 nmol/mol (Zero)	0.100				
		≤ 5.0 nmol/mol (Span)	0.800				
8f	Interferent m-Xylene with 1 µmol/mol	≤ 10 nmol/mol (Zero)	0.300	$U_{int,neg}$			
		≤ 10 nmol/mol (Span)	0.900				
9	Averaging effect	≤ 7.0% of the meas. value	1.100	U_{av}	0.84	0.7028	
10	Reproducibility standard deviation under field conditions	≤ 5.0% of 3 month average	4.800	$U_{r,f}$	6.34	40.1449	
11	Long term drift at zero level	≤ 5.0 nmol/mol	1.350	$U_{d,l,z}$	0.78	0.6075	
12	Long term drift at 1h-limit value	≤ 5.0% of max. of cert. range	1.560	$U_{d,l,1h}$	1.19	1.4134	
18	Difference sample/calibration port	≤ 1%	0.000	U_{asc}	0.00	0.0000	
21	Uncertainty of test gas	≤ 3%	1.000	U_{cg}	0.66	0.4356	
				Combined standard uncertainty		u_c	7.7578 nmol/mol
				Expanded uncertainty		U	15.5156 nmol/mol
				Relative expanded uncertainty		W	11.75 %
				Maximum allowed expanded uncertainty		W_{req}	15 %