

CERTIFICATE

of Product Conformity (QAL1)

Certificate No.: 0000038504_01

Certified AMS: 400E / T400 for O₃

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 14625: 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. 0000038504 of 22 March 2013



Suitability Tested
EN 15267
QAL1 Certified
Regular
Surveillance

www.tuv.com
ID 0000038504

Publication in the German Federal Gazette
(BAnz.) of 29 October 2005

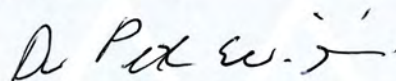
German Federal Environment Agency
Dessau, 20 August 2013



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:
0000038504_01 / 20 August 2013

Test report: 936/21207124/A1_DE of 22 August 2007
Addendum 936/21219874/D of 11 October 2012
Addendum 936/21221556/D 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 18

Approved application

The certified AMS is suitable for continuous ambient air monitoring of O₃ (stationary operation).

The suitability of the AMS for this application was assessed on the basis of a laboratory test and a more than 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 936/21207124/A1_DE of 22 August 2007 of TÜV Rheinland Immissionsschutz und Energiesysteme GmbH, addendum 936/21219874/D of 11 October 2012 of TÜV Rheinland Energie und Umwelt GmbH and addendum 936/21221556/D 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. 29 October 2005, p. 15700, chapter IV, No. 3.1)
- publication in the German Federal Gazette (BAnz. 20 April 2007, p. 4139, chapter IV, notification 7)
- publication in the German Federal Gazette (BAnz. 26 January 2011, p. 294, chapter IV, notification 25 and 26)
- publication in the German Federal Gazette (BAnz AT 05 March 2013 B10, chapter V, notification 6)
- publication in the German Federal Gazette (BAnz AT 23 July 2013 B4, chapter V, notification 18)

AMS designation:

Model 400E for O₃

Manufacturer:

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

Field of application:

For continuous ambient air monitoring of ozone (stationary operation)

Measuring ranges during the performance test:

O₃: 0 - 360 µg/m³
0 - 500 µg/m³

Software:

Version C.3

Restrictions:

In case of SO₂-concentrations greater than 150 µg/m³, the requirements on the cross-sensitivity are not completely fulfilled anymore.

Test institute:

TÜV Rheinland Immissionsschutz und Energiesysteme GmbH, Cologne
TÜV Rheinland Group, Cologne
Report No.: 936/21201601/A dated 10 July 2005

7 Notification as regards Federal Environmental Agency notices of 25 July 2005 (BAnz. p. 15700)

The measuring systems Modell 300E for CO and Modell 400E for ozone of the of the company Teledyne Instruments, San Diego, USA will not be distributed anymore in future – as mentioned in the publication - by the company MLU-Monitoring für Leben und Umwelt Ges.m.b.H. in A-2340 Mödling, Austria, but only by the company EAS Envimet Analytical Systems Ges.m.b.H., Brunn, Austria.

Opinion stated by TÜV Rheinland Immissionsschutz und Energiesysteme GmbH of 14 December 2006

25 Notification as regards Federal Environmental Agency notices of 25 July 2005 (BAnz. p. 15700, chapter IV No. 3.1) and of 12 April 2007 (BAnz. p. 4139, chapter IV, notification 7)

The current software version of the ambient air measuring system Modell 400E (=M400E) for O₃ of the company Teledyne Advanced Pollution Instrumentation is:

E.3 with Library Version 6.3

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

26 Notification as regards Federal Environmental Agency notices of 25 July 2005 (BAnz. p. 15700, chapter IV No. 3.1) and of 12 April 2007 (BAnz. p. 4139, chapter IV, notification 7)

The measuring system Modell 400E for O₃ of the company Teledyne Advanced Pollution Instrumentation is manufactured in the old design Modell 400E as well as in the new design Model T400. 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 T400

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

6 Notification as regards Federal Environmental Agency notices of 25 July 2005 (BAnz. p. 15700, chapter IV No. 3.1) and of 10 January 2011 (BAnz. p. 294, chapter IV, 25th and 26th notification)

The measuring system M400E respectively T400 for O₃ of the company Teledyne Advanced Pollution Instrumentation fulfills the requirements of EN 14625 (issue July 2005). Furthermore the manufacturing and the quality management of the measuring system M400E respectively T400 for O₃ fulfill the requirements of EN 15267.

The test report on the type approval with the report no. 936/21207124/A1_DE as well as an addendum to the test report with the report no. 936/21219874/D are available on available on the internet at www.qal1.de.

The current software version of the measuring system M400E is:

E.5 with Library Version 6.4

The current software version of the measuring system T400 is:

1.0.4 with Library Version 7.0.3

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

18 Notification on announcements of the Federal Environmental Agency of 25 July 2005 (BAnz. p. 15700, chapter IV, no. 3.1) and of 12 February 2013 (BAnz. AT of 5 March 2013 B10, chapter V, 6th notification)

The M400E / T400 measuring system for O₃ manufactured by Teledyne Advanced Pollution Instrumentation fulfils the requirements of Standard EN 14625 (December 2012). An addendum as integral part of test report no. 936/21221556/D is available online at www.qal1.de.

The new designation of the M400E measuring system for O₃ is 400E.

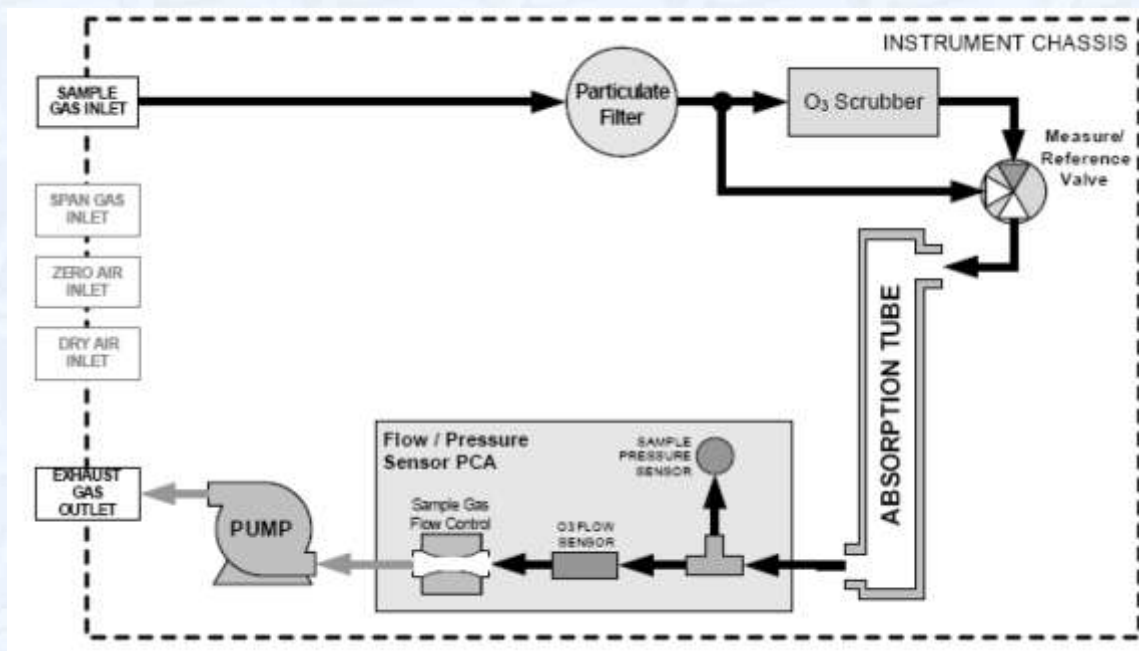
Statement of TÜV Rheinland Energie und Umwelt GmbH of 16 March 2013

Certified product

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

The measuring principle of the measuring system 400E respectively T400 is based on the determination of light absorption caused by the gas to be measured in the respective ranges of wave lengths characteristic for this gas, which is for ozone in the UV-range at a wave length of 253.7 nm and thus complies with the reference method described in the standard EN 14625.

The schematic set-up / flow diagram of the measuring system 400E respectively T400 (with optional zero- and 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 400E / T400 for O₃ is based on the documents listed below and the regular, continuous monitoring of the Quality Management System of the manufacturer:

Basic test:

Test report: 936/21201601/A dated 10 July 2005
TÜV Rheinland Immissionsschutz und Energiesysteme GmbH, Cologne

Publication: BAnz. 29 October 2005, No. 206, p. 15700, chapter IV, No. 3.1
Announcement by UBA from 25 July 2005

Notification:

Publication: BAnz. 20 April 2007, No. 75, p. 4139, chapter IV, notification 7
Announcement by UBA from 12 April 2007 (*name change*)

Publication: BAnz. 26 January 2011, No. 14, p. 294, chapter IV, notification 25 and notification 26
Announcement by UBA from 10 January 2011 (*software change + design*)

Publication: BAnz AT 05 March 2013 B10, chapter V, notification 6
Announcement by UBA from 12 February 2013 (*standard change*)

Initial certification according to EN 15267:

Certificate No. 0000038504: 22 March 2013

Expiration date of the certificate: 04 March 2018

Test report: 936/21207124/A1_DE dated 22 August 2007
TÜV Rheinland Immissionsschutz und Energiesysteme GmbH, Cologne

Addendum: 936/21219874/D 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 6
Announcement by UBA from 12 February 2013

Supplementary testing according to EN 15267:

Certificate No. 0000038504_01: 20 August 2013

Expiration date of the certificate: 04 March 2018

Test report: 936/21207124/A1_DE of 22 August 2007
TÜV Rheinland Immissionsschutz und Energiesysteme GmbH, Cologne

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

Publication: BAnz AT 23 July 2013 B4, chapter V, notification 18
Announcement by UBA from 03 July 2013

Calculation of overall uncertainty (device 1)

Measuring device:		Teledyne API M400E / T400		Serial number:		SN 309	
Measured component:		O3		1h-Alert threshold:		120 nmol/mol	
No.	Performance characteristic	Performance criterion	Result	Partial uncertainty		Square of partial uncertainty	
1	Repeatability standard deviation at zero	≤ 1.0 nmol/mol	0.500	U _{r,z}	0.13	0.0169	
2	Repeatability standard deviation at 1h-limit value	≤ 3.0 nmol/mol	1.100	U _{r,1h}	0.29	0.0830	
3	"lack of fit" at 1h-limit value	≤ 4.0% of meas. value	0.700	U _{l,1h}	0.48	0.2352	
4	Sensitivity coefficient of sample gas pressure at 1h-limit value	≤ 2.0 nmol/mol/kPa	0.380	U _{gp}	1.12	1.2519	
5	Sensitivity coefficient of sample gas temperature at 1h-limit value	≤ 1.0 nmol/mol/K	0.010	U _{gt}	0.11	0.0120	
6	Sensitivity coefficient of surrounding temperature at 1h-limit value	≤ 1.0 nmol/mol/K	0.060	U _{st}	0.22	0.0479	
7	Sensitivity coefficient of electrical voltage at 1h-limit value	≤ 0.30 nmol/mol/V	0.020	U _v	0.26	0.0652	
8a	Interferent H ₂ O with 21 mmol/mol	≤ 10 nmol/mol (Zero)	-0.800	U _{H2O}	-1.49	2.2271	
		≤ 10 nmol/mol (Span)	-2.000				
8b	Interferent Toluene with 0.5 µmol/mol	≤ 5.0 nmol/mol (Zero)	0.400	U _{int,pos}	1.85	3.4133	
		≤ 5.0 nmol/mol (Span)	1.500				
8c	Interferent Xylene with 0.5 µmol/mol	≤ 5.0 nmol/mol (Zero)	0.200	or	1.85	3.4133	
		≤ 5.0 nmol/mol (Span)	1.700				
9	Averaging effect	≤ 7.0% of meas. value	2.600	U _{av}	1.80	3.2448	
18	Difference sample/calibration port	≤ 1%	0.000	U _{ssc}	0.00	0.0000	
21	Uncertainty of test gas	≤ 3%	2.000	U _{cg}	1.20	1.4400	
Combined standard uncertainty				U _c		3.4695	nmol/mol
Expanded uncertainty				U		6.9390	nmol/mol
Relative expanded uncertainty				W		5.78	%
Maximum allowed expanded uncertainty				W _{req}		15	%

Measuring device:		Teledyne API M400E / T400		Serial number:		SN 309	
Measured component:		O3		1h-Alert threshold:		120 nmol/mol	
No.	Performance characteristic	Performance criterion	Result	Partial uncertainty		Square of partial uncertainty	
1	Repeatability standard deviation at zero	≤ 1.0 nmol/mol	0.500	U _{r,z}	0.13	0.0169	
2	Repeatability standard deviation at 1h-limit value	≤ 3.0 nmol/mol	1.100	U _{r,1h}	not considered, as u _{r,1h} = 0.28 < u _{r,f}	-	
3	"lack of fit" at 1h-limit value	≤ 4.0% of meas. value	0.700	U _{l,1h}	0.48	0.2352	
4	Sensitivity coefficient of sample gas pressure at 1h-limit value	≤ 2.0 nmol/mol/kPa	0.380	U _{gp}	1.12	1.2519	
5	Sensitivity coefficient of sample gas temperature at 1h-limit value	≤ 1.0 nmol/mol/K	0.010	U _{gt}	0.11	0.0120	
6	Sensitivity coefficient of surrounding temperature at 1h-limit value	≤ 1.0 nmol/mol/K	0.060	U _{st}	0.22	0.0479	
7	Sensitivity coefficient of electrical voltage at 1h-limit value	≤ 0.30 nmol/mol/V	0.020	U _v	0.26	0.0652	
8a	Interferent H ₂ O with 21 mmol/mol	≤ 10 nmol/mol (Zero)	-0.800	U _{H2O}	-1.49	2.2271	
		≤ 10 nmol/mol (Span)	-2.000				
8b	Interferent Toluene with 0.5 µmol/mol	≤ 5.0 nmol/mol (Zero)	0.400	U _{int,pos}	1.85	3.4133	
		≤ 5.0 nmol/mol (Span)	1.500				
8c	Interferent Xylene with 0.5 µmol/mol	≤ 5.0 nmol/mol (Zero)	0.200	or	1.85	3.4133	
		≤ 5.0 nmol/mol (Span)	1.700				
9	Averaging effect	≤ 7.0% of meas. value	2.600	U _{av}	1.80	3.2448	
10	Reproducibility standard deviation under field conditions	≤ 5.0% of 3 month average	2.690	U _{r,f}	3.23	10.4200	
11	Long term drift at zero level	≤ 5.0 nmol/mol	0.900	U _{d,l,z}	0.52	0.2700	
12	Long term drift at 1h-limit value	≤ 5.0% of max. of cert. range	3.700	U _{d,l,1h}	2.56	6.5712	
18	Difference sample/calibration port	≤ 1%	0.000	U _{ssc}	0.00	0.0000	
21	Uncertainty of test gas	≤ 3%	2.000	U _{cg}	1.20	1.4400	
Combined standard uncertainty				U _c		5.4051	nmol/mol
Expanded uncertainty				U		10.8103	nmol/mol
Relative expanded uncertainty				W		9.01	%
Maximum allowed expanded uncertainty				W _{req}		15	%

Calculation of overall uncertainty (device 2)

Measuring device:		Teledyne API M400E / T400		Serial number:		SN 308		
Measured component:		O3		1h-Alert threshold:		120 nmol/mol		
No.	Performance characteristic	Performance criterion	Result	Partial uncertainty		Square of partial uncertainty		
1	Repeatability standard deviation at zero	≤ 1.0 nmol/mol	0.700	$u_{r,z}$	0.19	0.0354		
2	Repeatability standard deviation at 1h-limit value	≤ 3.0 nmol/mol	1.100	$u_{r,lh}$	0.30	0.0910		
3	"lack of fit" at 1h-limit value	≤ 4.0% of meas. value	0.100	$u_{l,f}$	0.07	0.0048		
4	Sensitivity coefficient of sample gas pressure at 1h-limit value	≤ 2.0 nmol/mol/kPa	0.150	u_{sp}	0.44	0.1951		
5	Sensitivity coefficient of sample gas temperature at 1h-limit value	≤ 1.0 nmol/mol/K	0.030	u_{st}	0.33	0.1077		
6	Sensitivity coefficient of surrounding temperature at 1h-limit value	≤ 1.0 nmol/mol/K	0.040	u_{st}	0.15	0.0213		
7	Sensitivity coefficient of electrical voltage at 1h-limit value	≤ 0.30 nmol/mol/V	0.020	u_v	0.26	0.0652		
8a	Interferent H ₂ O with 21 mmol/mol	≤ 10 nmol/mol (Zero)	-0.900	u_{H_2O}	-1.34	1.8040		
		≤ 10 nmol/mol (Span)	-1.800					
8b	Interferent Toluene with 0,5 µmol/mol	≤ 5.0 nmol/mol (Zero)	0.100	$u_{int,pos}$	1.21	1.4700		
		≤ 5.0 nmol/mol (Span)	1.200					
8c	Interferent Xylene with 0,5 µmol/mol	≤ 5.0 nmol/mol (Zero)	-0.300	$u_{int,neg}$	1.21	1.4700		
		≤ 5.0 nmol/mol (Span)	0.900					
9	Averaging effect	≤ 7.0% of meas. value	3.500	u_{av}	2.42	5.8800		
18	Difference sample/calibration port	≤ 1%	0.000	u_{disc}	0.00	0.0000		
21	Uncertainty of test gas	≤ 3%	2.000	u_{cg}	1.20	1.4400		
				Combined standard uncertainty		u_c	3.3338	nmol/mol
				Expanded uncertainty		U	6.6676	nmol/mol
				Relative expanded uncertainty		W	5.56	%
				Maximum allowed expanded uncertainty		W_{req}	15	%

Measuring device:		Teledyne API M400E / T400		Serial number:		SN 308		
Measured component:		O3		1h-Alert threshold:		120 nmol/mol		
No.	Performance characteristic	Performance criterion	Result	Partial uncertainty		Square of partial uncertainty		
1	Repeatability standard deviation at zero	≤ 1.0 nmol/mol	0.700	$u_{r,z}$	0.19	0.0354		
2	Repeatability standard deviation at 1h-limit value	≤ 3.0 nmol/mol	1.100	$u_{r,lh}$	not considered, as $u_{r,lh} = 0.3 < u_{r,f}$	-		
3	"lack of fit" at 1h-limit value	≤ 4.0% of meas. value	0.100	$u_{l,f}$	0.07	0.0048		
4	Sensitivity coefficient of sample gas pressure at 1h-limit value	≤ 2.0 nmol/mol/kPa	0.150	u_{sp}	0.44	0.1951		
5	Sensitivity coefficient of sample gas temperature at 1h-limit value	≤ 1.0 nmol/mol/K	0.030	u_{st}	0.33	0.1077		
6	Sensitivity coefficient of surrounding temperature at 1h-limit value	≤ 1.0 nmol/mol/K	0.040	u_{st}	0.15	0.0213		
7	Sensitivity coefficient of electrical voltage at 1h-limit value	≤ 0.30 nmol/mol/V	0.020	u_v	0.26	0.0652		
8a	Interferent H ₂ O with 21 mmol/mol	≤ 10 nmol/mol (Zero)	-0.900	u_{H_2O}	-1.34	1.8040		
		≤ 10 nmol/mol (Span)	-1.800					
8b	Interferent Toluene with 0.5 µmol/mol	≤ 5.0 nmol/mol (Zero)	0.100	$u_{int,pos}$	1.21	1.4700		
		≤ 5.0 nmol/mol (Span)	1.200					
8c	Interferent Xylene with 0.5 µmol/mol	≤ 5.0 nmol/mol (Zero)	-0.300	$u_{int,neg}$	1.21	1.4700		
		≤ 5.0 nmol/mol (Span)	0.900					
9	Averaging effect	≤ 7.0% of meas. value	3.500	u_{av}	2.42	5.8800		
10	Reproducibility standard deviation under field conditions	≤ 5.0% of 3 month average	2.690	$u_{r,f}$	3.23	10.4200		
11	Long term drift at zero level	≤ 5.0 nmol/mol	-0.500	$u_{q,l,z}$	-0.29	0.0833		
12	Long term drift at 1h-limit value	≤ 5.0% of max. of cert. range	-3.700	$u_{q,l,lh}$	-2.56	6.5712		
18	Difference sample/calibration port	≤ 1%	0.000	u_{disc}	0.00	0.0000		
21	Uncertainty of test gas	≤ 3%	2.000	u_{cg}	1.20	1.4400		
				Combined standard uncertainty		u_c	5.3007	nmol/mol
				Expanded uncertainty		U	10.6015	nmol/mol
				Relative expanded uncertainty		W	8.83	%
				Maximum allowed expanded uncertainty		W_{req}	15	%