



CERTIFICATE

on Product Conformity (QAL1)

Certificate No.: 0000038504

Certified AMS:

M400E / 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 4203-3: 2004, EN 14625: 2005, EN 15267-1: 2009, EN 15267-2: 2009

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



- Complying with 2008/50/EC
- TUV approved
- Annual inspection

Publication in the German Federal Gazette (BAnz.) of 05 March 2013

The certificate will expire on: 04 March 2018

German Federal Environment Agency Dessau, 22 March 2013 TÜV Rheinland Energie und Umwelt GmbH Cologne, 21 March 2013

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Pit W.5

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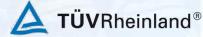
TÜV Rheinland Energie und Umwelt GmbH Am Grauen Stein 51105 Cologne

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

gal1.de

info@qal1.de

page 1 of 8



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936/21207124/A1_DE of 22 August 2007

Addendum 936/21219874/D of 11 October 2012

Initial certification: 05 March 2013

Date of expiry: 04 March 2018

Publication: BAnz AT 05 March 2013 B10, chapter V, notification 6

Approved application

Test report:

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.

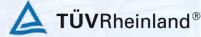
Any potential user should ensure, in consultation with the manufacturer, that this AMS is suitable for ambient air applications at which it will be installed.

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 and addendum 936/21219874/D of 11 October 2012 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





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AMS designation:

Modell 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:

 O_3 : 0

0 - 360 µg/m³

0 - 500 µg/m³

Software:

Version C.3

Restrictions:

In case of SO_2 -concentrations greater than 150 $\mu g/m^3$, the requirements on the cross-sensitivity are not completely fulfilled anymore .

Test institute:

TÜV Rheinland Immissionsschutz und Energiesysteme GmbH, Cologne,

TÜV Rheinland Group

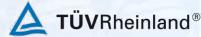
Report No.: 936/21201601/A dated 10 July 2005

7 Notification as regards Federal Environmental Agency notices of 25 July 2005 (BAnz. p. 15700, chapter IV No. 2.1)

The measuring systems Modell 300E for CO and Modell 400E for ozone of the of the company Teledyne Instruments, San Diego, USA will not by 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 2007





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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 O_3 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

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 O_3 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 O_3 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.gal1.de.

The current software version of the measuring system M400E is:

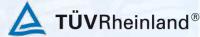
E.5 with Library Version 6.4

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





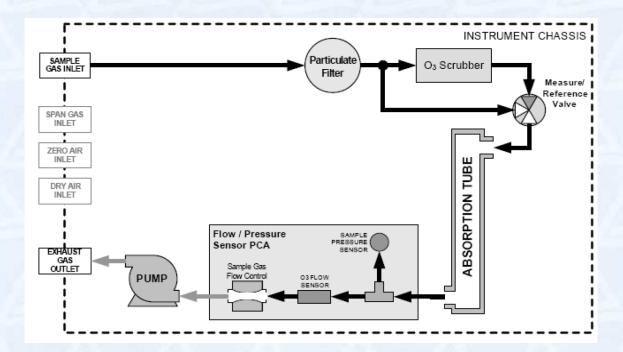
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Certified product

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

The measuring principle of the measuring system M400E 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 M400E respectively T400 (with optional zero- and span gas port) is as follows:



General notes

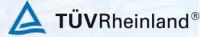
This certificate is based upon the equipment tested. The manufacturer is responsible for ensuring that on-going production complies with the requirements of the EN 15267. The manufacturer is required to maintain an approved quality management system controlling the manufacture of the certified product. 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.



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Certification of M400E / 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

Publication: BAnz. 26 January 2011, No. 14, p. 294, chapter IV, notification 25 and notification 26

Announcement by UBA from 10 January 2011

Publication: BAnz AT 05 March 2013 B10, chapter V, notification 6

Announcement by UBA from 12 February 2013

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

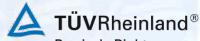
TÜV Rheinland Immissionsschutz und Energiesysteme GmbH, Cologne

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



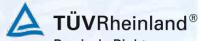
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Expanded measurement uncertainty based on the results of the laboratory test for device 1

Measuring device:	Teledyne API M400E					Serial number:	SN 309	
Measured component:	О3				1h	-Alert threshold	: 120	nmol/mol
No.	Performance characteristic	Pe	erformance criterion	Result	Partial u	ncertainty	Square of partial uncertainty	
1	Repeatability standard deviation at zero	٧I	1.0 nmol/mol	0.500	$u_{r,Z}$	0.07	0.0042	
2	Repeatability standard deviation at 1h-limit value	VI	3.0 nmol/mol	1.100	U _{r,lv}	0.14	0.0207	
3	"lack of fit" at 1h-limit value	VI	4.0% of meas. value	0.700	U _{I,Iv}	0.48	0.2352	
4	Sensitivity coefficient of sample gas pressure at 1h-limit value	VI	2.0 nmol/mol/kPa	0.380	u _{gp}	1.12	1.2519	
5	Sensitivity coefficient of sample gas temperature at 1h-limit value	VI	1.0 nmol/mol/K	0.010	u _{gt}	0.11	0.0120	
6	Sensitivity coefficient of surrounding temperature at 1h-limit value	VI	1.0 nmol/mol/K	0.060	u _{st}	0.22	0.0479	
7	Sensitivity coefficient of electrical voltage at 1h-limit value	Y	0.30 nmol/mol/V	0.020	u_V	0.26	0.0652	
8a	Interferent H ₂ 0 with 21 mmol/mol	×	10 nmol/mol	-2.250	U _{H2O}	1.52	2.3074	
8b	Interferent Toluene with 0.5 µmol/mol	×	5.0 nmol/mol	1.500	U _{int,pos}	1.05	2 4422	- 22
8c	Interferent Xylene with 0.5 µmol/mol	×	5.0 nmol/mol	1.700	or u _{int, neg}	1.85	3.4133	
9	Averaging effect	×	7.0% of meas. value	2.600	u _{av}	1.80	3.2448	
18	Difference sample/calibration port	VI	1%	0.000	U _{Dsc}	0.00	0.0000	
23	Uncertainty of test gas	≤	3%	2.000	ucg	1.20	1.4400	
			Combi	ined standa	rd uncertainty	uc	3.4703	nmol/mol
	Expanded und				ed uncertainty	U _c	6.9405	nmol/mol
			Relative expanded uncertainty			$U_{c,rel}$	5.78	%
			Maximum allow	ed expande	ed uncertainty	U _{req,rel.}	15	%

Expanded measurement uncertainty based on the results of the laboratory and field test for device 1

Measuring device:	Teledyne API M400E			-		Serial number:	SN 309	
Measured component:	О3					1h-Alert threshold:	120	nmol/mo
No.	Performance characteristic	Performance criterion Re			Partia	I uncertainty	Square of partial uncertainty	/
1	Repeatability standard deviation at zero	≤	1.0 nmol/mol	0.500	$u_{r,Z}$	0.07	0.0042	
2	Repeatability standard deviation at 1h-limit value	≤	3.0 nmol/mol	1.100	u _{r,lv}	not considered, as ur,lv = 0,14 < ur,f		
3	"lack of fit" at 1h-limit value	≤	4.0% of meas, value	0.700	u _{Llv}	0.48	0.2352	+
4	Sensitivity coefficient of sample gas pressure at 1h-limit value	۷	2.0 nmol/mol/kPa	0.380	u _{ap}	1.12	1,2519	+
5	Sensitivity coefficient of sample gas temperature at 1h-limit value	≤	1.0 nmol/mol/K	0.010	u _{at}	0.11	0.0120	1
6	Sensitivity coefficient of surrounding temperature at 1h-limit value	≤	1.0 nmol/mol/K	0.060	u _{st}	0.22	0.0479	1
7	Sensitivity coefficient of electrical voltage at 1h-limit value	≤	0.30 nmol/mol/V	0.020	U _V	0.26	0.0652	1
8a	Interferent H ₂ 0 with 21 mmol/mol	≤	10 nmol/mol	-2.250	U _{H2O}	1.52	2.3074	
8b	Interferent Toluene with 0.5 µmol/mol	≤	5.0 nmol/mol	1.500	U _{int.pos}			
8c	Interferent Xylene with 0.5 µmol/mol	≤	5.0 nmol/mol	1.700	or u _{int. nea}	1.85	3.4133	
9	Averaging effect	≤	7.0% of meas. value	2.600	Uav	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,lv}	2.56	6.5712	
18	Difference sample/calibration port	≤	1%	0.000	U _{Dsc}	0.00	0.0000	
23	Uncertainty of test gas	≤	3%	2.000	ucg	1.20	1.4400	
			Combined standard uncertainty			u _c	5.4114	nmol/mo
		Expanded uncertainty Relative expanded uncertainty			U _c	10.8228	nmol/mo	
					U _{c,rel}	9.02	%	
			Maximum allow	ed expande	ed uncertainty	U _{req,rel.}	15	%



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Expanded measurement uncertainty based on the results of the laboratory test for device 2

Measuring device:	Teledyne API M400E				,	Serial numbe	r SN 308	
Measured component:	O3				1h-Al	ert threshold	: 120	nmol/mol
No.	Performance characteristic	Pe	erformance criterion	Result	Partial ur	ncertainty	Square of partial uncertainty	
1	Repeatability standard deviation at zero	≤	1.0 nmol/mol	0.700	$u_{r,Z}$	0.09	0.0088	
2	Repeatability standard deviation at 1h-limit value	≤	3.0 nmol/mol	1.100	u _{r,lv}	0.15	0.0227	
3	"lack of fit" at 1h-limit value	≤	4.0% of meas. value	0.100	U _{I,Iv}	0.07	0.0048	
4	Sensitivity coefficient of sample gas pressure at 1h-limit value	≤	2.0 nmol/mol/kPa	0.150	u _{gp}	0.44	0.1951	
5	Sensitivity coefficient of sample gas temperature at 1h-limit value	≤	1.0 nmol/mol/K	0.030	u _{gt}	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	UV	0.26	0.0652	
8a	Interferent H ₂ 0 with 21 mmol/mol	≤	10 nmol/mol	-2.025	u _{H2O}	1.37	1.8690	0.00
8b	Interferent Toluene with 0.5 µmol/mol	≤	5.0 nmol/mol	1.200	U _{int,pos}	4.04	4.4700	
8c	Interferent Xylene with 0.5 µmol/mol	≤	5.0 nmol/mol	0.900	or u _{int, neg}	1.21	1.4700	
9	Averaging effect	≤	7.0% of meas. value	3.500	u _{av}	2.42	5.8800	10.1
18	Difference sample/calibration port	≤	1%	0.000	U _{Dsc}	0.00	0.0000	
23	Uncertainty of test gas	≤	3%	2.000	0	1.20	1.4400	
			Combined standard uncertainty			Uc	3.3294	nmol/mol
				Expande	d uncertainty	U _c	6.6587	nmol/mol
			Relativ	ve expande	d uncertainty	U _{c,rel}	5.55	%
			Maximum allowe	ed expande	d uncertainty	U _{req,rel.}	15	%

Expanded measurement uncertainty based on the results of the laboratory and field test for device 2

Measuring device:	Teledyne API M400E					Serial number:	SN 308	
Measured component:	О3					1h-Alert threshold:	120	nmol/mol
No.	Performance characteristic		Performance criterion	Result	Partia	al uncertainty	Square of partial uncertainty	
1	Repeatability standard deviation at zero	ч	1.0 nmol/mol	0.700	u _{r,Z}	0.09	0.0088	
2	Repeatability standard deviation at 1h-limit value	≤	3.0 nmol/mol	1.100	U _{r,lv}	not considered, as ur,lv = 0,15 < ur,f		
3	"lack of fit" at 1h-limit value	≤	4.0% of meas. value	0.100	U _{I,IV}	0.07	0.0048	
4	Sensitivity coefficient of sample gas pressure at 1h-limit value	≤	2.0 nmol/mol/kPa	0.150	U _{qp}	0.44	0.1951	
5	Sensitivity coefficient of sample gas temperature at 1h-limit value	≤	1.0 nmol/mol/K	0.030	u _{gt}	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	UV	0.26	0.0652	
8a	Interferent H ₂ 0 with 21 mmol/mol	≤	10 nmol/mol	-2.025	U _{H2O}	1.37	1.8690	
8b	Interferent Toluene with 0.5 µmol/mol	≤	5.0 nmol/mol	1.200	U _{int,pos}	4.04	1.4700	
8c	Interferent Xylene with 0.5 µmol/mol	≤	5.0 nmol/mol	0.900	or uint, neg	1.21	1.4700	
9	Averaging effect	≤	7.0% of meas. value	3.500	Uav	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 _{d,I,z}	-0.29	0.0833	
12	Long term drift at 1h-limit value	≤	5.0% of max. of cert. range	-3.700	U _{d,I,Iv}	-2.56	6.5712	
18	Difference sample/calibration port	≤	1%	0.000	U _{Dsc}	0.00	0.0000	
23	Uncertainty of test gas	≤	3%	2.000	0	1.20	1.4400	
			Combine	ed standar	d uncertainty	uc	5.3044	nmol/mo
		Expanded uncertainty			U _c	10.6087	nmol/mo	
		Relative expanded uncertainty				U _{c,rel}	8.84	%
			Maximum allowe	d expande	d uncertainty	U _{req,rel.}	15	%