

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).



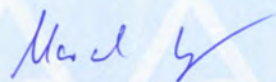
- Complying with 2008/50/EC
- TUV approved
- Annual inspection

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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Am Grauen Stein
51105 Cologne

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

Confirmation:

Fehler! Verweisquelle konnte nicht gefunden werden. / Fehler! Verweisquelle konnte nicht gefunden werden. / **Proprietary Right.**

| | |
|-------------------------------|--|
| Test report: | 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

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

Confirmation:

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gefunden werden.

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

Confirmation:

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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: | | 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 | $u_{r,z}$ | 0.07 | 0.0042 | |
| 2 | Repeatability standard deviation at 1h-limit value | ≤ 3.0 nmol/mol | 1.100 | $u_{r,lv}$ | 0.14 | 0.0207 | |
| 3 | "lack of fit" at 1h-limit value | ≤ 4.0% of meas. value | 0.700 | $u_{l,v}$ | 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 | -2.250 | u_{H_2O} | 1.52 | 2.3074 | |
| 8b | Interferent Toluene with 0.5 μmol/mol | ≤ 5.0 nmol/mol | 1.500 | $u_{int,pos}$ | 1.85 | 3.4133 | |
| 8c | Interferent Xylene with 0.5 μmol/mol | ≤ 5.0 nmol/mol | 1.700 | OR $u_{int,neg}$ | | | |
| 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_{psc} | 0.00 | 0.0000 | |
| 23 | Uncertainty of test gas | ≤ 3% | 2.000 | u_{cg} | 1.20 | 1.4400 | |
| Combined standard uncertainty | | | | u_c | | 3.4703 | nmol/mol |
| Expanded uncertainty | | | | U_c | | 6.9405 | nmol/mol |
| Relative expanded uncertainty | | | | $U_{c,rel}$ | | 5.78 | % |
| Maximum allowed expanded 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: | | 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 | $u_{r,z}$ | 0.07 | 0.0042 | |
| 2 | Repeatability standard deviation at 1h-limit value | ≤ 3.0 nmol/mol | 1.100 | $u_{r,lv}$ | not considered, as $u_{r,lv} = 0,14 < u_{r,f}$ | - | |
| 3 | "lack of fit" at 1h-limit value | ≤ 4.0% of meas. value | 0.700 | $u_{l,v}$ | 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 | -2.250 | u_{H_2O} | 1.52 | 2.3074 | |
| 8b | Interferent Toluene with 0.5 μmol/mol | ≤ 5.0 nmol/mol | 1.500 | $u_{int,pos}$ | 1.85 | 3.4133 | |
| 8c | Interferent Xylene with 0.5 μmol/mol | ≤ 5.0 nmol/mol | 1.700 | OR $u_{int,neg}$ | | | |
| 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 | $u_{q,l,z}$ | 0.52 | 0.2700 | |
| 12 | Long term drift at 1h-limit value | ≤ 5.0% of max. of cert. range | 3.700 | $u_{q,l,lv}$ | 2.56 | 6.5712 | |
| 18 | Difference sample/calibration port | ≤ 1% | 0.000 | u_{psc} | 0.00 | 0.0000 | |
| 23 | Uncertainty of test gas | ≤ 3% | 2.000 | u_{cg} | 1.20 | 1.4400 | |
| Combined standard uncertainty | | | | u_c | | 5.4114 | nmol/mol |
| Expanded uncertainty | | | | U_c | | 10.8228 | nmol/mol |
| Relative expanded uncertainty | | | | $U_{c,rel}$ | | 9.02 | % |
| Maximum allowed expanded uncertainty | | | | $U_{req,rel}$ | | 15 | % |

Confirmation:

Fehler! Verweisquelle konnte nicht gefunden werden. / Fehler! Verweisquelle konnte nicht gefunden werden. Precisely Right.

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

| Measuring device: | | Teledyne API M400E | | 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} | 0.09 | 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 _{l,lv} | 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 | u _v | 0.26 | 0.0652 | |
| 8a | Interferent H ₂ O 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} | 1.21 | 1.4700 | |
| 8c | Interferent Xylene with 0.5 µmol/mol | ≤ 5.0 nmol/mol | 0.900 | or u _{int,neg} | | | |
| 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 _{psc} | 0.00 | 0.0000 | |
| 23 | Uncertainty of test gas | ≤ 3% | 2.000 | 0 | 1.20 | 1.4400 | |
| Combined standard uncertainty | | | | u _c | | 3.3294 | nmol/mol |
| Expanded uncertainty | | | | U _c | | 6.6587 | nmol/mol |
| Relative expanded uncertainty | | | | U _{c,rel} | | 5.55 | % |
| Maximum allowed expanded 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: | | 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} | 0.09 | 0.0088 | |
| 2 | Repeatability standard deviation at 1h-limit value | ≤ 3.0 nmol/mol | 1.100 | u _{r,lv} | not considered, as u _{r,lv} = 0,15 < u _{r,f} | - | |
| 3 | "lack of fit" at 1h-limit value | ≤ 4.0% of meas. value | 0.100 | u _{l,lv} | 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 | u _v | 0.26 | 0.0652 | |
| 8a | Interferent H ₂ O 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} | 1.21 | 1.4700 | |
| 8c | Interferent Xylene with 0.5 µmol/mol | ≤ 5.0 nmol/mol | 0.900 | or u _{int,neg} | | | |
| 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 _{d,l,z} | -0.29 | 0.0833 | |
| 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 _{psc} | 0.00 | 0.0000 | |
| 23 | Uncertainty of test gas | ≤ 3% | 2.000 | 0 | 1.20 | 1.4400 | |
| Combined standard uncertainty | | | | u _c | | 5.3044 | nmol/mol |
| Expanded uncertainty | | | | U _c | | 10.6087 | nmol/mol |
| Relative expanded uncertainty | | | | U _{c,rel} | | 8.84 | % |
| Maximum allowed expanded uncertainty | | | | U _{req,rel} | | 15 | % |