CERTIFICATE

of Product Conformity (QAL1)

Certificate No.: 0000081164_00

Certified AMS:	N400 for Ozone
Manufacturer:	Teledyne API 9970 Carroll Canyon Road San Diego, CA, 92131 USA
Test Institute:	TÜV Rheinland Energy & Environment GmbH

This is to certify that the AMS has been tested and found to comply with the standards VDI 4202-1 (2018), EN 14625 (2012), as well as EN 15267-1 (2009) and EN 15267-2 (2023).

Certification is awarded in respect of the conditions stated in this certificate (this certificate contains 7 pages).

TÜVRheinland® CERTIFIED

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

www.tuv.com
ID 0000081164

Publication in the German Federal Gazette (BAnz) of 10 May 2024

German Environment Agency

Dessau, 12 June 2024

This certificate will expire on:
9 May 2029

TÜV Rheinland Energy & Environment GmbH
Cologne, 11 June 2024

Dr. Marcel Langner
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Test institute accredited to EN ISO/IEC 17025 by DAkkS (German Accreditation Body).
This accreditation is limited to the accreditation scope defined in the enclosure to the certificate D-PL-11120-02-00.

Test report:	EuL/21255654/D dated 28 August 2023
Initial certification	10 May 2024
Expiry date:	9 May 2029
Publication:	BAnz AT 10.05.2024 B7, chapter III No. 2.1

Approved application

The tested AMS is suitable for continuous immission measurement of O_3 in stationary use.

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 an ambient temperature range of 0 °C to 45 °C.

The notification of suitability of the AMS, performance testing and the uncertainty calculation have been effected on the basis of the regulations applicable at the time of testing. As changes in legal provisions are possible, any potential user should ensure that this AMS is suitable for monitoring the measured values relevant to the application.

Any potential user should ensure, in consultation with the manufacturer, that this AMS is suitable for the intended use.

Basis of the certification

This certification is based on:

- Test report EuL/21255654/D dated 28 August 2023 of TÜV Rheinland Energy 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 10.05.2024 B7, chapter III No. 2.1, Announcement by UBA dated 19 March 2024:

AMS designation:
N400 for Ozone

Manufacturer:
Teledyne API, San Diego, USA

Field of application:
For the continuous determination of ozone concentrations in ambient air in stationary use

Measuring ranges during the performance test:

Component	Certification range	Unit
Ozone	0 - 500	µg/m³

Software version:
Rev. 1.11.1

Restrictions:
none

Notes:
1. The report on the performance test is available at www.qal1.de.
2. The measuring system is approved for an ambient temperature range of 0 - 45 °C.
3. The N400 measuring system can be equipped with a standard Teflon particle filter with a pore size of 5 µm and a diameter of 47 mm as well as with a DFU filter cartridge with a pore size of 0.01 µm.

Test institute: TÜV Rheinland Energy GmbH, Cologne
Report No.: EuL/21255654/D dated 28 August 2023

Certified product

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

The immission measuring device N400 is a continuous ozone analyzer. The measuring principle is based on ultraviolet absorption. The device is designed for continuous measurement of ozone in ambient air.

The N400 ozone analyzer determines the concentration of ozone (O_3) in an air sample drawn into the measuring device. The N400 measures the intensity of ultraviolet light after it passes through a measuring chamber. In this chamber, the light is absorbed in proportion to the amount of ozone present. Every four seconds, a shuttle valve switches between a gas flow containing ozone and a reference gas flow that has been purified of ozone.

The photometer in the N400 analyzer uses a high-power mercury vapor lamp to generate a beam of UV light. This beam passes through a window that is non-reactive with O_3 and transmissive to UV radiation at 254 nm, and then enters the absorption tube filled with sample gas.

The UV light passes through a similar window at the other end of the absorption tube and is detected by a vacuum diode. This diode only detects radiation at or near a wavelength of 254 nm. The accuracy of the detector is high enough that no additional optical filter for UV light is needed. The detector responds to the UV light and outputs a voltage that is in direct proportion to the light intensity.

Alternative assemblies:

Particle filter
The N400 measuring device has a standard Teflon particle filter with a pore size of 5 µm directly behind the sample gas inlet. The particle filter is located on a flap secured with two screws on the rear of the measuring device. As an alternative to the Teflon filter, the N400 measuring device can be fitted with a DFU-filter cartridge with a pore size of 0.01 µm (a so-called long-life filter). The manufacturer specifies a replacement interval of up to 6 months for this filter. The replacement interval of the particle filter naturally depends on the dust load at the installation site and must be determined individually for each measuring point

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 & Environment 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 certification mark may be applied to the product or used in advertising materials for the certified product.

This document as well as the certification mark remains property of TÜV Rheinland Energy & Environment 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 & Environment GmbH this document shall be returned and the certificate mark must not be employed anymore.

The relevant version of this certificate and its expiration is also accessible on the internet: **qal1.de**.

History of documents

Certification of N400 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. 0000081164_00: 12 June 2024
Expiry date of the certificate: 9 May 2029
Test report: EuL/21255654/D dated 28 August 2023
TÜV Rheinland Energy GmbH
Publication: BAnz AT 10.05.2024 B7, chapter III number 2.1
UBA announcement dated 19 March 2024

Expanded uncertainty laboratory, system 1

Measuring device:	N400			Serial-No.:	55
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	0.860	$u_{r,z}$	0.16	0.0251
2	Repeatability standard deviation at 1h-alert threshold	≤ 3.0 nmol/mol	1.630	$u_{r,lh}$	0.30	0.0900
3	"lack of fit" at 1h-alert threshold	≤ 4.0% of measured value	2.330	$u_{l,lh}$	1.61	2.6059
4	Sensitivity coefficient of sample gas pressure at 1h-alert threshold	≤ 2.0 nmol/mol/kPa	0.290	u_{gp}	3.22	10.3895
5	Sensitivity coefficient of sample gas temperature at 1h-alert threshold	≤ 1.0 nmol/mol/K	0.040	u_{gt}	0.44	0.1977
6	Sensitivity coefficient of surrounding temperature at 1h-alert threshold	≤ 1.0 nmol/mol/K	0.167	u_{st}	2.77	7.6698
7	Sensitivity coefficient of electrical voltage at 1h-alert threshold	≤ 0.30 nmol/mol/V	0.010	u_v	0.13	0.0172
8a	Interferent H_20 with 19 mmol/mol	≤ 10 nmol/mol (Zero)	-0.470	u_{H2O}	-0.74	0.5457
		≤ 10 nmol/mol (Span)	-0.990			
8b	Interferent Toluene with 0,5 µmol/mol	≤ 5.0 nmol/mol (Zero)	3.070	$u_{int,pos}$	2.79	7.8085
		≤ 5.0 nmol/mol (Span)	2.810			
8c	Interferent Xylene with 0,5 µmol/mol	≤ 5.0 nmol/mol (Zero)	3.130	or		
		≤ 5.0 nmol/mol (Span)	2.030	$u_{int,neg}$		
9	Averaging effect	≤ 7.0% of measured value	-2.000	u_{av}	-1.39	1.9200
18	Difference sample/calibration port	≤ 1.0%	0.170	$u_{\Delta sc}$	0.20	0.0416
21	Uncertainty of test gas	≤ 3.0%	2.000	u_{cg}	1.20	1.4400

Combined standard uncertainty	u_c	5.7228	nmol/mol
Expanded uncertainty	U	11.4457	nmol/mol
Relative expanded uncertainty	W	9.54	%
Maximum allowed expanded uncertainty	W_{req}	15	%

Expanded uncertainty laboratory, system 2

Measuring device:	N400			Serial-No.:	56
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	0.570	$u_{r,z}$	0.11	0.0123
2	Repeatability standard deviation at 1h-alert threshold	≤ 3.0 nmol/mol	1.480	$u_{r,lv}$	0.29	0.0827
3	"lack of fit" at 1h-alert threshold	≤ 4.0% of measured value	1.980	$u_{l,lv}$	1.37	1.8818
4	Sensitivity coefficient of sample gas pressure at 1h-alert threshold	≤ 2.0 nmol/mol/kPa	0.260	u_{gp}	2.89	8.3512
5	Sensitivity coefficient of sample gas temperature at 1h-alert threshold	≤ 1.0 nmol/mol/K	0.040	u_{gt}	0.44	0.1977
6	Sensitivity coefficient of surrounding temperature at 1h-alert threshold	≤ 1.0 nmol/mol/K	0.161	u_{st}	2.67	7.1286
7	Sensitivity coefficient of electrical voltage at 1h-alert threshold	≤ 0.30 nmol/mol/V	0.020	u_v	0.26	0.0687
8a	Interferent H_20 with 19 mmol/mol	≤ 10 nmol/mol (Zero)	0.310	u_{H2O}	-0.51	0.2575
		≤ 10 nmol/mol (Span)	-0.680			
8b	Interferent Toluene with 0,5 µmol/mol	≤ 5.0 nmol/mol (Zero)	2.290	$u_{int,pos}$	2.77	7.6480
		≤ 5.0 nmol/mol (Span)	2.600			
8c	Interferent Xylene with 0,5 µmol/mol	≤ 5.0 nmol/mol (Zero)	1.610	or		
		≤ 5.0 nmol/mol (Span)	2.190	$u_{int,neg}$		
9	Averaging effect	≤ 7.0% of measured value	-0.700	u_{av}	-0.48	0.2352
18	Difference sample/calibration port	≤ 1.0%	-0.470	u_{Dsc}	-0.56	0.3181
21	Uncertainty of test gas	≤ 3.0%	2.000	ucg	1.20	1.4400

Combined standard uncertainty	u_c	5.2556	nmol/mol
Expanded uncertainty	U	10.5113	nmol/mol
Relative expanded uncertainty	W	8.76	%
Maximum allowed expanded uncertainty	W_{req}	15	%

Umwelt Bundesamt

Certificate:
0000081164_00 / 12 June 2024

TÜVRheinland®
Precisely Right.

Combined uncertainty, laboratory and field, system 1

Measuring device:	N400			Serial-No.:	55	
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	0.860	$u_{r,z}$	0.16	0.0251
2	Repeatability standard deviation at 1h-alert threshold	≤ 3.0 nmol/mol	1.630	$u_{r,lh}$	not considered, as ur,lh = 0.3 < ur,f	-
3	"lack of fit" at 1h-alert threshold	≤ 4.0% of measured value	2.330	$u_{l,lh}$	1.61	2.6059
4	Sensitivity coefficient of sample gas pressure at 1h-alert threshold	≤ 2.0 nmol/mol/kPa	0.290	u_{gp}	3.22	10.3895
5	Sensitivity coefficient of sample gas temperature at 1h-alert threshold	≤ 1.0 nmol/mol/K	0.040	u_{gt}	0.44	0.1977
6	Sensitivity coefficient of surrounding temperature at 1h-alert threshold	≤ 1.0 nmol/mol/K	0.167	u_{st}	2.77	7.6698
7	Sensitivity coefficient of electrical voltage at 1h-alert threshold	≤ 0.30 nmol/mol/V	0.010	u_{v}	0.13	0.0172
8a	Interferent H_20 with 19 mmol/mol	≤ 10 nmol/mol (Zero)	-0.470	u_{h2O}	-0.74	0.5457
		≤ 10 nmol/mol (Span)	-0.990			
8b	Interferent Toluene with 0,5 µmol/mol	≤ 5.0 nmol/mol (Zero)	3.070	$u_{int,pos}$ or $u_{int,neg}$	2.79	7.8085
		≤ 5.0 nmol/mol (Span)	2.810			
8c	Interferent Xylene with 0,5 µmol/mol	≤ 5.0 nmol/mol (Zero)	3.130			
		≤ 5.0 nmol/mol (Span)	2.030			
9	Averaging effect	≤ 7.0% of measured value	-2.000	u_{av}	-1.39	1.9200
10	Reproducibility standard deviation under field conditions	≤ 5.0% of average over 3 months	2.200	$u_{r,f}$	2.64	6.9696
11	Long term drift at zero level	≤ 5.0 nmol/mol	-1.770	$u_{d,l,z}$	-1.02	1.0443
12	Long term drift at span level	≤ 5.0% of max. of certification range	-2.530	$u_{d,l,lh}$	-1.75	3.0724
18	Difference sample/calibration port	≤ 1.0%	0.170	$u_{\Delta sc}$	0.20	0.0416
21	Uncertainty of test gas	≤ 3.0%	2.000	u_{cg}	1.20	1.4400

Combined standard uncertainty	u_c	6.6142	nmol/mol
Expanded uncertainty	U	13.2283	nmol/mol
Relative expanded uncertainty	W	11.02	%
Maximum allowed expanded uncertainty	W_{req}	15	%

Combined uncertainty, laboratory and field, system 2

Measuring device:	N400			Serial-No.:	56	
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	0.570	$u_{r,z}$	0.11	0.0123
2	Repeatability standard deviation at 1h-alert threshold	≤ 3.0 nmol/mol	1.480	$u_{r,lh}$	not considered, as ur,lh = 0.28 < ur,f	-
3	"lack of fit" at 1h-alert threshold	≤ 4.0% of measured value	1.980	$u_{l,lh}$	1.37	1.8818
4	Sensitivity coefficient of sample gas pressure at 1h-alert threshold	≤ 2.0 nmol/mol/kPa	0.260	u_{gp}	2.89	8.3512
5	Sensitivity coefficient of sample gas temperature at 1h-alert threshold	≤ 1.0 nmol/mol/K	0.040	u_{gt}	0.44	0.1977
6	Sensitivity coefficient of surrounding temperature at 1h-alert threshold	≤ 1.0 nmol/mol/K	0.161	u_{st}	2.67	7.1286
7	Sensitivity coefficient of electrical voltage at 1h-alert threshold	≤ 0.30 nmol/mol/V	0.020	u_{v}	0.26	0.0687
8a	Interferent H_20 with 19 mmol/mol	≤ 10 nmol/mol (Zero)	0.310	u_{h2O}	-0.51	0.2575
		≤ 10 nmol/mol (Span)	-0.680			
8b	Interferent Toluene with 0,5 µmol/mol	≤ 5.0 nmol/mol (Zero)	2.290	$u_{int,pos}$ or $u_{int,neg}$	2.77	7.6480
		≤ 5.0 nmol/mol (Span)	2.600			
8c	Interferent Xylene with 0,5 µmol/mol	≤ 5.0 nmol/mol (Zero)	1.610			
		≤ 5.0 nmol/mol (Span)	2.190			
9	Averaging effect	≤ 7.0% of measured value	-0.700	u_{av}	-0.48	0.2352
10	Reproducibility standard deviation under field conditions	≤ 5.0% of average over 3 months	2.200	$u_{r,f}$	2.64	6.9696
11	Long term drift at zero level	≤ 5.0 nmol/mol	-1.610	$u_{d,l,z}$	-0.93	0.8640
12	Long term drift at span level	≤ 5.0% of max. of certification range	-1.290	$u_{d,l,lh}$	-0.89	0.7988
18	Difference sample/calibration port	≤ 1.0%	-0.470	$u_{\Delta sc}$	-0.56	0.3181
21	Uncertainty of test gas	≤ 3.0%	2.000	u_{cg}	1.20	1.4400

Combined standard uncertainty	u_c	6.0143	nmol/mol
Expanded uncertainty	U	12.0285	nmol/mol
Relative expanded uncertainty	W	10.02	%
Maximum allowed expanded uncertainty	W_{req}	15	%