

CERTIFICATE

of Product Conformity (QAL1)

Certificate No.: 0000074637_00

Certified AMS: N500 for NO, NO₂ and NO_x

Manufacturer: Teledyne API
9970 Carroll Canyon Road
San Diego, CA, 92131
USA

Test Institute: TÜV Rheinland Energy GmbH

This is to certify that the AMS has been tested
and found to comply with the standards
VDI 4202-1 (2018), EN 14211 (2012),
Guide for Demonstration of Equivalence of Ambient Air Monitoring Methods (2010),
EN 15267-1 (2009) and EN 15267-2 (2009).

Certification is awarded in respect of the conditions stated in this certificate
(this certificate contains 13 pages).



Suitability Tested
Complying with
2008/50/EC
EN 15267
Regular
Surveillance
www.tuv.com
ID 0000074637

Publication in the German Federal Gazette
(BAnz) of 11 April 2022

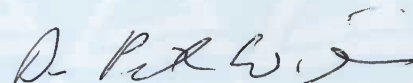
German Environment Agency
Dessau, 31 May 2022

This certificate will expire on:
11 April 2027

TÜV Rheinland Energy GmbH
Cologne, 30 May 2022



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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: 936/21251100/A dated 30 July 2021

Expiry date: 11 April 2027

Publication: BAnz AT 11.04.2022 B10, Chapter V No. 1.2

Approved application

The tested AMS is suitable for continuous ambient air monitoring of NO, NO₂ and NO_x (stationary operation).

The suitability of the AMS for these applications was assessed based on a laboratory test and a 3-month field test.

The AMS is approved for an ambient temperature range of 0° to 30°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 936/21251100/A dated 30 July 2021 of TÜV Rheinland Energy GmbH
- Suitability announced by the German 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 11.04.2022 B10, Chap. V No. 1.2,
Announcement by UBA dated 09 March 2022:

AMS designation

N500 for NO, NO₂ and NO_x

Manufacturer:

Teledyne API, San Diego, USA

Field of application:

For the continuous measurement of nitrogen oxide concentrations in ambient air (stationary operation).

Measuring ranges during the performance test:

Component	Certification range	Unit
Stickstoffmonoxid	0 - 1,200	µg/m ³
Stickstoffdioxid	0 - 500	µg/m ³

Software version: Rev. 1.6.0

Restriction:

None

Notes:

1. The test report on the suitability test is available on the Internet at www.qal1.de.
2. The equivalence to the reference method according to the requirements of the guideline "Demonstration of Equivalence of Ambient Air Monitoring Methods" was demonstrated for the components NO and NO₂.

Test institute: TÜV Rheinland Energy GmbH, Cologne

Test report No.: 936/21251100/A dated 30 July 2021

Certified product

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

The N500 measuring system determines the components NO, NO₂ and NO_x directly by means of CAPS spectroscopy (Cavity-Attenuated Phase Shift) and conversion by gas phase titration. In contrast with a CLD analyser, the instrument's measuring principle determines NO₂ and NO directly. The output for the NO_x value is always a calculated result. The CAPS method uses blue UV light from an LED with a wavelength of 405 nm, a measuring cell with highly reflective mirrors on both sides to extend the optical path, and a vacuum photo detector. All components are integrated in the optical measuring cell, which is located in a thermostatically controlled area.

The main components of the N500 analyser are: an optical cell, a pair of highly reflective mirrors at 405 nm, a light emitting diode (LED) light source and a vacuum photodiode detector. An internal vacuum pump, located downstream from the rest of the unit's components, draws sample gas through the unit's pneumatic connectors. The flow rate is controlled by a flow limiter upstream of the sensor.

After the sample gas has passed through a series of filtering and conditioning components, a sensor determines the NO₂ reading. The sample gas is titrated in turn with high concentrations of ozone. The sensor then measures a second, higher NO₂ value (NO_x mode). The NO_x concentration and the NO concentration are derived from this value.

In summary, the N500 analyser measures NO₂ first directly by optical absorption to obtain an actual reading of the NO₂ concentration. Then a precisely timed pulse rate is used to mix the sample with a high concentration of O₃ to generate NO_x. The software then subtracts the NO₂ concentration from the output NO_x concentration to calculate a reading for NO. For the NO concentration, compensation is then made for the titration efficiency, which is then added to the measured NO₂ value to produce the corrected NO_x reading.

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 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 and the certification mark remains property of TÜV Rheinland Energy 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 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: gal1.de.

History of documents

Certification of N500 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. 0000074637_00: 31 May 2022
Expiry date of the certificate: 11 April 2027
Test report 936/21251100/A dated 30 July 2021
TÜV Rheinland Energy GmbH, Cologne
Publication: BAnz AT 11.04.2022 B10, Chap. V No. 1.2
Announcement by UBA dated 09 March 2022

Expanded uncertainty laboratory, system 1

Measuring device:		Serial No.:		1h-limit value:		nmol/mol	
N500		65		104,6			
Measured component:		Result		Partial uncertainty		Square of partial uncertainty	
NO							
No.	Performance characteristic	Performance criterion	Result	Partial uncertainty	Square of partial uncertainty		
1	Repeatability standard deviation at zero	≤ 1.0 nmol/mol	0,130	$u_{r,z}$ 0,02	0,0004		
2	Repeatability standard deviation at 1h-limit value	≤ 3.0 nmol/mol	1,630	$u_{r,h}$ 0,05	0,0029		
3	"lack of fit" at 1h-limit value	≤ 4.0% of measured value	1,720	$u_{l,h}$ 1,04	1,0789		
4	Sensitivity coefficient of sample gas pressure at 1h-limit value	≤ 8.0 nmol/mol/kPa	0,230	u_{gp} 0,58	0,3396		
5	Sensitivity coefficient of sample gas temperature at 1h-limit value	≤ 3.0 nmol/mol/K	0,090	u_{gt} 0,23	0,0527		
6	Sensitivity coefficient of surrounding temperature at 1h-limit value	≤ 3.0 nmol/mol/K	0,952	u_{st} 2,43	5,9012		
7	Sensitivity coefficient of electrical voltage at 1h-limit value	≤ 0.30 nmol/mol/V	0,010	u_v 0,04	0,0015		
8a	Interferent H ₂ O with 19 mmol/mol	≤ 10 nmol/mol (Zero) ≤ 10 nmol/mol (Span)	0,000 0,400	u_{H_2O} 0,06	0,0038		
8b	Interferent CO ₂ with 500 µmol/mol	≤ 5.0 nmol/mol (Zero) ≤ 5.0 nmol/mol (Span)	0,400 1,800	$u_{int,pos}$ 0,82	0,6667		
8c	Interferent NH ₃ mit 200 nmol/mol	≤ 5.0 nmol/mol (Zero) ≤ 5.0 nmol/mol (Span)	0,600 1,200	$u_{int,neg}$ 1,87	3,5048		
9	Averaging effect	≤ 7.0% of measured value	3,100	u_{av} 0,15	0,0214		
18	Difference sample/calibration port	≤ 1.0%	0,140	u_{asc} 0,42	0,1751		
21	Converter efficiency	≥ 98	99,60	u_{ec} 1,05	1,0941		
23	Uncertainty of test gas	≤ 3.0%	2,000	u_{cg} 3,5842	7,1685		
				Combined standard uncertainty		u_c nmol/mol	
				Expanded uncertainty		U nmol/mol	
				Relative expanded uncertainty		W %	
				Maximum allowed expanded uncertainty		W _{req} %	
						15 %	

Expanded uncertainty laboratory, system 2

Measuring device:		Serial-No.:		76	
Measured component:		1h-limit value:		104,6	
N500		NO		nmol/mol	
No.	Performance characteristic	Performance criterion	Result	Partial uncertainty	Square of partial uncertainty
1	Repeatability standard deviation at zero	≤ 1.0 nmol/mol	0,130	$U_{r,z}$	0,0005
2	Repeatability standard deviation at 1h-limit value	≤ 3.0 nmol/mol	1,340	$U_{r,1h}$	0,0021
3	"lack of fit" at 1h-limit value	≤ 4.0% of measured value	2,240	$U_{l,1h}$	1,8299
4	Sensitivity coefficient of sample gas pressure at 1h-limit value	≤ 8.0 nmol/mol/kPa	0,170	U_{gp}	0,1856
5	Sensitivity coefficient of sample gas temperature at 1h-limit value	≤ 3.0 nmol/mol/K	0,110	U_{gt}	0,0788
6	Sensitivity coefficient of surrounding temperature at 1h-limit value	≤ 3.0 nmol/mol/K	0,451	U_{st}	1,3244
7	Sensitivity coefficient of electrical voltage at 1h-limit value	≤ 0.30 nmol/mol/V	0,000	U_v	0,0000
8a	Interferent H ₂ O with 19 mmol/mol	≤ 10 nmol/mol (Zero)	-0,600	U_{H_2O}	0,0116
8b	Interferent CO ₂ with 500 µmol/mol	≤ 10 nmol/mol (Span)	1,600	$U_{int,pos}$	
8c	Interferent NH ₃ mit 200 nmol/mol	≤ 5.0 nmol/mol (Zero)	0,400	or	0,8171
9	Averaging effect	≤ 5.0 nmol/mol (Span)	0,800	$U_{int,neg}$	
18	Difference sample/calibration port	≤ 7.0% of measured value	-2,900	U_{av}	3,0872
21	Converter efficiency	≥ 98	0,060	U_{asc}	0,0039
23	Uncertainty of test gas	≤ 3.0%	99,80	U_{EC}	0,0438
			2,000	U_{cg}	1,0941
		Combined standard uncertainty		u_c	2,9089
		Expanded uncertainty		U	5,8177
		Relative expanded uncertainty		W	5,56
		Maximum allowed expanded uncertainty		W_{req}	15

Combined uncertainty, laboratory and field, system 1

Measuring device:		N500		Sentat-No.:		65	
Measured component:		NO		1h-limit value:		104,6	
						nmol/mol	
No.	Performance characteristic	Performance criterion	Result	Partial uncertainty	Square of partial uncertainty		
1	Repeatability standard deviation at zero	≤ 1.0 nmol/mol	0,130	$u_{r,z}$	0,02	0,0004	
2	Repeatability standard deviation at 1h-limit value	≤ 3.0 nmol/mol	1,630	$u_{r,h}$	not considered, as $\sqrt{2} \cdot u_{r,h} = 0,07 < u_{r,f}$	-	
3	"lack of fit" at 1h-limit value	≤ 4.0% of measured value	1,720	$u_{l,h}$	1,04	1,0789	
4	Sensitivity coefficient of sample gas pressure at 1h-limit value	≤ 8.0 nmol/mol/kPa	0,230	u_{gp}	0,58	0,3396	
5	Sensitivity coefficient of sample gas temperature at 1h-limit value	≤ 3.0 nmol/mol/K	0,090	u_{gt}	0,23	0,0527	
6	Sensitivity coefficient of surrounding temperature at 1h-limit value	≤ 3.0 nmol/mol/K	0,952	u_{st}	2,43	5,9012	
7	Sensitivity coefficient of electrical voltage at 1h-limit value	≤ 0.30 nmol/mol/V	0,010	u_{v}	0,04	0,0015	
8a	Interferent H ₂ O with 19 nmol/mol	≤ 10 nmol/mol (Zero)	0,000	u_{H_2O}	0,06	0,0038	
		≤ 10 nmol/mol (Span)	0,400				
8b	Interferent CO ₂ with 500 µmol/mol	≤ 5.0 nmol/mol (Zero)	0,400	$u_{int,pos}$			
		≤ 5.0 nmol/mol (Span)	1,800	or	0,82	0,6667	
8c	Interferent NH ₃ mit 200 nmol/mol	≤ 5.0 nmol/mol (Zero)	0,600				
		≤ 5.0 nmol/mol (Span)	1,200	$u_{int,neg}$			
9	Averaging effect	≤ 7.0% of measured value	3,100	u_{av}	1,87	3,5048	
10	Reproducibility standard deviation under field conditions	≤ 5.0% of average over 3 months	3,670	$u_{r,f}$	3,84	14,7365	
11	Long term drift at zero level	≤ 5.0 nmol/mol	-0,920	$u_{d,l,z}$	-0,53	0,2821	
12	Long term drift at span level	≤ 5.0% of max. of certification range	0,930	$u_{d,l,h}$	0,56	0,3154	
18	Difference sample/calibration port	≤ 1.0%	0,140	u_{Asc}	0,15	0,0214	
21	Converter efficiency	≥ 98	99,600	u_{ec}	0,42	0,1751	
23	Uncertainty of test gas	≤ 3.0%	2,000	u_{eg}	1,05	1,0941	
				Combined standard uncertainty		u_c	5,3080
				Expanded uncertainty		U	10,6160
				Relative expanded uncertainty		W	10,15
				Maximum allowed expanded uncertainty		W_{req}	15

Combined uncertainty, laboratory and field, system 2

Measuring device:		N500		Sentat-No.:		76	
Measured component:		NO		1h-limit value:		104,6	
No.	Performance characteristic	Performance criterion	Result	Partial uncertainty	Square of partial uncertainty	nmol/mol	
1	Repeatability standard deviation at zero	≤ 1.0 nmol/mol	0,130	$u_{r,z}$	0,02	0,0005	
2	Repeatability standard deviation at 1h-limit value	≤ 3.0 nmol/mol	1,340	$u_{r,h}$	not considered, as $\sqrt{2} \cdot u_{r,h} = 0,06 < u_{r,f}$	-	
3	"lack of fit" at 1h-limit value	≤ 4.0% of measured value	2,240	$u_{l,h}$	1,35	1,8299	
4	Sensitivity coefficient of sample gas pressure at 1h-limit value	≤ 8.0 nmol/mol/kPa	0,170	u_{gp}	0,43	0,1856	
5	Sensitivity coefficient of sample gas temperature at 1h-limit value	≤ 3.0 nmol/mol/K	0,110	u_{gt}	0,28	0,0788	
6	Sensitivity coefficient of surrounding temperature at 1h-limit value	≤ 3.0 nmol/mol/K	0,451	u_{st}	1,15	1,3244	
7	Sensitivity coefficient of electrical voltage at 1h-limit value	≤ 0.30 nmol/mol/V	0,000	u_{v}	0,00	0,0000	
8a	Interferent H ₂ O with 19 nmol/mol	≤ 10 nmol/mol (Zero) ≤ 10 nmol/mol (Span)	-0,600 1,600	u_{H_2O}	-0,11	0,0116	
8b	Interferent CO ₂ with 500 µmol/mol	≤ 5.0 nmol/mol (Zero) ≤ 5.0 nmol/mol (Span)	0,400 0,800	$u_{int,pos}$ or	0,90	0,8171	
8c	Interferent NH ₃ mit 200 nmol/mol	≤ 5.0 nmol/mol (Zero) ≤ 5.0 nmol/mol (Span)	1,000 1,400	$u_{int,neg}$			
9	Averaging effect	≤ 7.0% of measured value	-2,900	u_{av}	-1,75	3,0672	
10	Reproducibility standard deviation under field conditions	≤ 5.0% of average over 3 months	3,670	$u_{r,f}$	3,84	14,7365	
11	Long term drift at zero level	≤ 5.0 nmol/mol	1,080	$u_{l,z}$	0,62	0,3888	
12	Long term drift at span level	≤ 5.0% of max. of certification range	1,020	$u_{l,h}$	0,62	0,3794	
18	Difference sample/calibration port	≤ 1.0%	0,060	u_{Asc}	0,06	0,0039	
21	Converter efficiency	≥ 98	99,800	u_{ec}	0,21	0,0438	
23	Uncertainty of test gas	≤ 3.0%	2,000	u_{eg}	1,05	1,0941	
Combined standard uncertainty						u_c	4,8951
Expanded uncertainty						U	9,7902
Relative expanded uncertainty						W	9,36
Maximum allowed expanded uncertainty						W_{req}	15

Expanded uncertainty laboratory, system 1

Measuring device:		Serial No.:		1h-limit value:		nmol/mol	
N500		65		104,6			
Measured component:		Result		Performance criterion		Square of partial uncertainty	
NO2							
No.	Performance characteristic	Performance criterion	Result	Partial uncertainty	Square of partial uncertainty		
1	Repeatability standard deviation at zero	≤ 1.0 nmol/mol	0,000	u _{r,z}	0,00	0,0000	
2	Repeatability standard deviation at 1h-limit value	≤ 3.0 nmol/mol	0,080	u _{r,h}	0,01	0,0002	
3	"lack of fit" at 1h-limit value	≤ 4.0% of measured value	0,850	u _{lf,h}	0,51	0,2635	
4	Sensitivity coefficient of sample gas pressure at 1h-limit value	≤ 8.0 nmol/mol/kPa	0,100	u _{sp}	0,91	0,8206	
5	Sensitivity coefficient of sample gas temperature at 1h-limit value	≤ 3.0 nmol/mol/K	0,010	u _{gr}	0,09	0,0082	
6	Sensitivity coefficient of surrounding temperature at 1h-limit value	≤ 3.0 nmol/mol/K	0,231	u _{st}	2,09	4,3787	
7	Sensitivity coefficient of electrical voltage at 1h-limit value	≤ 0.30 nmol/mol/V	0,020	u _v	0,27	0,0727	
8a	Interferent H ₂ O with 19 mmol/mol	≤ 10 nmol/mol (Zero) ≤ 10 nmol/mol (Span)	0,270 0,330	u _{H2O}	0,25	0,0606	
8b	Interferent CO ₂ with 500 µmol/mol	≤ 5.0 nmol/mol (Zero) ≤ 5.0 nmol/mol (Span)	0,000 0,700	u _{int,pos} or	1,03	1,0599	
8c	Interferent NH ₃ mit 200 nmol/mol	≤ 5.0 nmol/mol (Zero) ≤ 5.0 nmol/mol (Span)	0,000 1,090	u _{int,neg}			
9	Averaging effect	≤ 7.0% of measured value	0,700	u _{av}	0,42	0,1787	
18	Difference sample/calibration port	≤ 1.0%	-0,140	u _{asc}	-0,15	0,0214	
21	Converter efficiency	≥ 98	99,60	u _{ec}	0,42	0,1751	
23	Uncertainty of test gas	≤ 3.0%	2,000	u _{cg}	1,05	1,0941	
Combined standard uncertainty				u _c		2,8520	
Expanded uncertainty				U		5,7040	
Relative expanded uncertainty				W		5,45	
Maximum allowed expanded uncertainty				W _{req}		15	

Expanded uncertainty laboratory, system 2

Measuring device:		Serial-No.:		76	
Measured component:		1h-limit value:		104,6	
No.	Performance characteristic	Performance criterion	Result	Partial uncertainty	Square of partial uncertainty
1	Repeatability standard deviation at zero	≤ 1.0 nmol/mol	0,110	$u_{r,z}$	0,0003
2	Repeatability standard deviation at 1h-limit value	≤ 3.0 nmol/mol	0,080	$u_{r,1h}$	0,0002
3	"lack of fit" at 1h-limit value	≤ 4.0% of measured value	0,720	$u_{l,1h}$	0,1891
4	Sensitivity coefficient of sample gas pressure at 1h-limit value	≤ 8.0 nmol/mol/kPa	0,080	u_{gp}	0,5252
5	Sensitivity coefficient of sample gas temperature at 1h-limit value	≤ 3.0 nmol/mol/K	0,010	u_{gt}	0,0082
6	Sensitivity coefficient of surrounding temperature at 1h-limit value	≤ 3.0 nmol/mol/K	0,241	u_{st}	4,7661
7	Sensitivity coefficient of electrical voltage at 1h-limit value	≤ 0.30 nmol/mol/V	0,010	u_v	0,0182
8a	Interferent H ₂ O with 19 nmol/mol	≤ 10 nmol/mol (Zero)	0,000	u_{H_2O}	0,0267
8b	Interferent CO ₂ with 500 µmol/mol	≤ 10 nmol/mol (Span)	0,220	$u_{int,pos}$ or	1,00
		≤ 5.0 nmol/mol (Zero)	-0,210		
8c	Interferent NH ₃ mit 200 nmol/mol	≤ 5.0 nmol/mol (Span)	0,760	$u_{int,neg}$	0,9999
		≤ 5.0 nmol/mol (Zero)	-0,160		
9	Averaging effect	≤ 7.0% of measured value	3,200	u_{av}	3,7346
18	Difference sample/calibration port	≤ 1.0%	-0,330	u_{asc}	0,1191
21	Converter efficiency	≥ 98	99,80	u_{ec}	0,0438
23	Uncertainty of test gas	≤ 3.0%	2,000	u_{cg}	1,0941
Combined standard uncertainty				u_c	3,3950
Expanded uncertainty				U	6,7900
Relative expanded uncertainty				W	6,49
Maximum allowed expanded uncertainty				W_{req}	15

Combined uncertainty, laboratory and field, system 1

Measuring device:		SerialNo.:		65	
Measured component:		1h-limit value:		104,6	
No.	Performance characteristic	Performance criterion	Result	Partial uncertainty	Square of partial uncertainty
1	Repeatability standard deviation at zero	≤ 1.0 nmol/mol	0,000	$u_{r,z}$	0,0000
2	Repeatability standard deviation at 1h-limit value	≤ 3.0 nmol/mol	0,080	$u_{r,h}$	-
3	"lack of fit" at 1h-limit value	≤ 4.0% of measured value	0,850	$u_{l,h}$	0,2635
4	Sensitivity coefficient of sample gas pressure at 1h-limit value	≤ 8.0 nmol/mol/kPa	0,100	u_{pp}	0,8206
5	Sensitivity coefficient of sample gas temperature at 1h-limit value	≤ 3.0 nmol/mol/K	0,010	u_{gt}	0,0082
6	Sensitivity coefficient of surrounding temperature at 1h-limit value	≤ 3.0 nmol/mol/K	0,231	u_{st}	4,3787
7	Sensitivity coefficient of electrical voltage at 1h-limit value	≤ 0.30 nmol/mol/V	0,020	u_v	0,0727
8a	Interferent H ₂ O with 19 nmol/mol	≤ 10 nmol/mol (Zero)	0,270	u_{H_2O}	0,0606
8b	Interferent CO ₂ with 500 µmol/mol	≤ 10 nmol/mol (Span)	0,330		
8c	Interferent NH ₃ mit 200 nmol/mol	≤ 5.0 nmol/mol (Zero)	0,000	$u_{int,pos}$	
9	Averaging effect	≤ 5.0 nmol/mol (Span)	0,700	or	1,0599
10	Reproducibility standard deviation under field conditions	≤ 5.0 nmol/mol (Zero)	0,000	$u_{int,neg}$	
11	Long term drift at zero level	≤ 7.0% of measured value	0,700	u_{dr}	0,1787
12	Long term drift at span level	≤ 5.0% of average over 3 months	3,670	u_{dr}	14,7365
18	Difference sample/calibration port	≤ 5.0 nmol/mol	0,750	$u_{d,l,z}$	0,1875
21	Converter efficiency	≤ 5.0% of max. of certification range	2,290	$u_{d,l,h}$	1,9126
23	Uncertainty of test gas	≤ 1.0%	-0,140	u_{asc}	0,0214
		≥ 98	99,600	u_{EC}	0,1751
		≤ 3.0%	2,000	u_{cg}	1,0941
Combined standard uncertainty				u_c	4,9970
Expanded uncertainty				U	9,9940
Relative expanded uncertainty				W	9,55
Maximum allowed expanded uncertainty				W_{req}	15

Combined uncertainty, laboratory and field, system 2

Measuring device:		N500		Sentat-No.:		76	
Measured component:		NO2		1h-limit value:		104,6	
No.	Performance characteristic	Performance criterion	Result	Partial uncertainty	Square of partial uncertainty	nmol/mol	
1	Repeatability standard deviation at zero	≤ 1.0 nmol/mol	0,110	$u_{r,z}$	0,02	0,0003	
2	Repeatability standard deviation at 1h-limit value	≤ 3.0 nmol/mol	0,080	$u_{r,h}$	not considered, as $\sqrt{2} \cdot u_{r,h} = 0,01 < u_{r,f}$	-	
3	"lack of fit" at 1h-limit value	≤ 4.0% of measured value	0,720	$u_{l,h}$	0,43	0,1891	
4	Sensitivity coefficient of sample gas pressure at 1h-limit value	≤ 8.0 nmol/mol/kPa	0,080	u_{sp}	0,72	0,5252	
5	Sensitivity coefficient of sample gas temperature at 1h-limit value	≤ 3.0 nmol/mol/K	0,010	u_{pt}	0,09	0,0082	
6	Sensitivity coefficient of surrounding temperature at 1h-limit value	≤ 3.0 nmol/mol/K	0,241	u_{st}	2,18	4,7661	
7	Sensitivity coefficient of electrical voltage at 1h-limit value	≤ 0.30 nmol/mol/V	0,010	u_{v}	0,13	0,0182	
8a	Interferent H ₂ O with 19 nmol/mol	≤ 10 nmol/mol (Zero)	0,000	u_{H_2O}	0,16	0,0267	
		≤ 10 nmol/mol (Span)	0,220				
8b	Interferent CO ₂ with 500 µmol/mol	≤ 5.0 nmol/mol (Zero)	-0,210	$u_{CO_2, pos}$			
		≤ 5.0 nmol/mol (Span)	0,760	or	1,00	0,9999	
8c	Interferent NH ₃ mit 200 nmol/mol	≤ 5.0 nmol/mol (Zero)	-0,160				
		≤ 5.0 nmol/mol (Span)	0,980	$u_{NH_3, neg}$			
9	Averaging effect	≤ 7.0% of measured value	3,200	u_{av}	1,93	3,7346	
10	Reproducibility standard deviation under field conditions	≤ 5.0% of average over 3 months	3,670	$u_{r,f}$	3,84	14,7365	
11	Long term drift at zero level	≤ 5.0 nmol/mol	0,870	$u_{d1,z}$	0,50	0,2523	
12	Long term drift at span level	≤ 5.0% of max. of certification range	2,050	$u_{d1,h}$	1,24	1,5327	
18	Difference sample/calibration port	1.0%	-0,330	$u_{\Delta sc}$	-0,35	0,1191	
21	Converter efficiency	98	99,800	u_{ec}	0,21	0,0438	
23	Uncertainty of test gas	≤ 3.0%	2,000	u_{tg}	1,05	1,0941	
Combined standard uncertainty				u_c		5,2959	nmol/mol
Expanded uncertainty				U		10,5919	nmol/mol
Relative expanded uncertainty				W		10,13	%
Maximum allowed expanded uncertainty				W_{req}		15	%