

CERTIFICATE

of Product Conformity (QAL1)

Certificate No.: 0000074638_00

Certified AMS: nCLD AL² for NO, NO₂ and NO_x

Manufacturer: ECO PHYSICS AG
Bubikonerstrasse 45
8635 Dürnten
Swiss

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),
EN 15267-1 (2009) and EN 15267-2 (2009).

Certification is awarded in respect of the conditions stated in this certificate
(this certificate contains 9 pages).



Suitability Tested
Complying with
2008/50/EC
EN 15267
Regular
Surveillance
www.tuv.com
ID 0000074638

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

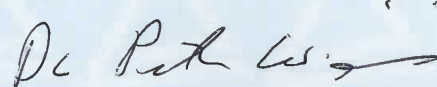
German Environment Agency
Dessau, 31 May 2022

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: 936/21250441/A dated 30 July 2021

Expiry date: 11 April 2022

Publication: BAnz AT 11.04.2022 B10, Chapter V No. 1.1

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 936/21250441/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, Chapter V No. 1.1,
Announcement by UBA dated 09 March 2022:

AMS designation

nCLD AL2 for NO, NO₂ and NO_x

Manufacturer:

ECO PHYSICS AG, Dürnten, Schweiz

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: Version: 1.7.0.0

Restriction:

None

Notes:

1. The test report on the suitability test is available on the Internet at www.qal1.de.
2. The suitability test also covers the device version nCLD 855Y.

Test institute: TÜV Rheinland Energy GmbH, Cologne

Test report No.: 936/21250441/A dated 30 July 2021

Certified product

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

The nCLD AL2 nitrogen oxide analyser uses the chemiluminescence method to continuously measure NO, NO₂ and NO_x in ambient air.

The measuring principle of the nCLD AL2 is based on the fact that nitrogen oxide (NO) and ozone (O₃) react with each other to produce a characteristic luminescence with an intensity linearly proportional to the NO concentration. In order to measure NO₂ in the sample air, it must be converted to NO before measurement. For this reduction to take place, the gas flows through a converter in which a temperature of 350 °C is maintained. NO is measured directly without a converter. The dual-channel principle allows the simultaneous measurement of NO and NO_x, and thus the temporally correct NO₂ measurement with the highest degree of precision.

The ambient air sample is drawn into the nCLD AL2 through the "sample" bulkhead. The sample flows through a capillary, and then to the mode solenoid valve. The solenoid valve routes the sample either straight to the reaction chamber (NO mode) or through the NO₂-to-NO converter and then to the reaction chamber (NO_x mode). The reaction chamber pressure is measured to infer the sample flow pressure deviations outside of the acceptable range are reported as a fault.

Dry air enters the nCLD AL2 through the permeation dryer, flows through a flow switch and then through a silent-discharge ozone generator. The ozone generator provides the ozone needed for the chemiluminescent reaction. At the reaction chamber, the ozone reacts with the NO in the sample to produce excited NO₂ molecules. A photomultiplier tube (PMT) housed in a thermoelectric cooler detects the luminescence generated during this reaction. From the reaction chamber, the exhaust travels through the ozone (O₃) converter to the pump, and is released through the vent.

The NO and NO_x concentrations calculated in the NO and NO_x modes are stored in the memory. The difference between the concentrations is used to calculate the NO₂ concentration.

The nCLD AL2 analyser outputs the NO, NO₂ and NO_x concentrations on the display and via the analogue outputs. The data is also available via the serial connection or the Ethernet interface.

The analyser consists of the following main assemblies:

- Converter: The NO₂ /NO converter consists of a heated and thermally insulated steel block in which the actual converter cartridge is located. This can be easily replaced if necessary. As converter material, the cartridge contains, depending on the selected option, a certain metallic, catalytically active material with a large specific surface area, which results in high efficiency and a long service life of the converter. In the nCLD AL2, the converter type "Y" is used, a molybdenum converter heated to 350 °C.
- Ozone generator: The integrated ozone generator works according to the principle of the so-called "silent electrical discharge". Dry air is passed through an alternating electric field, whereby an ionisation reaction creates ozone from the atmospheric oxygen. The ozone reacts with the NO in the ambient air sample to produce the electronically excited NO₂ molecules.

- Permeation dryer: The permeation dryer provides a continuous stream of dry air to the ozone generator.
- Switched-mode power supply and main processor board: The common electronics contain the computing and power cabling hardware. It also includes the USB ports, the Ethernet port and the I/O interfaces. All electronics operate from a universal VDC supply. The main processor board is also located here.
- Detection unit: This contains the PMT housings and the detectors

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: qal1.de.

History of documents

Certification of nCLD AL² 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. 0000074638_00: 31 May 2022
Expiry date of the certificate: 11 April 2022
Test report 936/21250441/A dated 30 July 2021
TÜV Rheinland Energy GmbH, Cologne
Publication: BAnz AT 11.04.2022 B10, Chap. V No. 1.1
Announcement by UBA dated 09 March 2022

Expanded uncertainty laboratory, system 1

Measuring device:		Serial-No.:		1h-limit value:	
nCLD AL ²		137		104,6	
Measured component:		Performance criterion		Square of partial uncertainty	
NO ₂		Result		Partial uncertainty	
No.	Performance characteristic	Performance criterion	Result	Partial uncertainty	Square of partial uncertainty
1	Repeatability standard deviation at zero	≤ 1.0 nmol/mol	0,000	0,00	0,0000
2	Repeatability standard deviation at 1h-limit value	≤ 3.0 nmol/mol	0,450	0,00	0,0000
3	"lack of fit" at 1h-limit value	≤ 4.0% of measured value	0,550	0,33	0,1103
4	Sensitivity coefficient of sample gas pressure at 1h-limit value	≤ 8.0 nmol/mol/kPa	0,080	0,20	0,0405
5	Sensitivity coefficient of sample gas temperature at 1h-limit value	≤ 3.0 nmol/mol/K	0,030	0,08	0,0057
6	Sensitivity coefficient of surrounding temperature at 1h-limit value	≤ 3.0 nmol/mol/K	0,269	0,68	0,4582
7	Sensitivity coefficient of electrical voltage at 1h-limit value	≤ 0.30 nmol/mol/V	0,000	0,00	0,0000
8a	Interferent H ₂ O with 19 nmol/mol	≤ 10 nmol/mol (Zero) ≤ 10 nmol/mol (Span)	0,000 0,850	0,13	0,0176
8b	Interferent CO ₂ with 500 µmol/mol	≤ 5.0 nmol/mol (Zero) ≤ 5.0 nmol/mol (Span)	0,710 -0,230	0,51	0,2634
8c	Interferent NH ₃ mit 200 nmol/mol	≤ 5.0 nmol/mol (Zero) ≤ 5.0 nmol/mol (Span)	0,340 0,510		
9	Averaging effect	≤ 7.0% of measured value	-1,800	-1,09	1,1816
18	Difference sample/calibration port	≤ 1.0%	0,000	0,00	0,0000
21	Converter efficiency	≥ 98	99,40	0,63	0,3939
23	Uncertainty of test gas	≤ 3.0%	2,000	1,05	1,0941
Combined standard uncertainty				u _c	1,8882
Expanded uncertainty				U	3,7764
Relative expanded uncertainty				W	3,61
Maximum allowed expanded uncertainty				W _{req}	15

Expanded uncertainty laboratory, system 2

Measuring device:		Serial-No.:		nmol/mol	
nCLD AL ²		138			
Measured component:		1h-limit value:		nmol/mol	
NO ₂		104,6			
No.	Performance characteristic	Performance criterion	Result	Partial uncertainty	Square of partial uncertainty
1	Repeatability standard deviation at zero	≤ 1.0 nmol/mol	0,010	u _{r,z}	0,0000
2	Repeatability standard deviation at 1h-limit value	≤ 3.0 nmol/mol	0,950	u _{r,1h}	0,0001
3	"lack of fit" at 1h-limit value	≤ 4.0% of measured value	1,010	u _{l,1h}	0,3720
4	Sensitivity coefficient of sample gas pressure at 1h-limit value	≤ 8.0 nmol/mol/kPa	0,060	u _{gp}	0,0228
5	Sensitivity coefficient of sample gas temperature at 1h-limit value	≤ 3.0 nmol/mol/K	0,010	u _{gt}	0,0006
6	Sensitivity coefficient of surrounding temperature at 1h-limit value	≤ 3.0 nmol/mol/K	0,128	u _{st}	0,1037
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)	-0,340	u _{H2O}	0,1469
		≤ 10 nmol/mol (Span)	-1,170		
8b	Interferent CO ₂ with 500 µmol/mol	≤ 5.0 nmol/mol (Zero)	0,440	u _{int,pos}	
		≤ 5.0 nmol/mol (Span)	-0,480	or	0,0767
8c	Interferent NH ₃ mit 200 nmol/mol	≤ 5.0 nmol/mol (Zero)	-0,090		
		≤ 5.0 nmol/mol (Span)	1,450	u _{int,neg}	
9	Averaging effect	≤ 7.0% of measured value	-1,600	u _{av}	0,9336
18	Difference sample/calibration port	≤ 1.0%	0,000	u _{asc}	0,0000
21	Converter efficiency	≥ 98	99,20	u _{ec}	0,7002
23	Uncertainty of test gas	≤ 3.0%	2,000	u _{cg}	1,0941
Combined standard uncertainty				u _c	1,8577
Expanded uncertainty				U	3,7154
Relative expanded uncertainty				W	3,55
Maximum allowed expanded uncertainty				W _{req}	15

Combined uncertainty, laboratory and field, system 1

Measuring device:		nCLD AL ²		Serial No.:		137	
Measured component:		NO ₂		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	0,000	u _{r,z}	0,00	0,0000	
2	Repeatability standard deviation at 1h-limit value	≤ 3.0 nmol/mol	0,450	u _{r,h}	not considered, as $\sqrt{2} \cdot u_{r,h} = 0 < u_{r,f}$	-	
3	"lack of fit" at 1h-limit value	≤ 4.0% of measured value	0,550	u _{l,h}	0,33	0,1103	
4	Sensitivity coefficient of sample gas pressure at 1h-limit value	≤ 8.0 nmol/mol/kPa	0,080	u _{gp}	0,20	0,0405	
5	Sensitivity coefficient of sample gas temperature at 1h-limit value	≤ 3.0 nmol/mol/K	0,030	u _{gt}	0,08	0,0057	
6	Sensitivity coefficient of surrounding temperature at 1h-limit value	≤ 3.0 nmol/mol/K	0,269	u _{st}	0,68	0,4582	
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 mmol/mol	≤ 10 nmol/mol (Zero)	0,000	u _{H2O}	0,13	0,0176	
		≤ 10 nmol/mol (Span)	0,850				
8b	Interferent CO ₂ with 500 µmol/mol	≤ 5.0 nmol/mol (Zero)	0,710	u _{int,pos}			
		≤ 5.0 nmol/mol (Span)	-0,230	or	0,51	0,2634	
8c	Interferent NH ₃ mit 200 nmol/mol	≤ 5.0 nmol/mol (Zero)	0,340				
		≤ 5.0 nmol/mol (Span)	0,510	u _{int,neg}			
9	Averaging effect	≤ 7.0% of measured value	-1,800	u _{av}	-1,09	1,1816	
10	Reproducibility standard deviation under field conditions	≤ 5.0% of average over 3 months	4,210	u _{r,f}	4,40	19,3922	
11	Long term drift at zero level	≤ 5.0 nmol/mol	0,270	u _{l,z}	0,16	0,0243	
12	Long term drift at span level	≤ 5.0% of max. of certification range	1,290	u _{l,h}	0,78	0,6069	
18	Difference sample/calibration port	≤ 1.0%	0,000	u _{asc}	0,00	0,0000	
21	Converter efficiency	≥ 98	99,400	u _{ec}	0,63	0,3939	
23	Uncertainty of test gas	≤ 3.0%	2,000	u _{cg}	1,05	1,0941	
Combined standard uncertainty						u _c	4,8568
Expanded uncertainty						U	9,7137
Relative expanded uncertainty						W	9,29
Maximum allowed expanded uncertainty						W _{req}	15

Combined uncertainty, laboratory and field, system 2

Measuring device:		Serial No.:		138	
Measured component:		1h-limit value:		104,6	
nCLD AL ²		NO ₂		nmol/mol	
No.	Performance characteristic	Performance criterion	Result	Partial uncertainty	Square of partial uncertainty
1	Repeatability standard deviation at zero	≤ 1.0 nmol/mol	0,010	U _{r,z}	0,0000
2	Repeatability standard deviation at 1h-limit value	≤ 3.0 nmol/mol	0,950	U _{r,h}	-
3	"lack of fit" at 1h-limit value	≤ 4.0% of measured value	1,010	U _{l,h}	0,3720
4	Sensitivity coefficient of sample gas pressure at 1h-limit value	≤ 8.0 nmol/mol/kPa	0,060	U _{gp}	0,0228
5	Sensitivity coefficient of sample gas temperature at 1h-limit value	≤ 3.0 nmol/mol/K	0,010	U _{gt}	0,0006
6	Sensitivity coefficient of surrounding temperature at 1h-limit value	≤ 3.0 nmol/mol/K	0,128	U _{gt}	0,1037
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)	-0,340	U _{H2O}	0,1469
		≤ 10 nmol/mol (Span)	-1,170		
8b	Interferent CO ₂ with 500 µmol/mol	≤ 5.0 nmol/mol (Zero)	0,440	U _{int,pos}	
		≤ 5.0 nmol/mol (Span)	-0,480	or	0,0767
8c	Interferent NH ₃ mit 200 nmol/mol	≤ 5.0 nmol/mol (Zero)	-0,090		
		≤ 5.0 nmol/mol (Span)	1,450	U _{int,neg}	
9	Averaging effect	≤ 7.0% of measured value	-1,600	U _{av}	0,9336
10	Reproducibility standard deviation under field conditions	≤ 5.0% of average over 3 months	4,210	U _{r,f}	19,3922
11	Long term drift at zero level	≤ 5.0 nmol/mol	0,960	U _{d,l,z}	0,3072
12	Long term drift at span level	≤ 5.0% of max. of certification range	1,300	U _{d,l,h}	0,6164
18	Difference sample/calibration port	≤ 1.0%	0,000	U _{asc}	0,0000
21	Converter efficiency	≥ 98	99,200	U _{EC}	0,7002
23	Uncertainty of test gas	≤ 3.0%	2,000	U _{cg}	1,0941
Combined standard uncertainty				U _c	4,8751
Expanded uncertainty				U	9,7502
Relative expanded uncertainty				W	9,32
Maximum allowed expanded uncertainty				W _{req}	15