Umwelt Bundesamt

TÜVRheinland®
Precisely Right.

CERTIFICATE

of Product Conformity (QAL1)

Certificate No.: 0000040328_02

AMS designation:	AC32M for NO, NO_2 und NO_X
Manufacturer:	ENVEA 111 Boulevard Robespierre 78304 Poissy Cedex France
Test Laboratory:	TÜV Rheinland Energy GmbH

This is to certify that the AMS has been tested and found to comply with the standards: VDI 4202-1 (2002), VDI 4203-3 (2004), 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 12 pages).
The present certificate replaces certificate 0000040328_01 of 01 April 2019.

TÜVRheinland® CERTIFIED

Suitability Tested
Equivalent to
2008/50/EC
EN 15267
Regular Surveillance

www.tuv.com
ID 0000040328

Publication in the German Federal Gazette (BAnz) of 01 April 2014

This certificate will expire on:
30 June 2025

German Federal Environment Agency
Dessau, 01 July 2020

Dr. Marcel Langner
Head of Section II 4.1

TÜV Rheinland Energy GmbH
Cologne, 30 June 2020

ppa. Dr. Peter Wilbring

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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 certificate D-PL-11120-02-00.

Test Report:	936/21205818/A dated 08 December 2006
Initial certification:	01 April 2014
Expiry date:	30 June 2025
Certificate:	Renewal (of previous certificate 0000040328_01 dated 01 April 2019 valid until 30 June 2020)
Publication:	BAnz AT 01.04.2014 B12, chapter VI notification 18

Approved application
The certified AMS is suitable for continuous ambient air monitoring of NO, NO_2 and NO_x (stationary operation).

The suitability of the AMS for this application was assessed on the basis of a laboratory test and a three-months field test.

The AMS is approved for an ambient temperature range of 0 °C 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, in consultation with the manufacturer, that this AMS is suitable for monitoring the AMS readings relevant to the application.

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

Basis of the certification
This certification is based on:

- Test report no. 936/21205818/A dated 08 December 2006 issued by TÜV Rheinland Immissionsschutz und Energiesysteme GmbH and Addendum 936/21221709/A dated 28 September 2013 issued by TÜV Rheinland Energie und Umwelt 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. 20 April 2007, No. 75, p. 4139, chapter III number 4.1, UBA announcement dated 12 April 2007:

AMS designation:
AC32M for NO, NO_2 and NO_X

Manufacturer:
Environnement S.A., Poissy Cedex, France and Ansyco GmbH Karlsruhe, Germany

Field of application:
For continuous monitoring of NO, NO_2 and NO_x in ambient air (stationary operation)

Measuring range during performance testing

NO_2	0–400 µg/m³
NO_2	0–500 µg/m³
NO	0–1200 µg/m³

Software version:
V2.45

Test Laboratory:
TÜV Rheinland Immissionsschutz und Energiesysteme GmbH, Cologne,
TÜV Rheinland Group
Report no.: 936/21205818/A dated 8 December 2006

Publication in the German Federal Gazette: BAnz AT 01.04.2014 B12, chapter VI notification 18, UBA announcement dated 27 February 2014:

18 Notification as regards Federal Environment Agency (UBA) notices of 12 April 2007 (BAnz. S. 4139, chapter III number 4.1)

The Model AC32M air quality monitor for NO, NO_2 and NO_x manufactured by Environnement complies with the requirements of EN 14211 (August 2012 version). Furthermore, the manufacturing process and the quality management for the AC32M measuring system for NO, NO_2 and NO_X meet the requirements of EN 15267.

The test report on performance testing No. 936/21205818/A and the addendum no. 936/21221709/A as an integral part of this report are available online at www.qal1.de.

Statement issued by TÜV Rheinland Energie und Umwelt GmbH
dated 28 September 2013

Publication in the German Federal Gazette: BAnz AT 26.08.2015 B4, chapter V notification 51, UBA announcement dated 22 July 2015:

51 Notification as regards Federal Environment Agency (UBA) notices of 12 April 2007 (BAnz. S. 4139, chapter III number 4.1) and of 27 February 2014 (BAnz AT 01.04.2014 B12, chapter VI 18th notification)

The latest software version of the AC32M measuring system for NO, NO_2 and NOx manufactured by Environnement S.A. is:
v1.02 (calculation process)
v3.6.b (display process)

To extend the means of communication, the measuring system will be equipped with a USB port and a TCP/IP interface.
The ozone generator has been optimised and is now called B01-5005-1.
The pressure sensors at the measuring chamber and in the sample gas were each replaced by sensors, type C06-C5-0291-A.
The high voltage supply was replace by the model PS1800N/12F.

Statement issued by TÜV Rheinland Energie und Umwelt GmbH
dated 14 March 2015

Publication in the German Federal Gazette: BAnz AT 26.03.2019 B7, chapter IV notification 21, UBA announcement dated 27 February 2019:

21 Notification as regards Federal Environment Agency (UBA) notices of 12 April 2007 (BAnz. p. 4139, chapter III number 4.1) and of 22 July 2015 (BAnz AT 26.08.2015 B4, chapter V 51st notification)

The latest software version of the AC32M measuring system for NO, NO_2 and NOx manufactured by Environnement S.A. is:

v1.02 (calculation process)
v3.6.g (display process)

Statement issued by TÜV Rheinland Energy GmbH dated 27 September 2018

Publication in the German Federal Gazette: BAnz AT 24.03.2020 B7, chapter IV notification 25, UBA announcement dated 24 February 2020:

25 Notification as regards Federal Environment Agency (UBA) notices of 12 April 2007 (BAnz. p. 4139, chapter III number 4.1) and of 27 February 2019 (BAnz AT 26.03.2019 B7, chapter IV 21st notification)

Environnement S.A., Poissy, France have changed their company name to ENVEA.
The latest software version of the AC32M measuring system for NO, NO_2 und NO_x manufactured by ENVEA is
v1.02 (calculation process)
v3.8.b (display process)

Statement issued by TÜV Rheinland Energy GmbH dated 1 October 2019

Certified product

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

The AC32M analyser measures nitrogen oxide (NO) and nitrogen dioxide (NO_2) in ambient air. The measuring principle is based on the light emission from the chemical reaction between NO and ozone in the reaction chamber, also referred to as chemiluminescence.

The chemiluminescence represents the oxidation of NO molecules by ozone molecules to NO_2^* molecules.

$$NO + O_3 \rightarrow NO_2^* + O_2$$

The return of the excited NO_2^* molecules to a basic electronic condition is performed using light radiation in a spectrum of 600 to 1200 nanometres:

$$NO_2^* \rightarrow NO_2 + hv$$

This energy can be lost (quenching) in the sample due to a collision with certain molecules, in particular H_2O and CO_2. A reduction of the pressure in the reaction chamber to approx. 200 mbar and the drying of the sample using a Perma Pure dryer reduces the likelihood of a collision which means a greater light yield and thus detection limit can be achieved.

The ozone required is generated in an internal ozone generator using stationary electrical charging in a cylindrical capacitor.

The reaction chamber is separated from the sensor by an optical red filter which only allows light beams with a wavelength of over 610 nanometres to pass through and thus suppresses the inferences caused by the hydrocarbons.

Radiation measurement is performed using a photomultiplier (PM). The electrical signal it provides is magnified and digitised for processing by the microprocessor.

In order to be measured by chemiluminescence the NO_2 must first be converted to NO. A hot molybdenum converter is used to perform this reduction according to the following reaction equation:

$$2NO_2 \xrightarrow{Mo} 2NO + O_2$$

The sample is sucked in by a vacuum pump at the entry to the system which provides the vacuum in the reaction chamber and the Perma Pure dryer blowback.

The measurement comprises 3 cycles:

- **Reference cycle:** The sample is fed into a pre-reaction chamber (tube section) where it is mixed with ozone. The NO in the sample is oxidised into NO_2 before it flows into the reaction chamber. The signal measured by the PM without chemiluminescence can be considered a measurement with zero air and serves as a reference signal or zero signal.
- **NO cycle:** The sample is fed directly into the measuring chamber in which the NO molecules are oxidised with ozone. The signal measured by the PM is proportional to the number of NO molecules present in the sample.
- **NO_x cycle:** The sample is fed through the NO_2 converter and then mixed with ozone in the reaction chamber. The signal measured by the PM is proportional to the total number of NO and NO_2 molecules in the sample, the latter originating from the reduction of NO_2. The sum of NO + NO_2 is referred to as NO_x.

This measuring principle corresponds to the standard reference method as described in EN 14211.

General remarks

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 manufacturing process for 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 document as well as the certification mark remains property of TÜV Rheinland Energy GmbH. Upon revocation of the publication the certificate loses its validity. After the expiration of the certificate and on request of TÜV Rheinland Energy GmbH this document shall be returned and the certificate mark must no longer be used.

The relevant version of this certificate and its expiration date are also accessible on the internet at **qal1.de**.

Document history

Certification of the AC32M measuring system is based on the documents listed below and the regular, continuous surveillance of the manufacturer's quality management system:

Basic testing

Test Report: 936/21205818/A dated 8 December 2006
TÜV Rheinland Immissionsschutz und Energiesysteme GmbH
Publication: BAnz. 20 April 2007, No. 75, p. 4139, chapter III number 4.1
UBA announcement dated 12 April 2007

Initial certification according to EN 15267

Certificate no. 0000040328: 29 April 2014
Expiry date of the certificate: 31 March 2019
Test report: 936/21205818/A dated 8 December 2006
TÜV Rheinland Immissionsschutz und Energiesysteme GmbH, Cologne
Publication: BAnz AT 01.04.2014 B12, chapter VI notification 18,
UBA announcement dated 27 February 2014

Notifications in accordance with EN 15267

Statement issued by TÜV Rheinland Energie und Umwelt GmbH dated 14 March 2015
Publication: BAnz AT 26.08.2015 B4, chapter V notification 51
UBA announcement dated 22 July 2015
(Design and software changes)

Renewal of the certificate

Certificate no. 0000040328_01: 01 April 2019
Expiry date of the certificate: 30 June 2020

Notifications in accordance with EN 15267

Statement issued by TÜV Rheinland Energy GmbH dated 27 September 2018
Publication: BAnz AT 26.03.2019 B7, chapter IV notification 21
UBA announcement dated 27 February 2019
(software updates)

Statement issued by TÜV Rheinland Energy GmbH dated 1 October 2019
Publication: BAnz AT 24.03.2020 B7, chapter IV notification 25
UBA announcement dated 24 February 2020
(Software changes, new company name)

Renewal of the certificate

Certificate no. 0000040328_02: 01 July 2020
Expiry date of the certificate: 30 June 2025

Expanded uncertainty from the results obtained in the laboratory tests for analyser 1

Measuring device:	Environnement AC32M	Serial-No.:	Gerät 1
Measured component:	NO_2	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	0.610	$u_{r,z}$	0.10	0.0101	
2	Repeatability standard deviation at 1h-limit value	≤	3.0 nmol/mol	2.260	$u_{r,lh}$	0.08	0.0059	
3	"lack of fit" at 1h-limit value	≤	4.0% of measured value	0.300	$u_{l,lh}$	0.18	0.0328	
4	Sensitivity coefficient of sample gas pressure at 1h-limit value	≤	8.0 nmol/mol/kPa	0.250	u_{gp}	0.57	0.3205	
5	Sensitivity coefficient of sample gas temperature at 1h-limit value	≤	3.0 nmol/mol/K	-0.060	u_{gt}	-0.14	0.0205	
6	Sensitivity coefficient of surrounding temperature at 1h-limit value	≤	3.0 nmol/mol/K	0.200	u_{st}	0.52	0.2679	
7	Sensitivity coefficient of electrical voltage at 1h-limit value	≤	0.30 nmol/mol/V	0.086	u_V	0.26	0.0684	
8a	Interferent H_20 with 21 mmol/mol	≤	10 nmol/mol (Zero)	2.300	u_{H2O}	1.62	2.6327	
		≤	10 nmol/mol (Span)	1.700				
8b	Interferent CO_2 with 500 µmol/mol	≤	5.0 nmol/mol (Zero)	0.700	$u_{int,pos}$			
		≤	5.0 nmol/mol (Span)	2.000	or	0.86	0.7313	
8c	Interferent NH_3 mit 200 nmol/mol	≤	5.0 nmol/mol (Zero)	0.300				
		≤	5.0 nmol/mol (Span)	1.300	$u_{int,neg}$			
9	Averaging effect	≤	7.0% of measured value	1.900	u_{av}	1.15	1.3166	
18	Difference sample/calibration port	≤	1.0%	0.000	$u_{\Delta sc}$	0.00	0.0000	
21	Converter efficiency	≥	98	98.40	u_{EC}	1.67	2.8009	
23	Uncertainty of test gas	≤	3.0%	2.000	u_{cg}	1.05	1.0941	
				Combined standard uncertainty	u_c		3.0525	nmol/mol
				Expanded uncertainty	U		6.1051	nmol/mol
				Relative expanded uncertainty	W		5.84	%
				Maximum allowed expanded uncertainty	W_{req}		15	%

Expanded uncertainty from the results obtained in the laboratory tests for analyser 2

Measuring device:	Environnement AC32M	Serial-No.:	Gerät 2		
Measured component:	NO_2	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	0.640	$u_{r,z}$	0.11	0.0121	
2	Repeatability standard deviation at 1h-limit value	≤	3.0 nmol/mol	2.700	$u_{r,lh}$	0.10	0.0092	
3	"lack of fit" at 1h-limit value	≤	4.0% of measured value	0.300	$u_{l,lh}$	0.18	0.0328	
4	Sensitivity coefficient of sample gas pressure at 1h-limit value	≤	8.0 nmol/mol/kPa	0.200	u_{gp}	0.45	0.2051	
5	Sensitivity coefficient of sample gas temperature at 1h-limit value	≤	3.0 nmol/mol/K	0.060	u_{gt}	0.14	0.0205	
6	Sensitivity coefficient of surrounding temperature at 1h-limit value	≤	3.0 nmol/mol/K	0.200	u_{st}	0.52	0.2679	
7	Sensitivity coefficient of electrical voltage at 1h-limit value	≤	0.30 nmol/mol/V	-0.029	u_V	-0.09	0.0078	
8a	Interferent H_20 with 21 mmol/mol	≤	10 nmol/mol (Zero)	0.000	u_{H2O}	1.21	1.4546	
		≤	10 nmol/mol (Span)	0.000				
8b	Interferent CO_2 with 500 µmol/mol	≤	5.0 nmol/mol (Zero)	0.300	$u_{int,pos}$			
		≤	5.0 nmol/mol (Span)	0.000	or	0.94	0.8758	
8c	Interferent NH_3 mit 200 nmol/mol	≤	5.0 nmol/mol (Zero)	1.300				
		≤	5.0 nmol/mol (Span)	1.700	$u_{int,neg}$			
9	Averaging effect	≤	7.0% of measured value	0.400	u_{av}	0.24	0.0584	
18	Difference sample/calibration port	≤	1.0%	0.000	$u_{\Delta sc}$	0.00	0.0000	
21	Converter efficiency	≥	98	98.80	u_{EC}	1.26	1.5755	
23	Uncertainty of test gas	≤	3.0%	2.000	u_{cg}	1.05	1.0941	
				Combined standard uncertainty	u_c		2.3738	nmol/mol
				Expanded uncertainty	U		4.7477	nmol/mol
				Relative expanded uncertainty	W		4.54	%
				Maximum allowed expanded uncertainty	W_{req}		15	%

Expanded uncertainty from the results obtained in the laboratory and field tests for analyser 1

Measuring device:	Environnement AC32M		Serial-No.:	Gerät 1		
Measured component:	NO_2		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	0.610	$u_{r,z}$	0.10	0.0101	
2	Repeatability standard deviation at 1h-limit value	≤	3.0 nmol/mol	2.260	$u_{r,lh}$	not considered, as √2*ur,lh = 0.1 < ur,f	-	
3	"lack of fit" at 1h-limit value	≤	4.0% of measured value	0.300	$u_{l,lh}$	0.18	0.0328	
4	Sensitivity coefficient of sample gas pressure at 1h-limit value	≤	8.0 nmol/mol/kPa	0.250	u_{gp}	0.57	0.3205	
5	Sensitivity coefficient of sample gas temperature at 1h-limit value	≤	3.0 nmol/mol/K	-0.060	u_{gt}	-0.14	0.0205	
6	Sensitivity coefficient of surrounding temperature at 1h-limit value	≤	3.0 nmol/mol/K	0.200	u_{st}	0.52	0.2679	
7	Sensitivity coefficient of electrical voltage at 1h-limit value	≤	0.30 nmol/mol/V	0.086	u_V	0.26	0.0684	
8a	Interferent H_20 with 21 mmol/mol	≤	10 nmol/mol (Zero)	2.300	u_{H2O}	1.62	2.6327	
		≤	10 nmol/mol (Span)	1.700				
8b	Interferent CO_2 with 500 µmol/mol	≤	5.0 nmol/mol (Zero)	0.700	$u_{int,pos}$ or $u_{int,neg}$	0.86	0.7313	
		≤	5.0 nmol/mol (Span)	2.000				
8c	Interferent NH_3 mit 200 nmol/mol	≤	5.0 nmol/mol (Zero)	0.300				
		≤	5.0 nmol/mol (Span)	1.300				
9	Averaging effect	≤	7.0% of measured value	1.900	u_{av}	1.15	1.3166	
10	Reproducibility standard deviation under field conditions	≤	5.0% of average over 3 months	4.890	$u_{r,f}$	5.11	26.1626	
11	Long term drift at zero level	≤	5.0 nmol/mol	-0.590	$u_{d,l,z}$	-0.34	0.1160	
12	Long term drift at span level	≤	5.0% of max. of certification range	0.790	$u_{d,l,lh}$	0.48	0.2276	
18	Difference sample/calibration port	≤	1.0%	0.000	$u_{\Delta sc}$	0.00	0.0000	
21	Converter efficiency	≥	98	98.400	u_{EC}	1.67	2.8009	
23	Uncertainty of test gas	≤	3.0%	2.000	u_{cg}	1.05	1.0941	
				Combined standard uncertainty	u_c		5.9843	nmol/mol
				Expanded uncertainty	U		11.9687	nmol/mol
				Relative expanded uncertainty	W		11.44	%
				Maximum allowed expanded uncertainty	W_{req}		15	%

Expanded uncertainty from the results obtained in the laboratory and field tests for analyser 2

Measuring device:	Environnement AC32M				Serial-No.:		Gerät 2	
Measured component:	NO_2				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	0.640	$u_{r,z}$	0.11	0.0121	
2	Repeatability standard deviation at 1h-limit value	≤	3.0 nmol/mol	2.700	$u_{r,lh}$	not considered, as √2*ur,lh = 0.13 < ur,f	-	
3	"lack of fit" at 1h-limit value	≤	4.0% of measured value	0.300	$u_{l,lh}$	0.18	0.0328	
4	Sensitivity coefficient of sample gas pressure at 1h-limit value	≤	8.0 nmol/mol/kPa	0.200	u_{gp}	0.45	0.2051	
5	Sensitivity coefficient of sample gas temperature at 1h-limit value	≤	3.0 nmol/mol/K	0.060	u_{gt}	0.14	0.0205	
6	Sensitivity coefficient of surrounding temperature at 1h-limit value	≤	3.0 nmol/mol/K	0.200	u_{st}	0.52	0.2679	
7	Sensitivity coefficient of electrical voltage at 1h-limit value	≤	0.30 nmol/mol/V	-0.029	u_V	-0.09	0.0078	
8a	Interferent H_20 with 21 mmol/mol	≤	10 nmol/mol (Zero)	1.700	u_{H2O}	1.21	1.4546	
		≤	10 nmol/mol (Span)	1.300				
8b	Interferent CO_2 with 500 µmol/mol	≤	5.0 nmol/mol (Zero)	0.300	$u_{int,pos}$ or $u_{int,neg}$	0.94	0.8758	
		≤	5.0 nmol/mol (Span)	0.000				
8c	Interferent NH_3 mit 200 nmol/mol	≤	5.0 nmol/mol (Zero)	1.300				
		≤	5.0 nmol/mol (Span)	1.700				
9	Averaging effect	≤	7.0% of measured value	0.400	u_{av}	0.24	0.0584	
10	Reproducibility standard deviation under field conditions	≤	5.0% of average over 3 months	4.890	$u_{r,f}$	5.11	26.1626	
11	Long term drift at zero level	≤	5.0 nmol/mol	0.780	$u_{d,l,z}$	0.45	0.2028	
12	Long term drift at span level	≤	5.0% of max. of certification range	0.660	$u_{d,l,lh}$	0.40	0.1589	
18	Difference sample/calibration port	≤	1.0%	0.000	$u_{\Delta sc}$	0.00	0.0000	
21	Converter efficiency	≥	98	98.800	u_{EC}	1.26	1.5755	
23	Uncertainty of test gas	≤	3.0%	2.000	u_{cg}	1.05	1.0941	
				Combined standard uncertainty		u_c	5.6693	nmol/mol
				Expanded uncertainty		U	11.3386	nmol/mol
				Relative expanded uncertainty		W	10.84	%
				Maximum allowed expanded uncertainty		W_{req}	15	%