

# CERTIFICATE

## of Product Conformity (QAL1)

Certificate No.: 0000040328

**Certified AMS:** AC32M for NO, NO<sub>2</sub> and NO<sub>x</sub>

**Manufacturer:** Environnement S.A.  
111 Boulevard Robespierre  
78304 Poissy Cedex  
France

**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 4203-2: 2004, EN 14211: 2012,  
EN 15267-1: 2009, EN 15267-2: 2009**

Certification is awarded in respect of the conditions stated in this certificate  
(see also the following pages).



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

www.tuv.com  
ID 0000040328

Publication in the German Federal Gazette  
(BAnz.) of 20 April 2007

German Federal Environment Agency  
Dessau, 29 April 2014



i. A. Dr. Marcel Langner

This certificate will expire on:  
31 March 2019

TÜV Rheinland Energie und Umwelt GmbH  
Cologne, 28 April 2014



ppa. Dr. Peter Wilbring

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TÜV Rheinland Energie und Umwelt GmbH  
Am Grauen Stein  
51105 Cologne

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

**Certificate:**  
0000040328 / 29 April 2014

**Test report:** 936/21205818/A of 08 December 2006  
Addendum 936/21221709/A of 28 September 2013

**Initial certification:** 01 April 2014

**Date of expiry:** 31 March 2019

**Publication:** BAnz AT 01 April 2014 B12, chapter VI, notification 18

**Approved application**

The certified AMS is suitable for continuous monitoring of NO, NO<sub>2</sub> and NO<sub>x</sub> in ambient air (stationary operation).

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 a temperature range of 0 °C to +30 °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 936/21205818/A of 08 December 2006 of TÜV Rheinland Immissionsschutz und Energiesysteme GmbH and Addendum 936/21221709/A of 28 September 2013 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. 20 April 2007, No. 75, p. 4139, chapter III, No. 4.1, UBA publication from 12 April 2007)
- publication in the German Federal Gazette (BAnz AT 01 April 2014 B12, chapter VI, notification 18 UBA publication from 27 February 2014)

**AMS designation:**

AC32M for NO, NO<sub>2</sub> and NO<sub>x</sub>

**Manufacturer:**

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

**Field of application:**

For continuous monitoring of NO, NO<sub>2</sub> und NO<sub>x</sub> in ambient air (stationary operation).

**Measuring ranges during the performance test:**

NO<sub>2</sub> 0 - 400 µg/m<sup>3</sup>

NO<sub>2</sub> 0 - 500 µg/m<sup>3</sup>

NO 0 - 1200 µg/m<sup>3</sup>

**Software version:**

V2.45

**Testing institute:**

TÜV Rheinland Immissionsschutz und Energiesysteme GmbH, Cologne  
TÜV Rheinland Group  
Report No.: 936/21205818/A of 8 December 2006

**Notification of announcement by the German Federal Environment Agency dated  
12th April 2007 (BAnz. p. 4139, Chapter III Number 4.1)**

The measuring system AC32M for NO, NO<sub>2</sub> and NO<sub>x</sub> manufactured by Environnement fulfils the requirements of DIN EN 14211 (November 2012). Furthermore, the manufacturing process and quality management system of the measuring system AC32M for NO, NO<sub>2</sub> and NO<sub>x</sub> fulfill the requirements of EN 15267.

The test report of the performance test with report number 936/21205818/A and an addendum as an integral part of to the test report with report number 936/21221709/A can be viewed on the internet at [www.qal1.de](http://www.qal1.de).

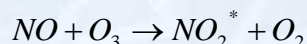
Statement by TÜV Rheinland Energie und Umwelt GmbH dated 28th September 2013

### Certified product

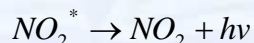
This certificate applies to automated measurement systems conforming to the following description:

The analyser AC32M measures nitrogen oxide (NO) and nitrogen dioxide (NO<sub>2</sub>) in ambient air. The measuring principle is based on the light emission from the chemical reaction between NO and ozone in the reaction chamber, the so called chemiluminescence.

The chemiluminescence represents the oxidation of NO molecules by ozone molecules to NO<sub>2</sub>\* molecules.



The return of the excited NO<sub>2</sub>\* molecules to a basic electronic condition is performed using light radiation in a spectrum of 600 to 1200 nanometres:



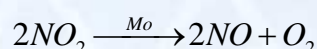
This energy can be lost (quenching) in the sample due to a collision with certain molecules, in particular H<sub>2</sub>O and CO<sub>2</sub>. A reduction of the temperature in the reaction chamber to approx. 200 mbar and the drying of the sample using a Perma Pure dryer reduces the likelihood of a collision 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 digitalized for processing by the microprocessor.

In order to be measured by chemiluminescence the NO<sub>2</sub> must first be converted to NO. A hot molybdenum converter is used to perform this reduction according to the following reaction equation:



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<sub>2</sub> 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<sub>x</sub> cycle:** The sample is fed through the NO<sub>2</sub> 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<sub>2</sub> molecules in the sample, the latter originating from the reduction of NO<sub>2</sub>. The sum of NO + NO<sub>2</sub> is referred to as NO<sub>x</sub>.

The measuring principle complies with the standard reference method stipulated in EN 14211.

**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 Energie und Umwelt 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 can be applied to the product or used in publicity material for the certified product is presented on page 1 of this certificate.

This document as well as the certification mark remains property of TÜV Rheinland Energie und Umwelt GmbH. With revocation of the publication the certificate loses its validity. After the expiration of the certificate and on requests of the TÜV Rheinland Energie und Umwelt GmbH this document shall be returned and the certificate mark must not be employed anymore.

The relevant version of this certificate and the validity is also accessible on the internet: [qal1.de](http://qal1.de).

Certification of Model AC32M for NO, NO<sub>2</sub> and NO<sub>x</sub> is based on the documents listed below and the regular, continuous monitoring of the Quality Management System of the manufacturer:

**Initial test:**

Test report: 936/21205818/A of 08 December 2006  
TÜV Rheinland Immissionsschutz und Energiesysteme GmbH, Cologne

Publication: BAnz. 20 April 2007, No. 75, p. 4139, chapter III, No. 4.1  
Announcement by UBA from 12 April 2007

**Initial certification according to EN 15267:**

Certificate No. 0000040328: 29 April 2014

Expiration date of the certificate: 31 March 2019

Test report: 936/21205818/A of 08 December 2006  
TÜV Rheinland Immissionsschutz und Energiesysteme GmbH, Cologne

Addendum 936/21221709/A of 28 September 2013  
TÜV Rheinland Energie und Umwelt GmbH, Cologne

Publication: BAnz AT 01 April 2014 B12, chapter VI, notification 18  
Announcement by UBA from 27 February 2014

**Notification:**

Publication: BAnz AT 01 April 2014 B12, chapter VI, notification 18  
Announcement by UBA from 27 February 2014

Calculation of overall uncertainty lab test (Device 1)

Measuring device:		Serial-No.:		Gerät 1	
Measured component:		1h-limit value:		104.6	
Environment AC32M		NO <sub>2</sub>		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 <sub>r,z</sub> 0.10	0.0101
2	Repeatability standard deviation at 1h-limit value	≤ 3.0 nmol/mol	2.260	U <sub>r,1h</sub> 0.08	0.0059
3	"lack of fit" at 1h-limit value	≤ 4.0% of measured value	0.300	U <sub>l,1h</sub> 0.18	0.0328
4	Sensitivity coefficient of sample gas pressure at 1h-limit value	≤ 8.0 nmol/mol/kPa	0.250	U <sub>gp</sub> 0.57	0.3205
5	Sensitivity coefficient of sample gas temperature at 1h-limit value	≤ 3.0 nmol/mol/K	-0.060	U <sub>gt</sub> -0.14	0.0205
6	Sensitivity coefficient of surrounding temperature at 1h-limit value	≤ 3.0 nmol/mol/K	0.200	U <sub>st</sub> 0.52	0.2679
7	Sensitivity coefficient of electrical voltage at 1h-limit value	≤ 0.30 nmol/mol/V	0.086	U <sub>v</sub> 0.26	0.0684
8a	Interferent H <sub>2</sub> O with 21 nmol/mol	≤ 10 nmol/mol (Zero) ≤ 10 nmol/mol (Span)	2.300 1.700	U <sub>H2O</sub> 1.62	2.6327
8b	Interferent CO <sub>2</sub> with 500 µmol/mol	≤ 5.0 nmol/mol (Zero) ≤ 5.0 nmol/mol (Span)	0.700 2.000	U <sub>int,pos</sub> 0.86 or	0.7313
8c	Interferent NH <sub>3</sub> mit 200 nmol/mol	≤ 5.0 nmol/mol (Zero) ≤ 5.0 nmol/mol (Span)	0.300 1.300	U <sub>int,neg</sub>	
9	Averaging effect	≤ 7.0% of measured value	1.900	U <sub>av</sub> 1.15	1.3166
18	Difference sample/calibration port	≤ 1.0%	0.000	U <sub>ssc</sub> 0.00	0.0000
21	Converter efficiency	≥ 98	98.40	U <sub>EC</sub> 1.67	2.8009
23	Uncertainty of test gas	≤ 3.0%	2.000	U <sub>cg</sub> 1.05	1.0941
Combined standard uncertainty				u <sub>c</sub>	3.0525
Expanded uncertainty				U	6.1051
Relative expanded uncertainty				W	5.84
Maximum allowed expanded uncertainty				W <sub>req</sub>	15

Calculation of overall uncertainty lab test (Device 2)

Measuring device:		Serial-No.:		Gerät 2		
Measured component:		1h-limit value:		104.6		
Environment AC32M		NO <sub>2</sub>		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	$u_{r,1h}$ 0.10	0.0092	
3	"lack of fit" at 1h-limit value	≤ 4.0% of measured value	0.300	$u_{l,1h}$ 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 <sub>2</sub> O with 21 mmol/mol	≤ 10 nmol/mol (Zero) ≤ 10 nmol/mol (Span)	0.000 0.000	$u_{H_2O}$ 1.21	1.4546	
8b	Interferent CO <sub>2</sub> with 500 µmol/mol	≤ 5.0 nmol/mol (Zero)	0.300	$u_{int,pos}$	0.8758	
8c	Interferent NH <sub>3</sub> mit 200 nmol/mol	≤ 5.0 nmol/mol (Span)	1.300	or		
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	$u_{asc}$ 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	%



Calculation of overall uncertainty lab and field test (Device 1)

Measuring device:		Serial-No.:		Gerät 1	
Measured component:		1h-limit value:		104.6	
Environment AC32M		1h-limit value:		104.6	
NO <sub>2</sub>		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	0.610	U <sub>r,z</sub>	0.0101
2	Repeatability standard deviation at 1h-limit value	≤ 3.0 nmol/mol	2.260	U <sub>r,1h</sub>	-
3	"lack of fit" at 1h-limit value	≤ 4.0% of measured value	0.300	U <sub>l,1h</sub>	0.0328
4	Sensitivity coefficient of sample gas pressure at 1h-limit value	≤ 8.0 nmol/mol/kPa	0.250	U <sub>sp</sub>	0.3205
5	Sensitivity coefficient of sample gas temperature at 1h-limit value	≤ 3.0 nmol/mol/K	-0.060	U <sub>gt</sub>	0.0205
6	Sensitivity coefficient of surrounding temperature at 1h-limit value	≤ 3.0 nmol/mol/K	0.200	U <sub>st</sub>	0.2679
7	Sensitivity coefficient of electrical voltage at 1h-limit value	≤ 0.30 nmol/mol/V	0.086	U <sub>v</sub>	0.0684
8a	Interferent H <sub>2</sub> O with 21 nmol/mol	≤ 10 nmol/mol (Zero) ≤ 10 nmol/mol (Span)	2.300 1.700	U <sub>H2O</sub>	2.6327
8b	Interferent CO <sub>2</sub> with 500 µmol/mol	≤ 5.0 nmol/mol (Zero) ≤ 5.0 nmol/mol (Span)	0.700 2.000	U <sub>int,pos</sub> or	0.7313
8c	Interferent NH <sub>3</sub> mit 200 nmol/mol	≤ 5.0 nmol/mol (Zero) ≤ 5.0 nmol/mol (Span)	0.300 1.300	U <sub>int,neg</sub>	
9	Averaging effect	≤ 7.0% of measured value	1.900	U <sub>av</sub>	1.3166
10	Reproducibility standard deviation under field conditions	≤ 5.0% of average over 3 months	4.890	U <sub>r,f</sub>	26.1626
11	Long term drift at zero level	≤ 5.0 nmol/mol	-0.590	U <sub>d,l,z</sub>	0.1160
12	Long term drift at span level	≤ 5.0% of max. of certification range	0.790	U <sub>d,l,1h</sub>	0.2276
18	Difference sample/calibration port	≤ 1.0%	0.000	U <sub>asc</sub>	0.0000
21	Converter efficiency	≥ 98	98.400	U <sub>EC</sub>	2.8009
23	Uncertainty of test gas	≤ 3.0%	2.000	U <sub>cg</sub>	1.0941
Combined standard uncertainty				U <sub>c</sub>	5.9843
Expanded standard uncertainty				U	11.9687
Relative expanded uncertainty				W	11.44
Maximum allowed expanded uncertainty				W <sub>req</sub>	15
					nmol/mol
					nmol/mol
					%
					%

Calculation of overall uncertainty lab and field test (Device 2)

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

# CONFIRMATION

Notification on changes according to EN 15267 regarding  
certificate 0000040328 dated 29 April 2014

**Measuring system:** AC32M for NO, NO<sub>2</sub> und NO<sub>x</sub>

**Manufacturer:** Environnement S.A.  
111 Boulevard Robespierre  
78304 Poissy Cedex  
France

## German Federal Environmental Agency (UBA)

**Announcement about the uniform practice in  
monitoring emissions and ambient air.**

**22 July 2015**

**Federal Gazette: BAnz AT 26 August 2015 B4**

**V Notifications to the uniform practice for the continuous monitoring of  
emission and ambient air:**

- 51** Notification as regards Federal Environment Agency (UBA) notices of 12 April 2007  
(Federal Gazette (BAnz.) p. 4139, chapter III number 4.1) and of 27 February 2014  
(Federal Gazette (BAnz.) AT 1 April 2014 B12, chapter VI 18<sup>th</sup> notification)

The current software version for the AC32M measuring system for NO, NO<sub>2</sub> and NO<sub>x</sub>,  
manufactured by Environnement S.A., is:

v1.02 (Calculation process)

v3.6.b (Display process)

For additional means of communication, the AMS was equipped with a USB and a  
TCP/IP interface.

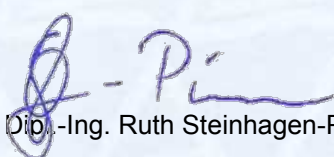
The ozone generator was optimised and now carries the designation B01-5005-1.

The pressure sensors in the measurement chamber and within the sample gas stream  
have been replaced in each case by one sensor of the type C06-C5-0291-A.

The high voltage supply was replaced by one of the type PS1800N/12F.

Statement of TÜV Rheinland Energie und Umwelt GmbH of 14 March 2015

TÜV Rheinland Energie und Umwelt GmbH  
Cologne, 04 November 2015

  
i. A. Dipl.-Ing. Ruth Steinhausen-Pinnow

  
i. A. Dipl. Ing. Carsten Röllig

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TÜV Rheinland Energie und Umwelt GmbH  
Am Grauen Stein  
51105 Cologne

Test institute accredited to EN ISO/IEC 17025:2005 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.