CERTIFICATE

of Product Conformity (QAL1)

Certificate No.: 0000087851_00

Certified AMS:	APMA-380 for Carbon monoxide
Manufacturer:	HORIBA Europe GmbH Hans-Mess-Str. 6 61440 Oberursel Germany
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 14626 (2012), EN 14626 (2024) 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 11 pages).

TÜVRheinland® CERTIFIED

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

www.tuv.com
ID 0000087851

Publication in the German Federal Gazette (BAnz) of 31 October 2025

German Environment Agency

Dessau, 23 March 2026

This certificate will expire on:
22 March 2031

TÜV Rheinland
Energy & Environment GmbH
Cologne, 20 March 2026

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51105 Köln

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/21262682/A dated 7 February 2025
Initial certification:	23 March 2026
Expiry date:	22 March 2031
Publication:	BAnz AT 31.10.2025 B5, chapter III No. 1.1

Approved application

The tested AMS is suitable for continuous ambient air measurement of CO 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 at a location close to traffic.

The AMS is approved for an ambient temperature range of +0 °C to +40 °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/21262682/A dated 7 February 2025 of TÜV Rheinland Energy & Environment 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 31.10.2025 B5, chapter III No. 1.1, Announcement by UBA dated 27 August 2025:

AMS designation:
APMA-380 for carbon monoxide

Manufacturer:
Horiba Europe GmbH, Oberursel, Germany

Field of application:
For continuous ambient air monitoring of CO (stationary operation)

Measuring ranges during the performance test:

Component	Certification range	Unit
CO	0 – 100	mg/m³

Software versions:

A7:	P2002638C	1.01
M4:	P2002642B	1.00
Analyzer:	P2002584C	1.02
FPGA:	P2002759A	1.01

Restrictions:
None

Notes:
1. The measuring system also fulfils the requirements of EN 14626:2024.
2. The test report on the suitability test can be viewed on the internet at www.qal1.de.

Test Report:
TÜV Rheinland Energy & Environment GmbH, Cologne
Report No.: EuL/21262682/A dated 7 February 2025

Certified product

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

The APMA-380 ambient air monitoring system is a continuous carbon monoxide analyser. The measuring principle is based on non-dispersive infrared photometry. The device was developed for the continuous measurement of carbon monoxide in ambient air.

The measuring principle is based on the determination of light absorption by the gas to be measured in the wavelength ranges characteristic of the gas. The evaluation is carried out by measuring the absorption on the basis of the dependence between the gas concentration and the amount of absorbed light according to Lambert-Beer's law:

$$I = I_0 * e^{-(\alpha L c)}$$

I	Intensity with absorption
I_0	Light intensity without absorption
L	Path travelled by the light during absorption
c	Concentration of the absorbing gas, in this case CO
α	Absorption coefficient (this provides information about the degree of absorption)

The non-dispersive infrared absorption method (NDIR), which is the measuring principle of the APMA-380, utilises the property that CO absorbs infrared rays in a specific wavelength range. The CO concentration is measured by alternately introducing a sample gas and a reference gas that does not contain CO into the measuring cell in a constant cycle and amplifying the signal difference between the two gases. If no CO is present in the sample gas, there is no signal difference between the sample gas and the reference gas. Accordingly, the zero point is always stable and no zero point drift occurs. The detectors consist of a detector for measurement, which mainly measures CO, and a detector for interference correction, which mainly measures moisture, which is a component of the interference gas. The product is designed to obtain extremely accurate readings by using these two detectors for measurement and simultaneous interference correction.

The APMA-380 analyser uses a heated infrared source to generate a beam of broadband IR light of known intensity (measured during instrument calibration). This beam is passed through the measurement chamber, which is filled with sample gas, several times. The measuring chamber uses mirrors at each end to send the IR beam back and forth through the chamber several times to create a long absorption path. The absolute length travelled by the reflected light is directly related to the intended accuracy of the instrument. The lower the concentrations the device is designed to detect, the longer the light path must be to produce detectable attenuation.
As it exits the measurement chamber, the light beam passes through a bandpass filter, which allows only light with a wavelength of 4.7 µm to pass through. Finally, the beam strikes a photodetector, which converts the light signal into a modulated voltage signal representing the attenuated intensity of the beam.

Technical data APMA-380:

Measuring range:	Maximum 0-300 ppm (selectable)
Units:	ppm / mg/m³
Measured compounds:	Carbon monoxide
Sample flow:	Approx. 1.5 litres/min (during the test)
Outputs:	Ethernet TCP/IP
	Modbus
	Serial interface, RS232
	0 - 1/5/10 Volt analogue
	4 - 20 mA analogue
	USB Interface
Input voltage:	100 V to 240 V, 50 Hz or 60 Hz
Power:	90 W; maximum 130 W
Dimensions (L x W x H):	568 x 430 x 221 mm
Weight:	Approx. 16 kg

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 request of 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 APMA-380 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. 0000087851_00: 23 March 2026
Expiry date of the certificate: 22 March 2031
Test report: EuL/21262682/A dated 7 February 2025
TÜV Rheinland Energy & Environment GmbH
Publication: BAnz AT 31.10.2025 B5, chapter III number 1.1
UBA announcement dated 27 August 2025

Overall uncertainty according to EN 14626 (2012)

Expanded uncertainty laboratory, system 1

Measuring device:	APMA 380				Serial-No.:	8R1M02V4	
Measured component:	CO				8h-limit value:	8.62	µmol/mol

No.	Performance characteristic	Performance criterion	Result	Partial uncertainty		Square of partial uncertainty
1	Repeatability standard deviation at zero	≤ 0.3 µmol/mol	0.000	$u_{r,z}$	0.00	0.0000
2	Repeatability standard deviation at 8h-limit value	≤ 0.4 µmol/mol	0.020	u_r	0.00	0.0000
3	"lack of fit" at 8h-limit value	≤ 4.0% of measured value	0.710	u_l	0.04	0.0012
4	Sensitivity coefficient of sample gas pressure at 8h-limit value	≤ 0.7 µmol/mol/kPa	0.050	u_{gp}	0.11	0.0132
5	Sensitivity coefficient of sample gas temperature at 8h-limit value	≤ 0.3 µmol/mol/K	0.000	u_{gt}	0.00	0.0000
6	Sensitivity coefficient of surrounding temperature at 8h-limit value	≤ 0.3 µmol/mol/K	0.032	u_{st}	0.07	0.0054
7	Sensitivity coefficient of electrical voltage at 8h-limit value	≤ 0.3 µmol/mol/V	0.000	u_V	0.00	0.0000
8a	Interferent H_2O with 19 mmol/mol	≤ 1.0 µmol/mol (Zero)	-0.090	u_{H2O}	0.00	0.0000
		≤ 1.0 µmol/mol (Span)	0.000			
8b	Interferent CO_2 with 500 µmol/mol	≤ 0.5 µmol/mol (Zero)	0.000	$u_{int,pos}$	0.03	0.0011
		≤ 0.5 µmol/mol (Span)	0.000			
8c	Interferent NO with 1 µmol/mol	≤ 0.5 µmol/mol (Zero)	-0.050	or		
		≤ 0.5 µmol/mol (Span)	0.040			
8d	Interferent N_2O with 50 nmol/mol	≤ 0.5 µmol/mol (Zero)	-0.020			
		≤ 0.5 µmol/mol (Span)	0.020	$u_{int,neg}$		
9	Averaging effect	≤ 7.0% of measured value	-0.800	u_{av}	-0.04	0.0016
18	Difference sample/calibration port	≤ 1.0%	-0.030	$u_{\Delta sc}$	0.00	0.0000
21	Uncertainty of test gas	≤ 3.0%	2.000	u_{cg}	0.09	0.0074

Combined standard uncertainty	u_c	0.1731	µmol/mol
Expanded uncertainty	U	0.3462	µmol/mol
Relative expanded uncertainty	W	4.02	%
Maximum allowed expanded uncertainty	W_{req}	15	%

Expanded uncertainty laboratory, system 2

Measuring device:	APMA 380				Serial-No.:	17F8J2F3	
Measured component:	CO				8h-limit value:	8.62	µmol/mol

No.	Performance characteristic	Performance criterion	Result	Partial uncertainty		Square of partial uncertainty
1	Repeatability standard deviation at zero	≤ 0.3 µmol/mol	0.000	$u_{r,z}$	0.00	0.0000
2	Repeatability standard deviation at 8h-limit value	≤ 0.4 µmol/mol	0.000	u_r	0.00	0.0000
3	"lack of fit" at 8h-limit value	≤ 4.0% of measured value	0.700	u_l	0.03	0.0012
4	Sensitivity coefficient of sample gas pressure at 8h-limit value	≤ 0.7 µmol/mol/kPa	0.050	u_{gp}	0.11	0.0132
5	Sensitivity coefficient of sample gas temperature at 8h-limit value	≤ 0.3 µmol/mol/K	0.000	u_{gt}	0.00	0.0000
6	Sensitivity coefficient of surrounding temperature at 8h-limit value	≤ 0.3 µmol/mol/K	0.042	u_{st}	0.10	0.0093
7	Sensitivity coefficient of electrical voltage at 8h-limit value	≤ 0.3 µmol/mol/V	0.000	u_V	0.00	0.0000
8a	Interferent H_2O with 19 mmol/mol	≤ 1.0 µmol/mol (Zero)	-0.040	u_{H2O}	0.00	0.0000
		≤ 1.0 µmol/mol (Span)	0.000			
8b	Interferent CO_2 with 500 µmol/mol	≤ 0.5 µmol/mol (Zero)	0.000	$u_{int,pos}$	0.01	0.0001
		≤ 0.5 µmol/mol (Span)	0.000			
8c	Interferent NO with 1 µmol/mol	≤ 0.5 µmol/mol (Zero)	-0.050			
		≤ 0.5 µmol/mol (Span)	-0.020	or		
8d	Interferent N_2O with 50 nmol/mol	≤ 0.5 µmol/mol (Zero)	0.000			
		≤ 0.5 µmol/mol (Span)	0.000	$u_{int,neg}$		
9	Averaging effect	≤ 7.0% of measured value	-0.800	u_{av}	-0.04	0.0016
18	Difference sample/calibration port	≤ 1.0%	-0.060	$u_{\Delta sc}$	-0.01	0.0000
21	Uncertainty of test gas	≤ 3.0%	2.000	u_{cg}	0.09	0.0074

Combined standard uncertainty	u_c	0.1814	µmol/mol
Expanded uncertainty	U	0.3627	µmol/mol
Relative expanded uncertainty	W	4.21	%
Maximum allowed expanded uncertainty	W_{req}	15	%

Combined uncertainty, laboratory and field, system 1

Measuring device:	APMA 380					Serial-No.:	8R1M02V4	
Measured component:	CO					8h-limit value:	8.62	µmol/mol

No.	Performance characteristic		Performance criterion	Result	Partial uncertainty		Square of partial uncertainty	
1	Repeatability standard deviation at zero	≤	0.3 µmol/mol	0.000	$u_{r,z}$	0.00	0.0000	
2	Repeatability standard deviation at 8h-limit value	≤	0.4 µmol/mol	0.020	u_r	not considered, as ur = 0 < ur,f	-	
3	"lack of fit" at 8h-limit value	≤	4.0% of measured value	0.710	u_l	0.04	0.0012	
4	Sensitivity coefficient of sample gas pressure at 8h-limit value	≤	0.7 µmol/mol/kPa	0.050	u_{gp}	0.11	0.0132	
5	Sensitivity coefficient of sample gas temperature at 8h-limit value	≤	0.3 µmol/mol/K	0.000	u_{gt}	0.00	0.0000	
6	Sensitivity coefficient of surrounding temperature at 8h-limit value	≤	0.3 µmol/mol/K	0.032	u_{st}	0.07	0.0054	
7	Sensitivity coefficient of electrical voltage at 8h-limit value	≤	0.3 µmol/mol/V	0.000	u_V	0.00	0.0000	
8a	Interferent H_2O with 19 mmol/mol	≤	1.0 µmol/mol (Zero)	-0.090	u_{H2O}	0.00	0.0000	
		≤	1.0 µmol/mol (Span)	0.000				
8b	Interferent CO_2 with 500 µmol/mol	≤	0.5 µmol/mol (Zero)	0.000	$u_{int,pos}$	0.03	0.0011	
		≤	0.5 µmol/mol (Span)	0.000				
8c	Interferent NO with 1 µmol/mol	≤	0.5 µmol/mol (Zero)	-0.050	or			
		≤	0.5 µmol/mol (Span)	0.040				
8d	Interferent N_2O with 50 nmol/mol	≤	0.5 µmol/mol (Zero)	-0.020				
		≤	0.5 µmol/mol (Span)	0.020	$u_{int,neg}$			
9	Averaging effect	≤	7.0% of measured value	-0.800	u_{av}	-0.04	0.0016	
10	Reproducibility standard deviation under field conditions	≤	5.0% of average over 3 months	2.550	$u_{r,f}$	0.22	0.0483	
11	Long term drift at zero level	≤	0.5 µmol/mol	0.150	$u_{d,l,z}$	0.09	0.0075	
12	Long term drift at span level	≤	5.0% of max. of certification range	-1.180	$u_{d,l,8h}$	-0.06	0.0034	
18	Difference sample/calibration port	≤	1.0%	-0.030	$u_{\Delta sc}$	0.00	0.0000	
21	Uncertainty of test gas	≤	3.0%	2.000	u_{cg}	0.09	0.0074	

Combined standard uncertainty	u_c	0.2987	µmol/mol
Expanded uncertainty	U	0.5974	µmol/mol
Relative expanded uncertainty	W	6.93	%
Maximum allowed expanded uncertainty	W_{req}	15	%

Combined uncertainty, laboratory and field, system 2

Measuring device:	APMA 380					Serial-No.:	17F8J2F3	
Measured component:	CO					8h-limit value:	8.62	µmol/mol

No.	Performance characteristic		Performance criterion	Result	Partial uncertainty		Square of partial uncertainty	
1	Repeatability standard deviation at zero	≤	0.3 µmol/mol	0.000	$u_{r,z}$	0.00	0.0000	
2	Repeatability standard deviation at 8h-limit value	≤	0.4 µmol/mol	0.000	u_r	not considered, as ur = 0 < ur,f	-	
3	"lack of fit" at 8h-limit value	≤	4.0% of measured value	0.700	u_l	0.03	0.0012	
4	Sensitivity coefficient of sample gas pressure at 8h-limit value	≤	0.7 µmol/mol/kPa	0.050	u_{gp}	0.11	0.0132	
5	Sensitivity coefficient of sample gas temperature at 8h-limit value	≤	0.3 µmol/mol/K	0.000	u_{gt}	0.00	0.0000	
6	Sensitivity coefficient of surrounding temperature at 8h-limit value	≤	0.3 µmol/mol/K	0.042	u_{st}	0.10	0.0093	
7	Sensitivity coefficient of electrical voltage at 8h-limit value	≤	0.3 µmol/mol/V	0.000	u_V	0.00	0.0000	
8a	Interferent H_2O with 19 mmol/mol	≤	1.0 µmol/mol (Zero)	-0.040	u_{H2O}	0.00	0.0000	
		≤	1.0 µmol/mol (Span)	0.000				
8b	Interferent CO_2 with 500 µmol/mol	≤	0.5 µmol/mol (Zero)	0.000	$u_{int,pos}$	0.01	0.0001	
		≤	0.5 µmol/mol (Span)	0.000				
8c	Interferent NO with 1 µmol/mol	≤	0.5 µmol/mol (Zero)	-0.050				
		≤	0.5 µmol/mol (Span)	-0.020	or			
8d	Interferent N_2O with 50 nmol/mol	≤	0.5 µmol/mol (Zero)	0.000				
		≤	0.5 µmol/mol (Span)	0.000	$u_{int,neg}$			
9	Averaging effect	≤	7.0% of measured value	-0.800	u_{av}	-0.04	0.0016	
10	Reproducibility standard deviation under field conditions	≤	5.0% of average over 3 months	2.550	$u_{r,f}$	0.22	0.0483	
11	Long term drift at zero level	≤	0.5 µmol/mol	0.160	$u_{d,l,z}$	0.09	0.0085	
12	Long term drift at span level	≤	5.0% of max. of certification range	-2.470	$u_{d,l,8h}$	-0.12	0.0151	
18	Difference sample/calibration port	≤	1.0%	-0.060	$u_{\Delta sc}$	-0.01	0.0000	
21	Uncertainty of test gas	≤	3.0%	2.000	u_{cg}	0.09	0.0074	

Combined standard uncertainty	u_c	0.3238	µmol/mol
Expanded uncertainty	U	0.6476	µmol/mol
Relative expanded uncertainty	W	7.51	%
Maximum allowed expanded uncertainty	W_{req}	15	%

Overall uncertainty according to EN 14626 (2024)

Expanded uncertainty laboratory, system 1

Measuring device:	APMA 380				Serial-No.:	8R1M02V4	
Measured component:	CO				8h-limit value:	8.62	µmol/mol

No.	Performance characteristic	Performance criterion	Result	Partial uncertainty		Square of partial uncertainty
1	Repeatability standard deviation at zero	≤ 0.3 µmol/mol	0.000	$u_{r,z}$	0.00	0.0000
2	Repeatability standard deviation at 8h-limit value	≤ 0.4 µmol/mol	0.020	u_r	0.00	0.0000
3	"lack of fit" at 8h-limit value	≤ 4.0% of measured value	0.890	u_l	0.04	0.0020
4	Sensitivity coefficient of sample gas pressure at 8h-limit value	≤ 0.7 µmol/mol/kPa	0.070	u_{gp}	0.11	0.0115
5	Sensitivity coefficient of sample gas temperature at 8h-limit value	≤ 0.3 µmol/mol/K	0.000	u_{gt}	0.00	0.0000
6	Sensitivity coefficient of surrounding temperature at 8h-limit value	≤ 0.3 µmol/mol/K	0.023	u_{st}	0.06	0.0038
7	Sensitivity coefficient of electrical voltage at 8h-limit value	≤ 0.3 µmol/mol/V	0.000	u_V	0.00	0.0000
8a	Interferent H_2O with 19 mmol/mol	≤ 1.0 µmol/mol (Zero)	-0.090	u_{H2O}	0.00	0.0000
		≤ 1.0 µmol/mol (Span)	0.000			
8b	Interferent CO_2 with 500 µmol/mol	≤ 0.5 µmol/mol (Zero)	0.000	$u_{int,pos}$	0.03	0.0011
		≤ 0.5 µmol/mol (Span)	0.000			
8c	Interferent NO with 1 µmol/mol	≤ 0.5 µmol/mol (Zero)	-0.050	or		
		≤ 0.5 µmol/mol (Span)	0.040			
8d	Interferent N_2O with 500 nmol/mol	≤ 0.5 µmol/mol (Zero)	-0.020			
		≤ 0.5 µmol/mol (Span)	0.020	$u_{int,neg}$		
9	Averaging effect	≤ 7.0% of measured value	-0.800	u_{av}	-0.04	0.0016
18	Difference sample/calibration port	≤ 1.0%	-0.030	$u_{\Delta sc}$	0.00	0.0000
21	Uncertainty of test gas	≤ 3.0%	2.000	u_{cg}	0.09	0.0074

Combined standard uncertainty	u_c	0.1654	µmol/mol
Expanded uncertainty	U	0.3309	µmol/mol
Relative expanded uncertainty	W	3.84	%
Maximum allowed expanded uncertainty	W_{req}	15	%

Expanded uncertainty laboratory, system 2

Measuring device:	APMA 380				Serial-No.:	17F8J2F3	
Measured component:	CO				8h-limit value:	8.62	µmol/mol

No.	Performance characteristic	Performance criterion	Result	Partial uncertainty		Square of partial uncertainty
1	Repeatability standard deviation at zero	≤ 0.3 µmol/mol	0.000	$u_{r,z}$	0.00	0.0000
2	Repeatability standard deviation at 8h-limit value	≤ 0.4 µmol/mol	0.000	u_r	0.00	0.0000
3	"lack of fit" at 8h-limit value	≤ 4.0% of measured value	0.680	u_l	0.03	0.0011
4	Sensitivity coefficient of sample gas pressure at 8h-limit value	≤ 0.7 µmol/mol/kPa	0.070	u_{gp}	0.11	0.0115
5	Sensitivity coefficient of sample gas temperature at 8h-limit value	≤ 0.3 µmol/mol/K	0.000	u_{gt}	0.00	0.0000
6	Sensitivity coefficient of surrounding temperature at 8h-limit value	≤ 0.3 µmol/mol/K	0.033	u_{st}	0.09	0.0078
7	Sensitivity coefficient of electrical voltage at 8h-limit value	≤ 0.3 µmol/mol/V	0.000	u_V	0.00	0.0000
8a	Interferent H_2O with 19 mmol/mol	≤ 1.0 µmol/mol (Zero)	-0.040	u_{H2O}	0.00	0.0000
		≤ 1.0 µmol/mol (Span)	0.000			
8b	Interferent CO_2 with 500 µmol/mol	≤ 0.5 µmol/mol (Zero)	0.000	$u_{int,pos}$	0.01	0.0001
		≤ 0.5 µmol/mol (Span)	0.000			
8c	Interferent NO with 1 µmol/mol	≤ 0.5 µmol/mol (Zero)	-0.050			
		≤ 0.5 µmol/mol (Span)	-0.020	or		
8d	Interferent N_2O with 500 nmol/mol	≤ 0.5 µmol/mol (Zero)	0.000			
		≤ 0.5 µmol/mol (Span)	0.000	$u_{int,neg}$		
9	Averaging effect	≤ 7.0% of measured value	-0.800	u_{av}	-0.04	0.0016
18	Difference sample/calibration port	≤ 1.0%	-0.060	$u_{\Delta sc}$	-0.01	0.0000
21	Uncertainty of test gas	≤ 3.0%	2.000	u_{cg}	0.09	0.0074

Combined standard uncertainty	u_c	0.1722	µmol/mol
Expanded uncertainty	U	0.3443	µmol/mol
Relative expanded uncertainty	W	3.99	%
Maximum allowed expanded uncertainty	W_{req}	15	%

Umwelt Bundesamt

Certificate:
0000087851_00 / 23 March 2026

TÜVRheinland®
Precisely Right.

Combined uncertainty, laboratory and field, system 1

Measuring device:	APMA 380				Serial-No.:	8R1M02V4
Measured component:	CO				8h-limit value:	8.62 µmol/mol

No.	Performance characteristic	Performance criterion	Result	Partial uncertainty		Square of partial uncertainty
1	Repeatability standard deviation at zero	≤ 0.3 µmol/mol	0.000	$u_{r,z}$	0.00	0.0000
2	Repeatability standard deviation at 8h-limit value	≤ 0.4 µmol/mol	0.020	u_r	not considered, as ur = 0 < ur,f	-
3	"lack of fit" at 8h-limit value	≤ 4.0% of measured value	0.890	u_l	0.04	0.0020
4	Sensitivity coefficient of sample gas pressure at 8h-limit value	≤ 0.7 µmol/mol/kPa	0.070	u_{gp}	0.11	0.0115
5	Sensitivity coefficient of sample gas temperature at 8h-limit value	≤ 0.3 µmol/mol/K	0.000	u_{gt}	0.00	0.0000
6	Sensitivity coefficient of surrounding temperature at 8h-limit value	≤ 0.3 µmol/mol/K	0.023	u_{st}	0.06	0.0038
7	Sensitivity coefficient of electrical voltage at 8h-limit value	≤ 0.3 µmol/mol/V	0.000	u_V	0.00	0.0000
8a	Interferent H_2O with 19 mmol/mol	≤ 1.0 µmol/mol (Zero)	-0.090	u_{H2O}	0.00	0.0000
		≤ 1.0 µmol/mol (Span)	0.000			
8b	Interferent CO_2 with 500 µmol/mol	≤ 0.5 µmol/mol (Zero)	0.000	$u_{int,pos}$	0.03	0.0011
		≤ 0.5 µmol/mol (Span)	0.000			
8c	Interferent NO with 1 µmol/mol	≤ 0.5 µmol/mol (Zero)	-0.050	or		
		≤ 0.5 µmol/mol (Span)	0.040			
8d	Interferent N_2O with 500 nmol/mol	≤ 0.5 µmol/mol (Zero)	-0.020			
		≤ 0.5 µmol/mol (Span)	0.020	$u_{int,neg}$		
9	Averaging effect	≤ 7.0% of measured value	-0.800	u_{av}	-0.04	0.0016
10	Reproducibility standard deviation under field conditions	≤ 5.0% of average over 3 months	0.200	$u_{r,f}$	0.02	0.0003
11	Long term drift at zero level	≤ 0.5 µmol/mol	0.150	$u_{d,l,z}$	0.09	0.0075
12	Long term drift at span level	≤ 5.0% of max. of certification range	-1.180	$u_{d,l,8h}$	-0.06	0.0034
18	Difference sample/calibration port	≤ 1.0%	-0.030	$u_{\Delta sc}$	0.00	0.0000
21	Uncertainty of test gas	≤ 3.0%	2.000	u_{cg}	0.09	0.0074

Combined standard uncertainty	u_c	0.1965	µmol/mol
Expanded uncertainty	U	0.3930	µmol/mol
Relative expanded uncertainty	W	4.56	%
Maximum allowed expanded uncertainty	W_{req}	15	%

Combined uncertainty, laboratory and field, system 2

Measuring device:	APMA 380				Serial-No.:	17F8J2F3
Measured component:	CO				8h-limit value:	8.62 µmol/mol

No.	Performance characteristic	Performance criterion	Result	Partial uncertainty		Square of partial uncertainty
1	Repeatability standard deviation at zero	≤ 0.3 µmol/mol	0.000	$u_{r,z}$	0.00	0.0000
2	Repeatability standard deviation at 8h-limit value	≤ 0.4 µmol/mol	0.000	u_r	not considered, as ur = 0 < ur,f	-
3	"lack of fit" at 8h-limit value	≤ 4.0% of measured value	0.680	u_l	0.03	0.0011
4	Sensitivity coefficient of sample gas pressure at 8h-limit value	≤ 0.7 µmol/mol/kPa	0.070	u_{gp}	0.11	0.0115
5	Sensitivity coefficient of sample gas temperature at 8h-limit value	≤ 0.3 µmol/mol/K	0.000	u_{gt}	0.00	0.0000
6	Sensitivity coefficient of surrounding temperature at 8h-limit value	≤ 0.3 µmol/mol/K	0.033	u_{st}	0.09	0.0078
7	Sensitivity coefficient of electrical voltage at 8h-limit value	≤ 0.3 µmol/mol/V	0.000	u_V	0.00	0.0000
8a	Interferent H_2O with 19 mmol/mol	≤ 1.0 µmol/mol (Zero)	-0.040	u_{H2O}	0.00	0.0000
		≤ 1.0 µmol/mol (Span)	0.000			
8b	Interferent CO_2 with 500 µmol/mol	≤ 0.5 µmol/mol (Zero)	0.000	$u_{int,pos}$	0.01	0.0001
		≤ 0.5 µmol/mol (Span)	0.000			
8c	Interferent NO with 1 µmol/mol	≤ 0.5 µmol/mol (Zero)	-0.050			
		≤ 0.5 µmol/mol (Span)	-0.020	or		
8d	Interferent N_2O with 500 nmol/mol	≤ 0.5 µmol/mol (Zero)	0.000			
		≤ 0.5 µmol/mol (Span)	0.000	$u_{int,neg}$		
9	Averaging effect	≤ 7.0% of measured value	-0.800	u_{av}	-0.04	0.0016
10	Reproducibility standard deviation under field conditions	≤ 5.0% of average over 3 months	0.200	$u_{r,f}$	0.02	0.0003
11	Long term drift at zero level	≤ 0.5 µmol/mol	0.160	$u_{d,l,z}$	0.09	0.0085
12	Long term drift at span level	≤ 5.0% of max. of certification range	-2.470	$u_{d,l,8h}$	-0.12	0.0151
18	Difference sample/calibration port	≤ 1.0%	-0.060	$u_{\Delta sc}$	-0.01	0.0000
21	Uncertainty of test gas	≤ 3.0%	2.000	u_{cg}	0.09	0.0074

Combined standard uncertainty	u_c	0.2315	µmol/mol
Expanded uncertainty	U	0.4630	µmol/mol
Relative expanded uncertainty	W	5.37	%
Maximum allowed expanded uncertainty	W_{req}	15	%