Umwelt Bundesamt

TÜVRheinland®
Precisely Right.

CERTIFICATE

of Product Conformity (QAL1)

Certificate No. : 0000025931_01

Certified AMS:	ZRE and ZRE/ZFK7 for CO, NO, SO_2 and O_2
Manufacturer:	Fuji Electric Co., Ltd. No. 1, Fuji-machi, Hino-city Tokyo 191-8502 Japan
Test Institute:	TÜV Rheinland Energie und Umwelt GmbH

This is to certify that the AMS has been tested and found to comply with:

EN 15267-1: 2009, EN 15267-2: 2009, EN 15267-3: 2008 and EN 14181: 2004

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

TÜVRheinland® CERTIFIED

Suitability Tested
EN 15267
QAL1 Certified
Regular
Surveillance

www.tuv.com
ID 0000025931

Publication in the German Federal Gazette (BAnz.) of 12 February 2010

This certificate will expire on:
11 February 2020

German Federal Environment Agency
Dessau, 2 February 2015

i. A. Dr. Marcel Langner

TÜV Rheinland Energie und Umwelt GmbH
Cologne, 30 January 2015

ppa. Dr. Peter Wilbring

www.umwelt-tuv.de / **www.eco-tuv.com** teu@umwelt-tuv.de Tel. +49 221 806-5200	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.	

10/221 2.08

Test report:	936/21210059/A of 21 October 2009
Initial certification:	12 February 2010
Certificate:	renewal (previous certificate 0000025931 of 10 March 2010 valid until 11 February 2015)
Expiry date:	11 February 2020
Publication:	BAnz. 12 February 2010, no. 24, p. 552, chapter I, no. 1.1

Approved application
The tested AMS is suitable for use at large combustion plants according to Directive 2001/80/EC and the German Technical Instruction on Air Quality Control as long as the daily mean values for carbon monoxide, sulphur dioxide and nitrogen oxide that shall be monitored do not fall below 120 / 230 / 125 mg/m³. The instrument cannot be used at plants where N_2O concentrations higher than 30 mg/m³ are to be expected.

The suitability of the AMS for this application was assessed on the basis of a laboratory test and a field test at a municipal waste incineration plant.

The AMS is approved for an ambient temperature range of 5 °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 valid at the time of performance testing. As changes in legal regulations are possible, any potential user should ensure that this AMS is suitable for monitoring the limit values relevant to the application.

Any potential user should ensure, in consultation with the manufacturer, that this AMS is suitable for the installation at which it will be installed.

Basis of the certification
This certification is based on:

- test report 936/21210059/A dated 21 October 2009 of TÜV Rheinland Immissionsschutz und Energiesysteme 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. 12 February 2010, no. 24, p. 552, chapter I, no. 1.1, UBA announcement of 25 January 2010)
- publication in the German Federal Gazette (BAnz. 29 July 2011, no. 113, p. 2725, chapter III, notification 9, UBA announcement of 15 July 2011)
- publication in the German Federal Gazette (BAnz. 2 March 2012, no. 36, p. 920, chapter V, notification 7, UBA announcement of 23 February 2012)
- publication in the German Federal Gazette (BAnz AT 5 August 2014 B11, chapter V, notification 7, UBA announcement of 17 July 2014)

AMS designation:
ZRE and ZRE/ZFK7 for NO, SO_2, CO and O_2

Manufacturer:
Fuji Electric Systems Co., Ltd., Tokyo, Japan

Field of application:
For plants according to Directive 2001/80/EC and the German Technical Instruction on Air Quality Control

Measuring ranges during the performance test:

Component	Certification-range	Supplementary range	Unit
CO	**0 - 125**	0 - 1250	mg/m³
NO	**0 - 268**	0 - 2680	mg/m³
SO_2	**0 - 571**	0 - 5710	mg/m³
O_2 (Pa.*)	**0 - 25**	0 - 10	Vol.-%
O_2 (Zi.**)	**0 - 25**	0 - 10	Vol.-%

* Pa. = paramagnetic
** Zi. = zirconium oxide

Software version:
1.02

Restrictions:
1. The requirements with regard to measurement uncertainty in accordance with EN 15267-3 are fulfilled for a daily average limit value of 120 mg/m³ for CO.
2. The requirements with regard to measurement uncertainty in accordance with EN 15267-3 are fulfilled for a daily average limit value of 230 mg/m³ for SO_2.
3. The requirements with regard to measurement uncertainty in accordance with EN 15267-3 are fulfilled for a daily average limit value of 125 mg/m^3 for NO.
4. The measuring system is not suitable for plants where N_2O concentrations in the stack gas exceed 30 mg/m³.

Notes:
1. Either the paramagnetic or the zirconia oxygen sensor may be used for measuring O_2:
   Version ZRE: NO, SO_2, CO and O_2 (Pa)
   Version ZRE/ZFK7: NO, SO_2, CO and O_2 (Zi)
2. The maintenance interval is four weeks.
3. An automatic zero point calibration must be carried out at least once every 24 h.
4. Test gases shall be fed via the dynamic injector at least once every three months (control of the gas line and gas processing).
5. An AMS of identical design is also distributed by the company ETA, Rue Einstein, BP60129, 62220 Carvin, France.

Test report:
TÜV Rheinland Immissionsschutz und Energiesysteme GmbH, Cologne
Report no.: 936/21210059/A of 21 October 2009

9 Notification as regards Federal Environment Agency notices of 25 January 2010 (BAnz. p. 552, chapter I, no. 1.1)

The current software version of the measuring system ZRE und ZRE/ZFK7 manufactured by Fuji Electric Systems Co., Ltd. is:

1.03

Statement of TÜV Rheinland Energie und Umwelt GmbH of 24 March 2011

7 Notification as regards Federal Environment Agency notices of 25 January 2010 (Federal Gazette (BAnz.) p. 552, chapter I, no. 1.1) and 15 July 2011 (Federal Gazette (BAnz.) p. 2725, chapter III, 9th notification)

The company Fuji Electric Systems Co., Ltd., manufacturer of the ZRE and ZRE/ZFK7 measuring system for NO, SO_2, CO and O_2, was renamed. The new company name is:

Fuji Electric Co., Ltd.

Statement of TÜV Rheinland Energie und Umwelt GmbH of 26 September 2011

7 Notification as regards Federal Environmental Agency notices of 25 January 2010 (Federal Gazette (BAnz.) p. 552, chapter I, no. 1.1) and of 23 February 2012 (Federal Gazette (BAnz.) p. 920, chapter V, 7th notification)

The ZRE and ZRE/ZFK7 measuring systems for monitoring CO, NO, SO_2 and O_2 manufactured by Fuji Electric Co., Ltd. will hereafter be distributed with the P1.1E pump manufactured by Bühler Technologies GmbH.

Statement of TÜV Rheinland Energie und Umwelt GmbH of 12 March 2014

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

The AMS is a non-dispersive infrared gas analyser (NDIR analyser) based on the single-beam principle for the determination of CO, SO_2 and NO. A paramagnetic sensor or, alternatively, a zirconia cell (ZFK7) may be installed for the determination of O_2.

The ZRE option consists of a NDIR analyser and a paramagnetic O_2 analyser. The sample gas is divided into three partial flows: one flow passes through the converters and the optical bench for NO detection, another partial flow passes the optical bench for CO and SO_2 detection, and the third partial flow passes through the paramagnetic sensor.

The ZRE/ZFK7 option consists of the NDIR analyser and a zirconium sensor for detecting O_2. Here, the measuring gas is divided into two partial gas flows: one flow passes through the converters and the optical bench for NO detection and the other one passes through the optical bench for CO and SO_2 detection, followed by the zirconium oxygen sensor.
The ZFK7 analyser is connected to the ZRE analyser in a way that allows operation, parameterisation and output of all measured values via the ZRE analyser.

The systems are equipped with a probe manufactured by TECNOVA HT PERO-MI (type AGP04), a cooler manufactured by M&C, type ECM-2 G/SR 25.2, ZDL021 converters manufactured by Fuji Electric Systems Co., Ltd., Japan, and, as an option if the measuring gas contains NH_3, with a scrubber of the AS-series manufactured by Permapure. The cabinet is equipped with a cooling unit.

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.

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 its expiration is also accessible on the internet: **qal1.de**.

Certification of ZRE and ZRE/ZFK7 for NO, SO_2, CO and O_2 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. 0000025931: 10 March 2010

Expiry date of the certificate: 11 February 2015

Test report: 936/21210059/A of 21 October 2009
TÜV Rheinland Immissionsschutz und Energiesysteme GmbH, Cologne

Publication: BAnz. 12 February 2010, no. 24, p. 552, chapter I, no. 1.1
UBA announcement of 25 January 2010

Notifications

Statement of TÜV Rheinland Energie und Umwelt GmbH of 24 March 2011
Publication: BAnz. 29 July 2011, no. 113, p. 2725, chapter III, notification 9 (new software version)
UBA announcement of 15 July 2011

Statement of TÜV Rheinland Energie und Umwelt GmbH of 26 September 2011
Publication: BAnz. 2 March 2012, no. 36, p. 920, chapter V, notification 7 (change of manufacturer name)
UBA announcement of 23 February 2012

Statement of TÜV Rheinland Energie und Umwelt GmbH of 12 March 2014
Publication: BAnz AT 5 August 2014 B11, chapter V, notification 7 (change of pump)
UBA announcement of 17 July 2014

Renewal of the certificate

Certificate No. 0000025931_01 2 February 2015

Expiry date of the certificate: 11 February 2020

Calculation of overall uncertainty for QAL1 in EN 14181 and EN 15267-3

Manufacturer data

Manufacturer	Fuji Electric Systems Co., Ltd
Name of measuring system	ZRE
Serial Number	100AC01 / 100AC02
Measuring Principle	NDIR

TÜV Data

Approval Report	936/21210059/A / 2009-10-21
Editor	Steinhagen
Date	2009-10-19

Measurement Component	SO_2
Certificated range	571 mg/m³

Evaluation of the cross sensitivity (CS)

Sum of positive CS at zero point	3.60 mg/m³
Sum of negative CS at zero point	0.00 mg/m³
Sum of postive CS at reference point	19.87 mg/m³
Sum of negative CS at reference point	-2.97 mg/m³
Maximum sum of cross sensitivities	19.87 mg/m³
Uncertainty of cross sensitivity	11.47 mg/m³

Calculation of the combined standard uncertainty

Test Value		u	u²
Standard deviation from paired measurements under field conditions *	u_D	2.108 mg/m³	4.444 (mg/m³)²
Lack of fit	u_{lof}	0.635 mg/m³	0.403 (mg/m³)²
Zero drift from field test	$u_{d,z}$	-2.670 mg/m³	7.129 (mg/m³)²
Span drift from field test	$u_{d,s}$	-7.810 mg/m³	60.996 (mg/m³)²
Influence of ambient temperature at span	u_t	8.307 mg/m³	69.006 (mg/m³)²
Influence of supply voltage	u_v	0.500 mg/m³	0.250 (mg/m³)²
Cross sensitivity (interference)	u_i	11.472 mg/m³	131.616 (mg/m³)²
Influence of sample gas flow	u_p	-1.717 mg/m³	2.948 (mg/m³)²
Uncertainty of reference material at 70% of certification range	u_{rm}	4.615 mg/m³	21.301 (mg/m³)²

* The bigger value of: "Repeatability standard deviation at span" or "Standard deviation from paired measurements under field conditions"

Combined standard uncertainty (u_C)	$u_c = \sqrt{\sum (u_{max,i})^2}$	17.27 mg/m³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	33.84 mg/m³

Relative total expanded uncertainty	**U in % of the ELV 230 mg/m³**	**14.7**
Requirement of 2000/76/EC and 2001/80/EC	**U in % of the ELV 230 mg/m³**	**20.0**
Requirement of EN 15267-3	U in % of the ELV 230 mg/m³	15.0

Calculation of overall uncertainty for QAL1 in EN 14181 and EN 15267-3

Manufacturer data	
Manufacturer	Fuji Electric Systems Co., Ltd
Name of measuring system	ZRE
Serial Number	100AC01 / 100AC02
Measuring Principle	NDIR
TÜV Data	
Approval Report	936/21210059/A / 2009-10-21
Editor	Steinhagen
Date	2009-10-19
Measurement Component	CO
Certificated range	125 mg/m³

Evaluation of the cross sensitivity (CS)	
Sum of positive CS at zero point	2.15 mg/m³
Sum of negative CS at zero point	0.00 mg/m³
Sum of postive CS at reference point	3.86 mg/m³
Sum of negative CS at reference point	-0.63 mg/m³
Maximum sum of cross sensitivities	3.86 mg/m³
Uncertainty of cross sensitivity	2.23 mg/m³

Calculation of the combined standard uncertainty

Test Value		u	u²
Standard deviation from paired measurements under field conditions *	u_D	1.604 mg/m³	2.573 (mg/m³)²
Lack of fit	u_{lof}	0.289 mg/m³	0.084 (mg/m³)²
Zero drift from field test	$u_{d,z}$	-0.274 mg/m³	0.075 (mg/m³)²
Span drift from field test	$u_{d,s}$	-1.667 mg/m³	2.779 (mg/m³)²
Influence of ambient temperature at span	u_t	2.498 mg/m³	6.240 (mg/m³)²
Influence of supply voltage	u_v	0.346 mg/m³	0.120 (mg/m³)²
Cross sensitivity (interference)	u_i	2.230 mg/m³	4.973 (mg/m³)²
Influence of sample gas flow	u_p	-0.361 mg/m³	0.130 (mg/m³)²
Uncertainty of reference material at 70% of certification range	u_{rm}	1.010 mg/m³	1.021 (mg/m³)²

* The bigger value of: "Repeatability standard deviation at span" or "Standard deviation from paired measurements under field conditions"

Combined standard uncertainty (u_C)	$u_c = \sqrt{\sum (u_{max,j})^2}$	4.24 mg/m³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	8.31 mg/m³

Relative total expanded uncertainty	**U in % of the ELV 120 mg/m³**	**6.9**
Requirement of 2000/76/EC and 2001/80/EC	**U in % of the ELV 120 mg/m³**	**10.0**
Requirement of EN 15267-3	U in % of the ELV 120 mg/m³	7.5

Calculation of overall uncertainty for QAL1 in EN 14181 and EN 15267-3

Manufacturer data

Manufacturer	Fuji Electric Systems Co., Ltd
Name of measuring system	ZRE
Serial Number	100AC01 / 100AC02
Measuring Principle	NDIR

TÜV Data

Approval Report	936/21210059/A / 2009-10-21
Editor	Steinhagen
Date	2009-10-19

Measurement Component	NO
Certificated range	268 mg/m³

Evaluation of the cross sensitivity (CS)

Sum of positive CS at zero point	3.59 mg/m³
Sum of negative CS at zero point	-1.96 mg/m³
Sum of postive CS at reference point	2.17 mg/m³
Sum of negative CS at reference point	-2.06 mg/m³
Maximum sum of cross sensitivities	3.59 mg/m³
Uncertainty of cross sensitivity	2.07 mg/m³

Calculation of the combined standard uncertainty

Test Value		u	u²
Standard deviation from paired measurements under field conditions *	u_D	1.324 mg/m³	1.753 (mg/m³)²
Lack of fit	u_{lof}	-0.242 mg/m³	0.059 (mg/m³)²
Zero drift from field test	$u_{d,z}$	1.070 mg/m³	1.145 (mg/m³)²
Span drift from field test	$u_{d,s}$	4.350 mg/m³	18.923 (mg/m³)²
Influence of ambient temperature at span	u_t	5.689 mg/m³	32.365 (mg/m³)²
Influence of supply voltage	u_v	0.462 mg/m³	0.213 (mg/m³)²
Cross sensitivity (interference)	u_i	2.073 mg/m³	4.299 (mg/m³)²
Influence of sample gas flow	u_p	0.097 mg/m³	0.009 (mg/m³)²
Uncertainty of reference material at 70% of certification range	u_{rm}	2.166 mg/m³	4.693 (mg/m³)²

* The bigger value of: "Repeatability standard deviation at span" or "Standard deviation from paired measurements under field conditions"

Combined standard uncertainty (u_C)	$u_c = \sqrt{\sum (u_{max,j})^2}$	7.97 mg/m³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	15.61 mg/m³

Relative total expanded uncertainty	**U in % of the ELV 125 mg/m³**	**12.5**
Requirement of 2000/76/EC and 2001/80/EC	**U in % of the ELV 125 mg/m³**	**20.0**
Requirement of EN 15267-3	U in % of the ELV 125 mg/m³	15.0

Calculation of overall uncertainty for QAL1 in EN 14181 and EN 15267-3

Manufacturer data	
Manufacturer	Fuji Electric Systems Co., Ltd
Name of measuring system	ZRE
Serial Number	100AC01 / 100AC02
Measuring Principle	Paramagnetism
TÜV Data	
Approval Report	936/21210059/A / 2009-10-21
Editor	Steinhagen
Date	2009-10-19
Measurement Component	O_2
Certificated range	25 Vol.-%

Evaluation of the cross sensitivity (CS)

Sum of positive CS at zero point	0.00 Vol.-%
Sum of negative CS at zero point	0.00 Vol.-%
Sum of postive CS at reference point	0.14 Vol.-%
Sum of negative CS at reference point	0.00 Vol.-%
Maximum sum of cross sensitivities	0.14 Vol.-%
Uncertainty of cross sensitivity	0.08 Vol.-%

Calculation of the combined standard uncertainty

Test Value		u	u^2
Standard deviation from paired measurements under field conditions *	u_D	0.058 Vol.-%	0.003 (Vol.-%)²
Lack of fit	u_{lof}	0.040 Vol.-%	0.002 (Vol.-%)²
Zero drift from field test	$u_{d,z}$	-0.064 Vol.-%	0.004 (Vol.-%)²
Span drift from field test	$u_{d,s}$	0.110 Vol.-%	0.012 (Vol.-%)²
Influence of ambient temperature at span	u_t	0.184 Vol.-%	0.034 (Vol.-%)²
Influence of supply voltage	u_v	0.020 Vol.-%	0.000 (Vol.-%)²
Cross sensitivity (interference)	u_i	0.081 Vol.-%	0.007 (Vol.-%)²
Influence of sample gas flow	u_p	0.075 Vol.-%	0.006 (Vol.-%)²
Uncertainty of reference material at 70% of certification range	u_{rm}	0.202 Vol.-%	0.041 (Vol.-%)²

* The bigger value of: "Repeatability standard deviation at span" or "Standard deviation from paired measurements under field conditions"

Combined standard uncertainty (u_C)	$u_c = \sqrt{\sum (u_{max,j})^2}$	0.33 Vol.-%
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	0.65 Vol.-%

Relative total expanded uncertainty	**U in % of the range 25 Vol.-%**	**2.6**
Requirement of 2000/76/EC and 2001/80/EC	**U in % of the range 25 Vol.-%**	**10.0 ****
Requirement of EN 15267-3	U in % of the range 25 Vol.-%	7.5

** For this component no requirements in the EC-directives 2001/80/EC und 2000/76/EC are given. A value of 10 % was used for this.

Umwelt Bundesamt

Certificate:
0000025931_01 / 2 February 2015

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Calculation of overall uncertainty for QAL1 in EN 14181 and EN 15267-3

Manufacturer data

Manufacturer	Fuji Electric Systems Co., Ltd
Name of measuring system	ZFK7
Serial Number	100AC01 / 100AC02
Measuring Principle	zirconia

TÜV Data

Approval Report	936/21210059/A / 2009-10-21
Editor	Steinhagen
Date	2009-10-19

Measurement Component	O_2
Certificated range	25 Vol.-%

Evaluation of the cross sensitivity (CS)

Sum of positive CS at zero point	0.00 Vol.-%
Sum of negative CS at zero point	0.00 Vol.-%
Sum of postive CS at reference point	0.25 Vol.-%
Sum of negative CS at reference point	0.00 Vol.-%
Maximum sum of cross sensitivities	0.25 Vol.-%
Uncertainty of cross sensitivity	0.14 Vol.-%

Calculation of the combined standard uncertainty

Test Value		u	u^2
Standard deviation from paired measurements under field conditions *	u_D	0.051 Vol.-%	0.003 (Vol.-%)²
Lack of fit	u_{lof}	-0.040 Vol.-%	0.002 (Vol.-%)²
Zero drift from field test	$u_{d,z}$	-0.052 Vol.-%	0.003 (Vol.-%)²
Span drift from field test	$u_{d,s}$	0.098 Vol.-%	0.010 (Vol.-%)²
Influence of ambient temperature at span	u_t	0.231 Vol.-%	0.053 (Vol.-%)²
Influence of supply voltage	u_v	0.023 Vol.-%	0.001 (Vol.-%)²
Cross sensitivity (interference)	u_i	0.144 Vol.-%	0.021 (Vol.-%)²
Influence of sample gas flow	u_p	0.063 Vol.-%	0.004 (Vol.-%)²
Uncertainty of reference material at 70% of certification range	u_{rm}	0.202 Vol.-%	0.041 (Vol.-%)²

* The bigger value of: "Repeatability standard deviation at span" or "Standard deviation from paired measurements under field conditions"

Combined standard uncertainty (u_C)	$u_c = \sqrt{\sum (u_{max,j})^2}$	0.37 Vol.-%
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	0.72 Vol.-%

Relative total expanded uncertainty	**U in % of the range 25 Vol.-%**	**2.9**
Requirement of 2000/76/EC and 2001/80/EC	**U in % of the range 25 Vol.-%**	**10.0 ****
Requirement of EN 15267-3	U in % of the range 25 Vol.-%	7.5

** For this component no requirements in the EC-directives 2001/80/EC und 2000/76/EC are given. A value of 10 % was used for this.