

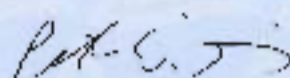
CERTIFICATE

TÜV Rheinland Immissionsschutz und Energiesysteme GmbH

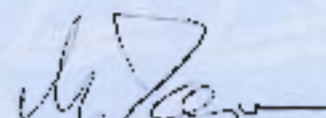
Manufacturer:	SICK MAIHAK GmbH
Measuring System:	MCS 100 E HW
Components:	CO, CO ₂ , NO, SO ₂ , HCl, NH ₃ , H ₂ O, O ₂
Test Report:	Eignungsprüfung 936/801010/A of 30.09.1999

The measurement system fulfils
the requirements of
QAL 1
according to EN 14181 and EN ISO 14956.

Köln, 26. Feb. 2007



i.V. Dr. P. Wilbring



i.A. Dipl.-Chem. M. Kerpa

www.umwelt-tuv.de / www.eco-tuv.com
tfe@umwelt-tuv.de
Tel. +49 - 221 - 806 - 2275

TÜV Rheinland Immissionsschutz und Energiesysteme GmbH
Am Grauen Stein,
51105 Köln

The company is accredited to DIN EN ISO/IEC 17025

DIN EN ISO 14958 and prEN 15267-3 calculation for QAL 1 in DIN EN 14181

Manufacturer data
 Manufacturer
 Measurement System
 Name
 Serial Number
 Measuring Principle

Sick UPA GmbH
 MGS 100 E HW
 Multicomponent
 SN 10 und SN 20
 Photometric

TÜV Data
 TÜV Report
 Date
 City

00RSC0012A
 30.09.1999
 Cr. Wülfring

Measurement Component

CO 15 mg/m³

Evaluation of the cross sensitivity (CS)

CS Δ_{meas}

- to 3 Vol.-% Oxygen
- to 21 Vol.-% Oxygen
- to 30 Vol.-% Humidity
- to 15 Vol.-% Carbon dioxide
- to 50 mg/m³ Methane
- to 20 mg/m³ Nitrogen monoxide
- to 300 mg/m³ Nitrogen monoxide
- to 50 mg/m³ Nitrogen dioxide
- to 20 mg/m³ Ammonia
- to 200 mg/m³ Sulphur dioxide
- to 1300 mg/m³ Sulphur dioxide
- to 60 mg/m³ Hydrogen chloride
- to 9,6 mg/m³ Methanol
- to 12,1 mg/m³ Formaldehyde
- to 9,7 mg/m³ Acetone
- to 15,3 mg/m³ Diisobutane

- 0,30 mg/m³
- 0,30 mg/m³
- 0,15 mg/m³
- 0,18 mg/m³
- 0,30 mg/m³
- 0,23 mg/m³
- 0,58 mg/m³
- 0,07 mg/m³
- 0,08 mg/m³
- 0,50 mg/m³
- 0,25 mg/m³
- 0,00 mg/m³
- 0,00 mg/m³
- 0,00 mg/m³
- 0,00 mg/m³
- 0,00 mg/m³

Sum of positive cross sensitivities
 Sum of negative cross sensitivities

0,65 mg/m³
 -1,35 mg/m³

Calculation of the combined standard uncertainty
Test Value

	ΔX_{meas}	$\Delta X_{\text{meas}} \cdot \sqrt{\frac{1}{J^2}}$	ΔX_{meas}^2
Lack of fit	u_1	0,68 mg/m ³	0,35
Biggest interference (positive or negative)	u_2	-1,08 mg/m ³	1,289
System shift in the field test	u_{10}	0,79 mg/m ³	0,207
Zero shift in the field test	u_{11}	0,00 mg/m ³	0,000
Sensitivity to sample volume flow	u_3	0,00 mg/m ³	0,000
Sensitivity to sample pressure	u_4	0,00 mg/m ³	0,000
Sensitivity to sample temperature	u_5	0,00 mg/m ³	0,000
Sensitivity to ambient temperature	u_6	1,35 mg/m ³	0,600
Dependence on supply voltage	u_7	0,00 mg/m ³	0,000
Repeatability at span	u_8	0,38 mg/m ³	0,047
Field reproducibility	u_9	0,64 mg/m ³	0,135
Uncertainty of the test gas at the reference point	u_{12}	1,50 mg/m ³	0,750

Combined standard uncertainty (u_c)

u_c

$$u_c = \sqrt{\sum u_{\text{meas}}^2}$$

1,902

Total expanded uncertainty

$(U, \cdot k)$

$$U_k = u_c \cdot 1,96$$

2,904

Relative total expanded uncertainty

Uc in % of the limit 50 mg/m³

5,8

Requirement

Uc in % of the limit 50 mg/m³

10,0

Result: Requirements keep to QAL 1 of EN 14181

DIN EN ISO 14956 and prEN 15267-3 calculation for QAL 1 in DIN EN 14181

Manufacturer data

Manufacturer	SICK MA/HAK GmbH
Measurement System	MOS 100 E HW
Name	Multicomponent
Serial Number	SN_19 and SN_20

TÜV Data

TÜV Report	936/908C10A
Date	30.09.1998
Editor	Dr. Weibung

Measurement Component	CO ₂	25	Vol.-%
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Evaluation of the cross sensitivity (CS)

to 3 Vol.-% Oxygen	CS: K_{max}	0,00 Vol.-%
to 21 Vol.-% Oxygen		0,00 Vol.-%
to 30 Vol.-% Humidity		0,00 Vol.-%
to 300 mg/m ³ Carbon monoxide		0,00 Vol.-%
to 50 mg/m ³ Methane		0,00 Vol.-%
to 20 mg/m ³ Nitrogen monoxide		0,00 Vol.-%
to 300 mg/m ³ Nitrogen monoxide		0,00 Vol.-%
to 30 mg/m ³ Nitrogen dioxide		0,00 Vol.-%
to 20 mg/m ³ Ammonia		0,00 Vol.-%
to 200 mg/m ³ Sulphur dioxide		0,00 Vol.-%
to 1000 mg/m ³ Sulphur dioxide		0,00 Vol.-%
to 60 mg/m ³ Hydrogen chloride		0,00 Vol.-%
to 96 mg/m ³ Methylal		0,00 Vol.-%
to 121 mg/m ³ Formaldehyde		0,00 Vol.-%
to 97 mg/m ³ Acetone		0,00 Vol.-%
to 15,3 mg/m ³ Dinitroethene		0,00 Vol.-%

Sum of positive cross sensitivities

0,10 Vol.-%

Sum of negative cross sensitivities

-0,05 Vol.-%

Calculation of the combined standard uncertainty

Test Value		ΔX_{max}	$U(X)_{max} = 1 \cdot \frac{\Delta X}{\sqrt{3}}$	$u(X)_{max}^2$
Leak off U_L	U_L	0,40 Vol.-%	0,23 Vol.-%	0,053
Biggest interference (positive or negative) U_i	U_i	0,10 Vol.-%	0,06 Vol.-%	0,003
Span shift in the field test U_{s1}	U_{s1}	0,25 Vol.-%	0,15 Vol.-%	0,023
Zero shift in the field test U_{s2}	U_{s2}	0,30 Vol.-%	0,00 Vol.-%	0,000
Sensitivity to sample volume flow U_{v1}	U_{v1}	0,00 Vol.-%	0,00 Vol.-%	0,000
Sensitivity to sample pressure U_{p1}	U_{p1}	0,00 Vol.-%	0,00 Vol.-%	0,000
Sensitivity to sample temperature U_{t1}	U_{t1}	0,00 Vol.-%	0,00 Vol.-%	0,000
Sensitivity to ambient temperature U_a	U_a	0,55 Vol.-%	0,32 Vol.-%	0,101
Dependence on supply voltage U_{u1}	U_{u1}	0,00 Vol.-%	0,00 Vol.-%	0,000
Repeatability at span u_1	u_1	0,01 Vol.-%	0,00 Vol.-%	0,000
Field reproducibility U_{r1}	U_{r1}	0,20 Vol.-%	0,12 Vol.-%	0,013
Uncertainty of the test gas at the reference point U_{g1}	U_{g1}	0,50 Vol.-%	0,29 Vol.-%	0,085
Combined standard uncertainty u_c	u_c	$u_c = \sqrt{\sum u_{i,max}^2}$		0,598
Total expanded uncertainty $(U_k \cdot \%)$	$(U_k \cdot \%)$	$U_k = u_c \cdot 1,96$		1,172
Relative total expanded uncertainty		Le in % of the limit 10 Vol.-%		10,3
Requirement		Uo in % of the limit 10 Vol.-%		20,0

Result: Requirements keep to QAL 1 of EN 14181

Attention: For the component no requirements in the EC directives 2004/100/EG and 2000/75/EG are given

DIN EN ISO 14956 and prEN 15267-3 calculation for QAL 1 in DIN EN 14181

Manufacturer data
 Manufacturer
 Measurement System
 Name
 Serial Number

SECK MAHAK GmbH
 MCS 100 E HW
 Multicomponent
 SN_19 und SN_20

TÜV Data
 TÜV Report
 Date
 Editor

936/00010/A
 30.09.1998
 Dr. Wilberg

Measurement Component

NO 200 mg/m³

Evaluation of the cross sensitivity (CS)

CS 3 rel.

to 3 Vol.-% Oxygen

0.00 mg/m³

to 21 Vol.-% Oxygen

0.00 mg/m³

to 30 Vol.-% Humidity

0.00 mg/m³

to 15 Vol.-% Carbon dioxide

0.00 mg/m³

to 50 mg/m³ Methane

0.60 mg/m³

to 20 mg/m³ Dinitrogen monoxide

0.40 mg/m³

to 300 mg/m³ Nitrogen monoxide

1.00 mg/m³

to 30 mg/m³ Nitrogen dioxide

0.24 mg/m³

to 20 mg/m³ Ammonia

0.15 mg/m³

to 200 mg/m³ Sulphur dioxide

0.10 mg/m³

to 1000 mg/m³ Sulphur dioxide

0.00 mg/m³

to 50 mg/m³ Hydrogen chloride

0.40 mg/m³

to 9.6 mg/m³ Methanol

0.00 mg/m³

to 12.1 mg/m³ Formaldehyde

0.00 mg/m³

to 8.7 mg/m³ Acetone

0.00 mg/m³

to 15.3 mg/m³ Dichloromethane

0.00 mg/m³

Sum of positive cross sensitivities

1.83 mg/m³

Sum of negative cross sensitivities

0.80 mg/m³

Calculation of the combined standard uncertainty

Test Value

$\Delta x_{\text{rel.}}$ $\Delta x_{\text{rel.}}^2 = \frac{U_c^2}{x^2}$ $\Delta x_{\text{rel.}}^2$

Lack of fit

u_L 0.50 mg/m³ 0.48 mg/m³ 0.213

Biggest interference (positive or negative)

u_I 1.83 mg/m³ 1.06 mg/m³ 1.117

Span shift in the field test

u_{L_1} 2.10 mg/m³ 1.21 mg/m³ 1.470

Zero shift in the field test

u_{L_2} 0.00 mg/m³ 0.00 mg/m³ 0.000

Sensitivity to sample volume flow

u_V 0.00 mg/m³ 0.00 mg/m³ 0.000

Sensitivity to sample pressure

u_p 0.00 mg/m³ 0.00 mg/m³ 0.000

Sensitivity to sample temperature

u_{T_1} 0.00 mg/m³ 0.00 mg/m³ 0.000

Sensitivity to ambient temperature

u_{T_2} 6.40 mg/m³ 3.70 mg/m³ 13.653

Dependence on supply voltage

u_{U_1} 0.00 mg/m³ 0.00 mg/m³ 0.000

Repeatability at span

u_{R_1} 0.00 mg/m³ 0.35 mg/m³ 0.120

Field reproducibility

u_{R_2} 0.20 mg/m³ 0.50 mg/m³ 0.249

Uncertainty of the test gas at the reference point

u_{T_3} 4.00 mg/m³ 2.31 mg/m³ 5.550

Combined standard uncertainty (u_c)

$u_c = \sqrt{\sum u_{i,rel.}^2}$ 4.707

Total expanded uncertainty

$U_c = u_c \cdot 1.96$ 9.226

Relative total expanded uncertainty

U_c in % of the limit 130 mg/m³ 7.0

Requirement

U_c in % of the limit 130 mg/m³ 20.0

Result: Requirements keep to QAL 1 of EN 14181

DIN EN ISO 14956 and prEN 15267-3 calculation for QAL 1 in DIN EN 14181

Manufacturer data
 Manufacturer
 Measurement System
 Name
 Serial Number

SICK MATHAR GmbH
 MCS 100 E HW
 Multi component
 SM_19 and SM_20

TÜV Data
 TÜV Report
 Date
 Editor

036.808012/A
 30.09.1999
 Dr. Willing

Measurement Component

SO₂ 75 mg/m³

Evaluation of the cross sensitivity (CS)

to 3 Vol.-% Oxygen	0.00 mg/m ³
to 21 Vol.-% Oxygen	0.00 mg/m ³
to 30 Vol.-% Humidity	0.00 mg/m ³
to 300 mg/m ³ Carbon monoxide	-0.23 mg/m ³
to 15 Vol.-% Carbon dioxide	0.00 mg/m ³
to 50 mg/m ³ Methane	0.23 mg/m ³
to 20 mg/m ³ Chlorine dioxide	0.00 mg/m ³
to 300 mg/m ³ Nitrogen monoxide	0.30 mg/m ³
to 30 mg/m ³ Nitrogen dioxide	-0.09 mg/m ³
to 20 mg/m ³ Ammonia	0.14 mg/m ³
to 50 mg/m ³ Hydrogen chloride	-0.30 mg/m ³
to 0,6 mg/m ³ Methylol	0.00 mg/m ³
to 12,1 mg/m ³ Formaldehyde	0.00 mg/m ³
to 0.7 mg/m ³ Acetone	0.45 mg/m ³
to 15,2 mg/m ³ Dichloromethane	0.00 mg/m ³

Sum of positive cross sensitivities

0.81 mg/m³

Sum of negative cross sensitivities

-0.81 mg/m³

Calculation of the combined standard uncertainty
Test Value

	x_{ref}	$u(x_{\text{ref}}) = \frac{\Delta F}{\sqrt{t}}$	$u(x_{\text{ref}})$
Lack of fit	0	-0.75 mg/m ³	0.168
Biggest interference (positive or negative)	0	0.91 mg/m ³	0.275
Span shift in the field test	u_{21}	0.50 mg/m ³	0.270
Zero shift in the field test	u_{47}	0.00 mg/m ³	0.000
Sensitivity to sample volume flow	u_v	0.00 mg/m ³	0.000
Sensitivity to sample pressure	u_p	0.00 mg/m ³	0.000
Sensitivity to sample temperature	u_T	0.00 mg/m ³	0.000
Sensitivity to ambient temperature	u_A	-2.55 mg/m ³	2.158
Dependence on supply voltage	u_U	0.00 mg/m ³	0.000
Repeatability at span	u_s	0.98 mg/m ³	0.317
Field reproducibility	u_R	0.45 mg/m ³	0.071
Uncertainty of the test gas at the reference point	u_{ref}	1.50 mg/m ³	0.750

Combined standard uncertainty (u_c)

$u_c = \sqrt{u_{\text{ref}}^2 + u_s^2 + u_R^2 + u_A^2}$ 2.1803

Total expanded uncertainty

$U_c = u_c \cdot k$ 3.9330

Relative total expanded uncertainty

U_c in % of the limit 50 mg/m³ 7.8

Requirement

U_c in % of the limit 50 mg/m³ 20.0

Result: Requirements keep to QAL 1 of EN 14181

DIN EN ISO 14958 and prEN 15267-3 calculation for QAL 1 in DIN EN 14181

Manufacturer data
 Manufacturer
 Measurement System
 Name
 Serial Number

SICK MAMAK GmbH
 MCS 100 E HW
 Multicomponent
 SN_19 und SN_20

TÜV Data
 TÜV Report
 Date
 Editor

03/02/2010 CA
 30.05.1999
 Dr. Weipert

Measurement Component

NO₂ 15 mg/m³

Evaluation of the cross sensitivity (CS)

to 2 Vol.-% Oxygen	0,00 mg/m ³
to 21 Vol.-% Oxygen	0,00 mg/m ³
to 30 Vol.-% Humidity	0,00 mg/m ³
to 300 mg/m ³ Carbon monoxide	-0,03 mg/m ³
to 15 Vol.-% Carbon dioxide	0,00 mg/m ³
to 50 mg/m ³ Methane	0,09 mg/m ³
to 20 mg/m ³ Nitrogen monoxide	0,00 mg/m ³
to 300 mg/m ³ Nitrogen monoxide	-0,05 mg/m ³
to 30 mg/m ³ Nitrogen dioxide	0,01 mg/m ³
to 20 mg/m ³ Ammonia	0,01 mg/m ³
to 300 mg/m ³ Sulphur dioxide	0,00 mg/m ³
to 1000 mg/m ³ Sulphur dioxide	0,00 mg/m ³
to 9,0 mg/m ³ Methanol	0,00 mg/m ³
to 12,1 mg/m ³ Formaldehyde	0,08 mg/m ³
to 9,7 mg/m ³ Acetone	0,00 mg/m ³
to 15,5 mg/m ³ Dichloromethane	0,00 mg/m ³

Sum of positive cross sensitivities

0,19 mg/m³

Sum of negative cross sensitivities

-0,05 mg/m³

Calculation of the combined standard uncertainty

Test Value		UCL max. / min.	$u_{\text{rel}}(x_{\text{meas}}) = \frac{UCL}{x}$	$u_{\text{rel}}(x_{\text{ref}})$
Look of fit	u_1	0,17 mg/m ³	0,10 mg/m ³	0,009
Biggest reference (positive or negative)	u_2	0,19 mg/m ³	0,11 mg/m ³	0,012
Span shift in the field test	$u_{3,1}$	0,20 mg/m ³	0,12 mg/m ³	0,014
Zero shift in the field test	$u_{3,2}$	0,00 mg/m ³	0,00 mg/m ³	0,000
Sensitivity to sample volume flow	u_4	0,00 mg/m ³	0,00 mg/m ³	0,000
Sensitivity to sample pressure	u_5	0,00 mg/m ³	0,00 mg/m ³	0,000
Sensitivity to sample temperature	u_6	0,00 mg/m ³	0,00 mg/m ³	0,000
Sensitivity to ambient temperature	u_7	0,54 mg/m ³	0,31 mg/m ³	0,027
Dependence on supply voltage	u_8	0,00 mg/m ³	0,00 mg/m ³	0,000
Repeatability at span	u_9	0,25 mg/m ³	0,15 mg/m ³	0,022
Field reproducibility	u_{10}	0,17 mg/m ³	0,10 mg/m ³	0,010
Uncertainty of the test gas at the reference point	u_{11}	0,30 mg/m ³	0,17 mg/m ³	0,030

Combined standard uncertainty u_c

u_c

$$u_c = \sqrt{\sum u_{\text{rel},i}^2}$$

0,440

Total expanded uncertainty

$(k = 1)$

$$U_c = u_c \cdot 1,96$$

0,852

Relative total expanded uncertainty

Uc in % of the limit 10 mg/m³

8,5

Requirement

Uc in % of the limit 10 mg/m³

10,0

Result: Requirements keep to QAL 1 of EN 14181

DIN EN ISO 14686 and prEN 15267-3 calculation for QAL 1 in DIN EN 14181

Manufacturer data
 Manufacturer
 Measurement System
 Name
 Serial Number

SICK MATHAK GmbH
 MCS 100 E HW
 Multicomponent
 SN 19 and SN 20

TUV Data
 TUV Report
 Date
 Editor

936809M02A
 30.09.1995
 Dr. Wilberg

Measurement Component

NH₃ 20 mg/m³

Evaluation of the cross sensitivity (CS)

CS $\frac{1}{100}$

to 3 Vol.-% Oxygen
 to 21 Vol.-% Oxygen
 to 30 Vol.-% Humidity
 to 300 mg/m³ Carbon monoxide
 to 15 Vol.-% Carbon dioxide
 to 50 mg/m³ Methane
 to 20 mg/m³ Dinitrogen monoxide
 to 300 mg/m³ Nitrogen monoxide
 to 20 mg/m³ Nitrogen dioxide
 to 200 mg/m³ Sulphur dioxide
 to 1000 mg/m³ Sulphur dioxide
 to 50 mg/m³ Hydrogen chloride
 to 9.5 mg/m³ Methanol
 to 12.1 mg/m³ Formaldehyde
 to 9.7 mg/m³ Acetone
 to 15.3 mg/m³ Dichloromethane

0.00 mg/m³
 0.00 mg/m³
 0.00 mg/m³
 0.00 mg/m³
 0.00 mg/m³
 -0.06 mg/m³
 -0.03 mg/m³
 0.09 mg/m³
 0.00 mg/m³
 -0.38 mg/m³
 0.33 mg/m³
 0.50 mg/m³
 0.00 mg/m³
 0.00 mg/m³
 0.00 mg/m³

Sum of positive cross sensitivities

0.10 mg/m³

Sum of negative cross sensitivities

-0.22 mg/m³

Calculation of the combined standard uncertainty

Test Value

	Δx_{rel}	$\Delta x_{rel, max} = \frac{\Delta x}{x}$	$\Delta x_{rel, max}^2$
Lack of fit	u_L	0.32 mg/m ³	0.10
Biggest interference (positive or negative)	u_I	0.22 mg/m ³	0.05
Span shift in the field test	u_{dr}	0.24 mg/m ³	0.06
Zero shift in the field test	u_{dr}	0.30 mg/m ³	0.09
Sensitivity to sample volume flow	u_v	0.30 mg/m ³	0.09
Sensitivity to sample pressure	u_p	0.30 mg/m ³	0.09
Sensitivity to sample temperature	u_d	0.30 mg/m ³	0.09
Sensitivity to ambient temperature	u_t	0.38 mg/m ³	0.15
Dependence on supply voltage	u_{el}	0.30 mg/m ³	0.09
Repeatability at span	u_R	0.70 mg/m ³	0.50
Field reproducibility	u_R	0.15 mg/m ³	0.02
Uncertainty of the test gas at the reference point	u_{g_0}	0.40 mg/m ³	0.16

Combined standard uncertainty (u_c)

$u_c = \sqrt{10 \cdot u_{rel, max}^2}$ 0.637

Total expanded uncertainty

$(U, \%)$ $U = u_c \cdot 1.96$ 1.249

Relative total expanded uncertainty

U_{rel} in % of the limit 10 mg/m³ 12.5

Requirement

U_{rel} in % of the limit 10 mg/m³ 40.0

Result: Requirements keep to QAL 1 of EN 14181

Attention: For this component no requirements in the EC-Regimes 2001/83/EG and 2000/6/EG are given.

DN EN ISO 14956 and prEN 15267-3 calculation for QAL 1 in DN EN 14181

Manufacturer data
 Manufacturer:
 Measurement System:
 Name:
 Serial Number:

SKK MAHAK GmbH
 MGS 100 E -NW
 Multicomponent
 SN_19 und SN_20

TÜV Data
 TÜV Report:
 Date:
 Editor:

93619360101A
 30.03.1999
 Dr. Wilberg

Measurement Component **H₂O** **40** **Vol.-%**

Evaluation of the cross sensitivity (CS)

to 1 Vol.-% Oxygen	0.00 Vol.-%
to 21 Vol.-% Oxygen	0.00 Vol.-%
to 300 mg/m ³ Carbon monoxide	0.00 Vol.-%
to 15 Vol.-% Carbon dioxide	0.00 Vol.-%
to 50 mg/m ³ Methane	0.00 Vol.-%
to 20 mg/m ³ Nitrogen monoxide	0.00 Vol.-%
to 200 mg/m ³ Nitrogen dioxide	0.00 Vol.-%
to 20 mg/m ³ Ammonia	0.00 Vol.-%
to 200 mg/m ³ Sulphur dioxide	0.00 Vol.-%
to 1000 mg/m ³ Sulphur dioxide	0.00 Vol.-%
to 50 mg/m ³ Hydrogen chloride	0.00 Vol.-%
to 3.6 mg/m ³ Methanol	0.00 Vol.-%
to 12.1 mg/m ³ Formaldehyde	0.00 Vol.-%
to 9.7 mg/m ³ Acetone	0.00 Vol.-%
to 15.3 mg/m ³ Dichloromethane	0.00 Vol.-%

Sum of positive cross sensitivities 0.00 Vol.-%
 Sum of negative cross sensitivities 0.00 Vol.-%

Calculation of the combined standard uncertainty

Test Value		ΔF_{max}	$\Delta F_{\text{max}} \cdot \frac{1}{\sqrt{3}}$	ΔF_{max}^2
Value of fit	u_1	0.44 Vol.-%	0.25 Vol.-%	0.085
Biases interference (positive or negative)	u_2	0.00 Vol.-%	0.00 Vol.-%	0.000
Span shift in the field test	$u_{3,1}$	0.00 Vol.-%	0.00 Vol.-%	0.000
Zero shift in the field test	$u_{3,2}$	0.00 Vol.-%	0.00 Vol.-%	0.000
Sensitivity to sample volume flow	u_4	0.00 Vol.-%	0.00 Vol.-%	0.000
Sensitivity to sample pressure	$u_{5,1}$	0.00 Vol.-%	0.00 Vol.-%	0.000
Sensitivity to sample temperature	$u_{5,2}$	0.00 Vol.-%	0.00 Vol.-%	0.000
Sensitivity to ambient temperature	u_6	0.36 Vol.-%	0.21 Vol.-%	0.043
Dependence on supply voltage	$u_{7,1}$	0.00 Vol.-%	0.00 Vol.-%	0.000
Repeatability at span	$u_{7,2}$	0.11 Vol.-%	0.06 Vol.-%	0.004
Field reproducibility	u_8	0.13 Vol.-%	0.08 Vol.-%	0.006
Uncertainty of the test gas at the reference point	u_9	0.90 Vol.-%	0.46 Vol.-%	0.213

Combined standard uncertainty (u_c) $u_c = \sqrt{\sum_{i=1}^9 u_i^2}$ 0.732
 Total expanded uncertainty ($k_2 = 2$) $U = u_c \cdot 1.96$ 1.442
 Relative total expanded uncertainty U in % of the limit 20 Vol.-% 7.2
 Requirement U in % of the limit 20 Vol.-% 20.0

Result: Requirements keep to QAL 1 of EN 14181

Attention: For this component no requirements in the EU directives 2001/83/EG and 2003/43/EG are given.

DIN EN ISO 14958 and prEN 15267-3 calculation for QAL 1 in DIN EN 14181

Manufacturer data
 Manufacturer
 Measurement System
 Name
 Serial Number

SICK MAIHAK GmbH
 MCS 100 E HW
 Multicomponent
 SN_13 und SN_20

TÜV Data
 TÜV Report
 Date
 Editor

036/806/110/A
 22.09.1998
 Dr. Wilbring

Measurement Component

O₂ 21 Vol.-%

Evaluation of the cross sensitivity (CS)

	CS (Vol.-%)
to 30 Vol.-% Humidity	0.00 Vol.-%
to 200 mg/m ³ Carbon monoxide	0.00 Vol.-%
to 15 Vol.-% Carbon dioxide	0.00 Vol.-%
to 50 mg/m ³ Methane	0.00 Vol.-%
to 20 mg/m ³ Dinitrogen monoxide	0.00 Vol.-%
to 500 mg/m ³ Nitrogen monoxide	0.00 Vol.-%
to 30 mg/m ³ Nitrogen dioxide	0.00 Vol.-%
to 20 mg/m ³ Ammonia	0.00 Vol.-%
to 200 mg/m ³ Sulphur dioxide	0.00 Vol.-%
to 1000 mg/m ³ Sulphur dioxide	0.00 Vol.-%
to 50 mg/m ³ Hydrogen chloride	0.00 Vol.-%
to 3.6 mg/m ³ Methanol	0.00 Vol.-%
to 12.1 mg/m ³ Formaldehyde	0.00 Vol.-%
to 9.7 mg/m ³ Acetone	0.00 Vol.-%
to 15.3 mg/m ³ Dichloromethane	0.00 Vol.-%

Sum of positive cross sensitivities 0.00 Vol.-%
 Sum of negative cross sensitivities 0.00 Vol.-%

Calculation of the combined standard uncertainty

Test Value		$\Delta X_{\text{max.}}$	$u(X_{\text{meas.}}) = \frac{\Delta X}{\sqrt{3}}$	$u(X_{\text{meas.}})^2$
Lack of fit	u_1	0.25 Vol.-%	0.15 Vol.-%	0.021
Biggest interference (positive or negative)	u_2	0.00 Vol.-%	0.00 Vol.-%	0.000
Span shift in the field test	u_{span}	0.13 Vol.-%	0.07 Vol.-%	0.005
Zero shift in the field test	u_{zero}	0.00 Vol.-%	0.00 Vol.-%	0.000
Sensitivity to sample volume flow	u_v	0.00 Vol.-%	0.00 Vol.-%	0.000
Sensitivity to sample pressure	u_p	0.00 Vol.-%	0.00 Vol.-%	0.000
Sensitivity to sample temperature	u_T	0.00 Vol.-%	0.00 Vol.-%	0.000
Sensitivity to ambient temperature	u_a	-0.29 Vol.-%	-0.17 Vol.-%	0.029
Dependence on supply voltage	u_{vol}	0.00 Vol.-%	0.00 Vol.-%	0.000
Repeatability at span	u_s	0.08 Vol.-%	0.05 Vol.-%	0.002
Field reproducibility	u_f	0.08 Vol.-%	0.04 Vol.-%	0.001
Uncertainty of the test gas at the reference point	u_{ref}	0.21 Vol.-%	0.12 Vol.-%	0.015
Combined standard uncertainty (u_c)	u_c		$u_c = \sqrt{\sum u_{\text{meas.}}^2}$	0.271
Total expanded uncertainty ($U_1 \cdot k$)			$U_1 = u_c \cdot 1.96$	0.532
Relative total expanded uncertainty			$U_{\text{rel}} = \% \text{ of the limit } 10 \text{ Vol.-%}$	5.3
Requirement			$U_{\text{rel}} = \% \text{ of the limit } 10 \text{ Vol.-%}$	5.0

Result: Requirements keep to QAL 1 of EN 14181

Attention: For this component no requirements in the EC-directives 2001/80/EG und 2000/76/EG are given