

# CERTIFICATE

## TÜV Rheinland Immissionsschutz und Energiesysteme GmbH

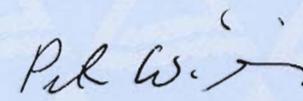
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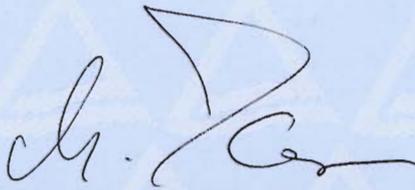
**Manufacturer:** SICK MAIHAK GmbH  
**Measuring System:** EuroFID Inline (H2/He)  
**Components:** TOC  
**Test Report:** TÜV-Nord 03CU012b / 2003-04-30

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

Köln, 2007-04-16

  
Dr. rer. nat. Peter Wilbring

  
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The company is accredited to DIN EN ISO/IEC 17025.

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

Manufacturer	Sick Maihak
Measurement System	TOC
Name	EuroFID Aufbau (H2/He)
Serial Number	4343 / 4549
Measuring Principle	flame ionization

**TÜV Data**

TÜV Report	TÜV-Nord 03CU012b vom 30.4.2003
Date	16.04.2007
Editor	Kerpa

<b>Measurement Component</b>	TOC	15	mg/m <sup>3</sup>
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**Evaluation of the cross sensitivity (CS)**

	CS	X <sub>max, j</sub>
to 21 Vol.-% Oxygen	-0,24	mg/m <sup>3</sup>
to 30 Vol.-% Humidity	-0,14	mg/m <sup>3</sup>
to 300 mg/m <sup>3</sup> Carbon monoxide	0,03	mg/m <sup>3</sup>
to 15 Vol.-% Carbon dioxide	-0,09	mg/m <sup>3</sup>
to 50 mg/m <sup>3</sup> Methane	0,00	mg/m <sup>3</sup>
to 100 mg/m <sup>3</sup> Dinitrogen monoxide	0,00	mg/m <sup>3</sup>
to 300 mg/m <sup>3</sup> Nitrogen monoxide	-0,08	mg/m <sup>3</sup>
to 30 mg/m <sup>3</sup> Nitrogen dioxide	-0,03	mg/m <sup>3</sup>
to 20 mg/m <sup>3</sup> Ammonia	-0,02	mg/m <sup>3</sup>
to 200 mg/m <sup>3</sup> Sulphur dioxide	0,12	mg/m <sup>3</sup>
to 50 mg/m <sup>3</sup> Hydrogen chloride	-0,08	mg/m <sup>3</sup>

Sum of positive cross sensitivities	0,15	mg/m <sup>3</sup>
Sum of negative cross sensitivities	-0,69	mg/m <sup>3</sup>

**Calculation of the combined standard uncertainty**

Test Value		$\Delta X_{max, j}$	$u(\Delta X_{max, j}) = \frac{\Delta X}{\sqrt{3}}$	$u(\Delta X_{max, j})^2$
Lack of fit	u <sub>L</sub>	0,11 mg/m <sup>3</sup>	0,06 mg/m <sup>3</sup>	0,004
Biggest interference (positiv or negativ)	u <sub>I</sub>	-0,69 mg/m <sup>3</sup>	-0,40 mg/m <sup>3</sup>	0,159
Span shift in the field test	u <sub>d, s</sub>	0,29 mg/m <sup>3</sup>	0,17 mg/m <sup>3</sup>	0,028
Zero shift in the field test	u <sub>d, z</sub>	0,27 mg/m <sup>3</sup>	0,16 mg/m <sup>3</sup>	0,025
Sensitivity to sample volume flow	u <sub>v</sub>	0,00 mg/m <sup>3</sup>	0,00 mg/m <sup>3</sup>	0,000
Sensitivity to sample pressure	u <sub>sp</sub>	-0,45 mg/m <sup>3</sup>	-0,26 mg/m <sup>3</sup>	0,068
Sensitivity to sample temperature	u <sub>st</sub>	0,00 mg/m <sup>3</sup>	0,00 mg/m <sup>3</sup>	0,000
Sensitivity to ambient temperature	u <sub>t</sub>	0,35 mg/m <sup>3</sup>	0,20 mg/m <sup>3</sup>	0,040
Dependence on supply voltage	u <sub>sv</sub>	-0,14 mg/m <sup>3</sup>	-0,08 mg/m <sup>3</sup>	0,006
Repeatability at span	u <sub>s</sub>	0,08 mg/m <sup>3</sup>	0,04 mg/m <sup>3</sup>	0,002
Field reproducibility	u <sub>D</sub>	0,12 mg/m <sup>3</sup>	0,07 mg/m <sup>3</sup>	0,005
Uncertainty of the test gas at the reference point	u <sub>to</sub>	0,45 mg/m <sup>3</sup>	0,26 mg/m <sup>3</sup>	0,068
Variation of response factors (TOC)	u <sub>R, TOC</sub>	2,27 mg/m <sup>3</sup>	1,31 mg/m <sup>3</sup>	1,710
Combined standard uncertainty (u <sub>c</sub> )	u <sub>c</sub>	$u_c = \sqrt{\sum(u_{max, j})^2}$		1,453
Total expanded uncertainty	(u <sub>c</sub> * k)	U <sub>c</sub> = u <sub>c</sub> * 1,96		2,849
Relative total expanded uncertainty		Uc in % of the limit 10 mg/m <sup>3</sup>		28,4
Requirement		Uc in % of the limit 10 mg/m <sup>3</sup>		30,0

**Result: Requirements keep to QAL 1 of EN 14181**