

# CERTIFICATE

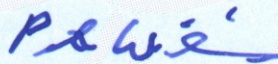
die TÜV Immissionsschutz und  
Energiesysteme GmbH  
TÜV Rheinland Group

The Measurement System

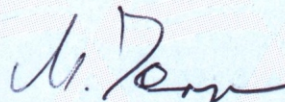
**Manufacturer:** Mess- und Analysetechnik GmbH  
**Emission Measuring System:** Thermo-FID  
**Test Report:** 936/806016 from 26.02.1997  
936/806016/B from 23.12.2003

fulfils the requirements of the QAL 1  
for the component:  
Total-Organic-Carbon  
according to EN 14181 und EN ISO 14956.

Cologne, 21. Juli 2005



Dr. P. Wilbring



Dipl.-Chem. Kerpa

TIE-ID:  
379371\_001

TÜV Immissionsschutz und Energiesysteme GmbH  
TÜV Rheinland Group  
Am Grauen Stein, 51105 Köln  
tie@umwelt-tuv.de



DAP-PL-3856.99

**DIN EN ISO 14956 Berechnung für die QAL 1 nach DIN EN 14181**

**Manufacturer Data**

|                     |                               |
|---------------------|-------------------------------|
| Manufacturer        | Mess- und Analysetechnik GmbH |
| Measurement System  | Gas measuring device          |
| Name                | Thermo-FID                    |
| Serial Number       | 3300196, 3300796, 3300496     |
| Measuring Principle | FID                           |

**TÜV Data**

|            |              |
|------------|--------------|
| TÜV Report | 936 / 806016 |
| Date       | 21.07.2005   |
| Editor     | Fr. Hamacher |

**Measurement Component**

TOC 15 mg/m<sup>3</sup>

**Evaluation of the cross sensitivity (CS)**

|   | CS $X_{max,j}$          |
|---|-------------------------|
| to 3 Vol.-% Oxygen                          | -0,53 mg/m <sup>3</sup> |
| to 21 Vol.-% Oxygen                         | 0,00 mg/m <sup>3</sup>  |
| to 30 Vol.-% Humidity                       | 0,00 mg/m <sup>3</sup>  |
| to 300 mg/m <sup>3</sup> Carbon monoxide    | 0,16 mg/m <sup>3</sup>  |
| to 15 Vol.-% Carbon dioxide                 | 0,00 mg/m <sup>3</sup>  |
| to 50 mg/m <sup>3</sup> Methane             | 0,00 mg/m <sup>3</sup>  |
| to 20 mg/m <sup>3</sup> Dinitrogen monoxide | 0,10 mg/m <sup>3</sup>  |
| to 100 mg/m <sup>3</sup> Dinitrogen oxide   | 0,00 mg/m <sup>3</sup>  |
| to 300 mg/m <sup>3</sup> Nitrogen monoxide  | 0,00 mg/m <sup>3</sup>  |
| to 30 mg/m <sup>3</sup> Nitrogen dioxide    | 0,00 mg/m <sup>3</sup>  |
| to 20 mg/m <sup>3</sup> Ammonia             | 0,00 mg/m <sup>3</sup>  |
| to 200 mg/m <sup>3</sup> Sulphur dioxide    | 0,00 mg/m <sup>3</sup>  |
| to 1000 mg/m <sup>3</sup> Sulphur dioxide   | -0,14 mg/m <sup>3</sup> |
| to 50 mg/m <sup>3</sup> Hydrogen chloride   | 0,00 mg/m <sup>3</sup>  |
| to 200 mg/m <sup>3</sup> Hydrogen chloride  | 0,00 mg/m <sup>3</sup>  |
| Sum of positive cross sensitivities         | 0,26 mg/m <sup>3</sup>  |
| Sum of negative cross sensitivities         | -0,67 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                             | $u_L$        | 0,06 mg/m <sup>3</sup>                    | 0,03 mg/m <sup>3</sup>                            | 0,001                   |
| Interference                            | $u_I$        | 0,26 mg/m <sup>3</sup>                    | -0,38 mg/m <sup>3</sup>                           | 0,148                   |
| Span shift in the field test            | $u_{d,s}$    | 0,26 mg/m <sup>3</sup>                    | 0,15 mg/m <sup>3</sup>                            | 0,022                   |
| Zero shift in the field test            | $u_{d,z}$    | 0,23 mg/m <sup>3</sup>                    | 0,13 mg/m <sup>3</sup>                            | 0,017                   |
| Sensitivity to sample volume flow       | $u_v$        | 0,00 mg/m <sup>3</sup>                    | 0,00 mg/m <sup>3</sup>                            | 0,000                   |
| Sensitivity to sample pressure          | $u_{sp}$     | 0,00 mg/m <sup>3</sup>                    | 0,00 mg/m <sup>3</sup>                            | 0,000                   |
| Sensitivity to sample temperature       | $u_{st}$     | 0,00 mg/m <sup>3</sup>                    | 0,00 mg/m <sup>3</sup>                            | 0,000                   |
| Sensitivity to ambient temperature      | $u_t$        | 0,70 mg/m <sup>3</sup>                    | 0,40 mg/m <sup>3</sup>                            | 0,164                   |
| Repeatability at zero                   | $u_z$        | 0,39 mg/m <sup>3</sup>                    | 0,23 mg/m <sup>3</sup>                            | 0,051                   |
| Repeatability at span                   | $u_r$        | 0,00 mg/m <sup>3</sup>                    | 0,00 mg/m <sup>3</sup>                            | 0,000                   |
| Dependence on supply voltage            | $u_{sv}$     | 0,00 mg/m <sup>3</sup>                    | 0,00 mg/m <sup>3</sup>                            | 0,000                   |
| Field reproducibility                   | $u_D$        | 0,17 mg/m <sup>3</sup>                    | 0,10 mg/m <sup>3</sup>                            | 0,009                   |
| NOx converter efficiency adjustment     | $u_{NOx}$    | 0,00 mg/m <sup>3</sup>                    | 0,00 mg/m <sup>3</sup>                            | 0,000                   |
| Variation of response factors (TOC)     | $u_{R, TOC}$ | 2,27 mg/m <sup>3</sup>                    | 1,31 mg/m <sup>3</sup>                            | 1,710                   |
| Excursion of measurement beam           | $u_{mb}$     | 0,00 mg/m <sup>3</sup>                    | 0,00 mg/m <sup>3</sup>                            | 0,000                   |
| Combined standard uncertainty ( $u_c$ ) | $u_c$        | $u_c = \sqrt{\sum(u_{max,j})^2}$          |   | 1,456                   |
| Total expanded uncertainty              | $(u_c * k)$  | $U_c = u_c * 1,96$                        |   | 2,855                   |
| Relative total expanded uncertainty     |              | Uc in % of the limit 10 mg/m <sup>3</sup> |   | 28,5                    |
| Requirement                             |              | Uc in % of the limit 10 mg/m <sup>3</sup> |   | 30,0                    |

**Result: Fulfills the requirements for QAL 1 of EN 14181**