APPLICATIONS

Calibration & Application

The GASMET™ FTIR Gas Analyzers allow simple calibration using only single component calibration gases. The factory calibration is performed in Gasmet technologies Oy laboratory. Each calibration gas is introduced to the analyzer via a clean regulator and a heated line in known concentrations. The certified analysis accuracy of each gas is usually 2 %. The calibration gases are typically taken directly from cylinders. If needed, additional concentrations are produced with dilution. Reference spectra are generated in different concentrations to cover the complete measuring range

The water calibration and also some calibration gases from liquids are generated by GASMET Calibrator. The accuracy of gases generated by calibrator is 3%. GASMET calibrator incorporates a syringe pump, needle valve, mass flow meter and heated injection chamber. The syringe pump injects precise amounts of liquid into a hot nitrogen flow and the injected liquid is vaporized rapidly in the injection chamber.

When the reference spectrum is measured, the spectrum is monitored by 5 sec. measurements until the absorbance value is stabilized. The measurement time for a reference spectrum is 3 minutes. Linearity and cross interferences are checked after factory calibration for each component. Also the analysis areas and interfering components are defined for each component according to the application.

Detection limits

The GASMET provides very good detection limits. Various institutes have tested GASMET detection limits in different applications. Usually, the detection limit of most components is well below 1 ppm. The difficulty in defining the detection limits is that: they are always application specific. A specified % of the measuring range is a better way of estimating the detection limit in a given application.

Measurement accuracy

The measurement accuracy depends on the application and on the used analyzer (pathlength, temperature, detector). If the application is well known, it is possible to estimate the possible measuring ranges. In this case, the accuracy is usually defined as follows:

Detection limit	< 2% of the measuring range
Linearity deviation	< 2% of the measuring range
Sum of cross interferences	< 4% of the measuring range

The above specification is valid only if the calibration is instrument specific.

Calibrations after installation

Zero point calibration (background) is required once in a day in continuous measurements. The zero point calibration gas can be clean instrument air or pure nitrogen. Nitrogen is recommended.

No Span gases are necessary unless required by a specific method (EPA, ASTM, etc.). The absorptivity is a physical constant specific to each gas and the span calibrations will remain constant and no recalibration is required.

Water vapor is the only exception in normal operation. H_2O calibration must be performed after every major maintenance operation (minimum once a year). Proper H_2O calibration guarantees accurate analysis components, which are usually present in the sample gas in ppm concentrations

GASMET Reference Library

The GASMET library consists of reference spectrum files of gases measured to date with different GASMET gas analyzers. The reference spectra can be transferred from analyzer to analyzer. The library contains hundreds of spectra and each reference spectrum contains both quantitative and qualitative information. In principle, an application can also be generated without the instrument specific calibration. Most of the GASMET analyzers are similar in the optical layout. If used correctly, the spectra of the reference library can be used for the analysis with relatively good accuracy. However, each analyzer has minor differences. Compared to each other these differences may affect the measured spectrum and cause some errors to the analysis results. It must also be kept in mind that the Reference Library has been generated with varying instrument parameters and environmental conditions (path length, pressure, temperature). The temperature and pressure may affect the spectrum line shape and cause some deviation in the results. These library reference spectra are excellent if used for semi-quantitative analysis or to help identify unknowns. The Reference Library does not provide as good accuracy as instrument specific calibration, which is always recommended for obtaining the best accuracy.

CALCMET Software

The advanced easy to use CALCMET software provides outstanding analytical performance. The software analyses the sample spectrum, operates the GASMET and controls automated sampling system units. For superior analytical accuracy, the software utilizes patented multicomponent algorithms to enhance analysis specificity. The software enables simultaneous detection, identification and quantification of up to 50 different gas components

The GASMET measures both organic and inorganic gases in concentrations from low ppm level up to several percentages. Cross interference effects are compensated for and analysis accuracy is maintained when analyzing complex gas mixtures with spectral overlapping. Accurate results are available in seconds. Stored spectra can be easily re-analyzed for identification of previously unknown components

The ability of the CALCMET Software to automatically carry out spectral identification allows for accurate analysis to be performed without detailed stream composition information. The software is also designed for easy and efficient processing of the results. Since water content of the sample gas is measured the results can be reported on either a "wet" or "dry" basis.

Extended CEM (APP-152)

No	Component	Concentration min	max
1	Water vapour H_2O	0-25 %	0-40 %
2	Carbon dioxide CO_2	0-10 %	0-30 %
3	Carbon monoxide CO	0-70 ppm	0-10000ppm
4	Nitrous oxide N_2O	0-50 ppm	0-500 ppm
5	Nitric oxide NO	0-100 ppm	0-1000ppm
6	Nitrogen dioxide NO_2	0-100 ppm	0-1000ppm
7	Sulphur dioxide SO_2	0-30 ppm	0-2000ppm
8	Ammonia NH_3	0-20 ppm	0-500 ppm
9	Hydrogen chlor. HCl	0-10 ppm	0-500 ppm
10	Hydrogen fluoride HF	0-17 ppm	0-100 ppm
11	Methane CH_4	0-50 ppm	0-1000 ppm

These applications are only examples. The concentration ranges and components are most common and those can be changed according to the application.

Engine Emissions (APP-153)

No	Component	Concentration min	max
1	Water vapour H_2O	0-10 %	0-20 %
2	Carbon dioxide CO_2	0-10 %	0-30 %
3	Carbon monoxide CO	0-200 ppm	0-10000ppm
4	Nitrous oxide N_2O	0-200 ppm	0-500 ppm
5	Nitric oxide NO	0-200 ppm	0-1000ppm
6	Nitrogen dioxide NO_2	0-200 ppm	0-1000ppm
7	Sulphur dioxide SO_2	0-50 ppm	0-1000 ppm
8	Carbonyl sulfide COS	0-100 ppm	0-200 ppm
9	Ammonia NH_3	0-50 ppm	0-500 ppm
10	Hydrogen chlor. HCl	0-50 ppm	0-500 ppm
11	Hydrogen cyan. HCN	0-100 ppm	0-500 ppm
12	Hydrogen fluoride HF	0-100 ppm	0-500 ppm
13	Methane CH_4	0-100 ppm	0-500 ppm
14	Ethane C_2H_6	0-100 ppm	0-500 ppm
15	Propane C_3H_8	0-100 ppm	0-500 ppm
16	Butane C_4H_{10}	0-100 ppm	0-500 ppm
17	Pentane C_5H_{12}	0-100 ppm	0-500 ppm
18	Hexane C_6H_{14}	0-100 ppm	0-500 ppm
19	Heptane C_7H_{16}	0-100 ppm	0-500 ppm
20	Octane C_8H_{18}	0-100 ppm	0-500 ppm
21	Acetylene C_2H_2	0-100 ppm	0-500 ppm
22	Ethylene C_2H_4	0-100 ppm	0-500 ppm
23	Propene C_3H_6	0-100 ppm	0-500 ppm
24	1,3-Butadiene C_4H_6	0-100 ppm	0-500 ppm
25	Benzene C_6H_6	0-100 ppm	0-500 ppm
26	Toluene C_7H_8	0-100 ppm	0-500 ppm
27	m-Xylene C_8H_{10}	0-100 ppm	0-500 ppm
28	o-Xylene C_8H_{10}	0-100 ppm	0-500 ppm
29	p-Xylene C_8H_{10}	0-100 ppm	0-500 ppm
30	1,2,3-Trimet.benz. C_9H_{12}	0-100 ppm	0-500 ppm
31	1,2,4-Trimethylbenz. C_9H_{12}	0-100 ppm	0-500 ppm
32	1,3,5-Trimethylbenz. C_9H_{12}	0-100 ppm	0-500 ppm
33	Formic acid CH_2O_2	0-100 ppm	0-500 ppm
34	Acetic acid $C_2H_4O_2$	0-100 ppm	0-500 ppm
35	Formaldehyde CH_2O	0-100 ppm	0-500 ppm
36	Acetaldehyde C_2H_4O	0-100 ppm	0-500 ppm
37	Methanol CH_4O	0-100 ppm	0-500 ppm
38	Ethanol C_2H_6O	0-100 ppm	0-500 ppm
39	Propanol C_3H_8O	0-100 ppm	0-500 ppm
40	MTBE $C_5H_{12}O$	0-100 ppm	0-500 ppm

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