

SWIP Compliance

The proposed CEMS system satisfies the requirements of:

1 The Environment Agency MCERTS monitoring scheme as follows:

For gaseous, particulate and flow-rate monitoring systems are certified to MCERTS Performance Standards and Test Procedures for Continuous Emission Monitoring Systems. Version 3.5 dated June 2016.

The performance standards, test procedures and general requirements for the testing of continuous emission monitoring systems (CEMs) under MCERTS are in compliance with CEN standard EN 15267-3, with additional provisions for testing and certification to EN ISO 16911-2 for flow-monitors. CEN developed EN 15267-3 to provide for the QAL1 and QAL3 requirements of EN 14181 and now provides a means of demonstrating compliance with the uncertainty requirements specified in the Industrial Emissions Directive (2010/75/EU).

In addition, the analysers proposed also fulfil IBS EN 15267-3 where it is mentioned that the total uncertainty of the AMS measured values determined in the performance test should be at least **25% below** the maximum permissible uncertainty specified e.g. in applicable regulations to provide a sufficient margin for the uncertainty contributions from the individual installation of the AMS to pass QAL2 and QAL3 successfully.

This last section is important as it minimises risk to you and your client as failing QAL2 and QAL3 can be costly. Please consider:

- i. QAL2 and QAL3 are performed during the commissioning phase and then they are on-going quality assurance tests throughout the equipment lifetime.
- ii. Measurement uncertainties increase at lower concentrations. Typically, on new plant with highly efficient abatement the concentration of the various parameters are well below emission limit values.

Data acquisition and reporting are certified to MCERTS Performance Standards and Test Procedures for Environmental Data Management Software, Version 2, dated September 2011 in respect of:

- iii. Part A - Generic Software Quality
- iv. Part B - Data Management General Aspects
- v. Part C1 - CEMS Data Management Applications – Generic Requirements
- vi. Part C2 - CEMS Data Management Applications - EN14181 Requirements

2 The supplied system satisfies the requirements and recommendations of: Industrial Emission Directive 2010/75/EU for Incineration and SWIP industrial processes.

EN14181:

QAL1

QAL2

QAL3 (Automated routine as an Option via CemSuite Plus)

AST

EN15267-1, EN15267-2 and EN1526

We will supply a full compliance certification package

SWIPCEMS IIe

SUMMARY

1-A-1to 1-A-7 Continuous Emission Monitoring System

Comprising of:

- 1-A-1 Exhaust Gas Sampling Probe – Stack mounted
- 1-A-2 CEMS Heated Sampling Line 10m
- 1-A-3 *Analyser Cabinet including Flame ionisation detector (FID) for VOCs and Zirconia Oxygen analyser*
- 1-A-4 *Dust monitor*
- 1-A-5 *CEM Data acquisition and reporting software inc PC and printer etc*

OPTIONAL

- 1-A-6 *Stack Flow, Temperature and Pressure measurement.*

1-A-8 to 1-A-10 Engineering Services Package

Comprising of:

- 1-A-7 Factory Acceptance Test (FAT)
- 1-A-8 Quantitech standard Documentation & Project Management
- 1-A-9 Commissioning (SAT)

1-A-1 to 1-A-7 Continuous Emission Monitoring System

The system as proposed is used to measure the gaseous and particulate components required to satisfy emissions reporting to the Industrial Emission Directive and the associated EN14181 limits

As you are aware EN15267-3 certification should be for the complete system which is the case for the Gasmeter SWIPCEMS IIe system which benefits from being housed in an air-conditioned cabinet and comprises of the Exhaust Gas Sampling System (1.1), the Emission Monitoring System (1.2) and the CEMS heated Sampling line c/w all accessories (1.3 -a and b).

We are proposing the Gasmeter SWIPCEMS IIe as this future-proofs your projects as much as possible due to the following:

1. The proposed Gasmeter SWIPCEMS IIes system benefits from an increased number of gases being QAL1 certified such as Formaldehyde (CH₂O), Methane (CH₄) and including Nitrous Oxide (N₂O). Mcert and TUV certification is available and enclosed within our bid documentation.
2. The system is capable of measuring 20 gases simultaneously. There is an extensive library in excess of 200 compounds which can be measured by the Gasmeter FTIR. The benefit is in most cases if you were required to measure another gas this can be done without the need of any additional hardware.
3. The Gasmeter SWIPCEMS IIe benefits from reduced levels of uncertainty well within the Industrial Emission Directive and the associated EN14181 limits for all measurement parameters when compared to other FTIR based systems available on the market.
This is something many sites overlook when choosing equipment often asking for TUV/Mcerts certification but then not looking at the detailed information within the certification such as the uncertainties stated on the certificate which can reduce risk of failing expensive QAL2 testing and problems associated with failing QAL3,
4. In addition to the increased number of gases certified and reduced levels of uncertainty the Gasmeter CEMS IIe has an extended period of unattended operation currently this is stated as three months on both the MCerts and TUV certificates. I am pleased to inform you that Gasmeter have completed another 6 months of field testing with the aim of extending the period of unattended operation even further from the current three months to six months. We have been informed that we have passed this extended test period and are awaiting confirmation and a new certificate from TUV/Mcerts confirming this point.
5. The Gasmeter SWIPCEMS IIe has a high annual availability calculated to be in excess of 98.5%. Many stack testers are also choosing to use a certified portable FTIR from Gasmeter for CEMS audits which I hope gives you an insight to the reliability and durability of Gasmeter FTIR systems.

6. A good example of Gasmeter design improving the performance within the CEMS IIe system is the automatic back flush of not only the analysers in the event of power failure but the back flush of the heated line, from the analyser end through to the sample probe. The dual back flush is to prevent warm stack gases cooling down in the heated line and sampling system during power outage and condensing. This dual backflush. Due to the power consumption of heated line UPS power supplies provides sufficient power for the analysers but typically do not provide backup power to the heated sampling lines. The dual backflush provides an increased level of security, reducing expensive repairs as it reduces the chances of water ingress causing costly damage to the analyser as and when power is reapplied. Within Calmet software the measured values and the actual spectra are saved allowing further analysis of the spectra post measurement should the need arise.
7. For TOC measurement we are proposing the SK Elektronik Thermo FID ES for measurement of TOC's due to the following:
 - i. The Thermo FID ES has recently received Mcerts certification.
 - ii. Uses Hydrogen Fuel which provides a significant cost saving over Hydrogen Helium fuelled FID's.
 - iii. Quantitech are the distributor for SK Elektronik for the UK and Ireland.
8. For Particulates, The Gasmeter SWIPCEMS IIe incorporates the PCME, MCERTS certified Electrodynamic particulate sensor and control unit.
9. As an option, for Stack Flow, Temperature and Pressure we integrate the SF200 averaging Pitot combining these measurements and a PCME Control Unit (integrated into CEMS IIe cabinet) so you and your client do not need to climb the stack to interface with or interrogate data from the probes.
10. It is also worth noting that the measurement data generated from the Gasmeter system is compatible with most PC based Data Acquisition Systems (DAS) which are generally deployed for logging, averaging and report generation. We can propose a Data acquisition and Reporting package complete with Data Storage Unit (DSU) integrated into the SWIPCEMS IIe cabinet.

1-A-1 Exhaust Gas Sampling System– Gasmeter SWIPCEMS IIe Gas Sampling Probe.

The Gasmeter SWIPCEMS IIe sample probes are designed for easy installation, reliable operation and trouble free maintenance. The probes are of a versatile design depending on application. With insertion probe- materials, insertion lengths, heating and filtration to ensure no condensation and loss of sample gas. The probes are temperature controlled and regulated they are also designed to minimise excessive sample volume for improved response time. The main filter element (ceramic as standard) has a large surface area and high capacity is located in the external housing. The probes are designed so that changing a filter element does not involve the use of tools. In this operation neither the sample probe tube nor sample line need to be removed, thus avoiding contamination of the clean gas path and maintaining the integrity of the system. The insertion sample tube can be cleaned, washed or rodded-out from outside of the process. Probe dimensions are 340mm(L) x 260mm(H) x 345mm(D) and are suitable for use outside in typical UK weather conditions. The flange length should be kept to a minimum approximately 100mm to avoid cooling of the extracted sample gas but still allowing access to mounting nuts and bolts. The DN65 PN6 flange should be mounted to allow a 5° downward slope into the stack for free draining of any water droplets and at a sufficient height from the sampling platform level to allow sample line and calibration gas line entry from the underside.



Please Note picture does not show heated sample tube used to avoid cold spots between internal stack connection outer wall of weather shield and the picture does not show optional end of probe filter.

The sampling pump extracting the sample gas is located within the analyser cabinet in the CEMS shelter.

1-A-2 SWIPCEMS IIe Heated Sampling Line c/w Accessories & Cabling

We are proposing Gasmeter heated sampling lines which are designed for continuous transportation of gaseous media. The Gasmeter heated lines were used during certification testing of the CEMS system as we know EN15267-3 is testing of the complete system. The Gasmeter heated sampling lines are flexible, temperature controlled, and are used to keep the sample gas in gas phase and prevent condensation. This is required when measuring water soluble compounds such as SO₂, NH₃, HCl, etc. If the inner sample core has been contaminated it is possible to change the inner sample line.



Integrated Calibration gas tube has been included.

1-A-3 SWIPCEM IIe Analyser Cabinet

The gas analysers at the heart of each system are Gasmeter industrial FTIR analysers, designed and built by Gasmeter Technologies Oy of Helsinki over the last 20 years. The hardware, firmware and software of these instruments have been developed by the engineers at Gasmeter and do not employ technology or systems supplied by another company.

The development of these analysers has enabled the instruments to be used in a wide variety of environmental, research and military analysis applications in many hazardous and challenging situations. For many of these applications systems have been designed and built by Gasmeter engineers. There are more than 3,000 Gasmeter FTIR systems in use around the world, and more than 150 in the UK.

Our proposal also includes devices for TOC and Particulates measurement supplied by carefully chosen third party suppliers to match the capability and performance of the Gasmeter FTIR.

Gasmeter SWIPCEMS IIe analyser components

The Gasmeter CEMS IIe FTIR measuring system is designed for continuous emissions monitoring measurements (CEM). Typical application is H₂O, CO₂, CO, N₂O, NO, NO₂, SO₂, HCl, HF, NH₃, CH₄, C₂H₆, C₃H₈, and C₂H₄ monitoring from waste incinerator or large combustion plants.

Measured components and calibration ranges can be changed according to application.

The Gasmeter SWIPCEMS II is an ideal tool to use for measuring trace concentrations of pollutants in wet, corrosive gas streams. All parts of the Gasmeter SWIPCEMS II are heated up to 180 °C. It can be used for undiluted gases and the sample gases do not need drying beforehand.

The Gasmeter CEMS II consists of:

- i. Gasmeter FTIR gas analyser,
- ii. Gasmeter industrial computer
- iii. Gasmeter sampling system.
- iv. Zirconia (ZrO₂) oxygen analyser.
- v. Flame Ionisation Detector (FID) Total hydrocarbon analyser.

All parts of the system are 19" rack mounted and are installed on the pull-out shelves.

Gasmeter have supplied systems to many System Integrators and have a flexible I/O platform to meet most plant protocols. The system we are proposing will transmit measured signals to the data acquisition package via TCP/IP Modbus.



The Gasmeter SWIPCEMS IIe includes all power connections and temperature controllers for heated lines and heated sample probe.

The operation of the system is fully automatic and controlled by the Calcmet software. Additionally, all functions of CEMS II can be controlled manually.

Comprehensive I/O functions make it possible to connect SWIPCEMS IIe into all kinds of automation or reporting systems.

Measuring data and alarms can be transferred from Gasmeter SWIPCEMS IIe to other systems with analog or digital format.

Gasmeter CEMS II is also equipped with analog / digital inputs for external data (other analysers or process).

Gasmeter CEMS II provides different alarm functions such as System alarm, Service request, Maintenance on progress (can also be set manually), Concentration alarm, and Result valid. Combinations for each alarm can be set on Calcmet.

If any of the critical alarm is activated, instrument air starts to flow automatically into the system to prevent condensation and damage to the analyser.

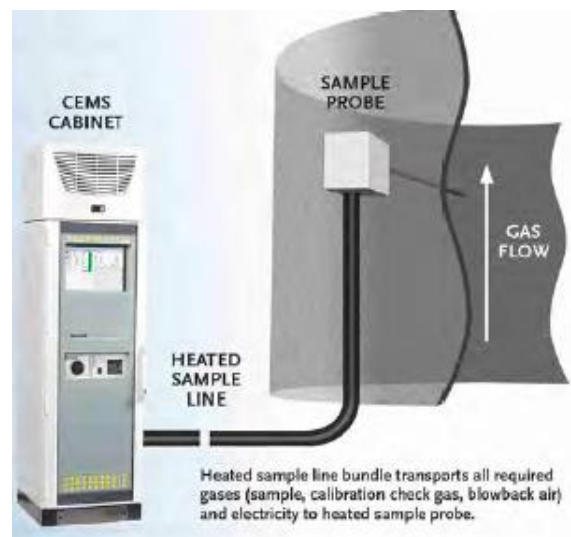
The picture above shows the CEMS IIe-A smaller cabinet

Standard CEMS II is equipped with two solenoid valves to allow automated span/zero checks as required by the new legislation.

For your proposal both CEMS systems will allow up to eight calibration cylinders to be connected. Gasmeter SWIPCEMS IIe when fitted with an FID for TOC measurement the cabinet is air conditioned with using a compressor-cooling unit mounted on the rear door of the cabinet.

Cabinet includes lead through-rubbers on each side and top of the cabinet for cable and Sample and Gas line entry/exit.

Gasmeter SWIPCEMS IIe is also supported by full remote control using a modem and team viewer software installed on the industrial PC.



The system also has a number of in-built failsafe devices to protect the instrument from potential damage.

Integrated Elektronik-Thermo FID ES

For TOC measurement we are proposing integrating a FID within the Gasmeter SWIPCEMS IIe cabinets used for Primary and Secondary Clean Gas measurements.

In the UK the Environmental Agency take the position that there is no CEN standard for low range TOC measurement by any method other than FID as stated within EN12619. As such the Environmental Agency tend to insist on TOC measurement by FID.

Gasmeter are on the working group ISO TC146/SC1/WG31 and as we are a true FTIR manufacturer we are probably the most advanced member regarding demonstrating compliance of various compounds using FTIR. However, until this working group has concluded, a standard is developed and instruments undergo TUV/MCERTS testing using EN15267-3 to the new standard then we have to continue using FID for TOC measurement.

In addition, Quantitech are the distributor for SK Elektronik products for the UK and Ireland.



The Thermo FID-ES is a 19" rack mounted FID analyser for measurement of Total Hydrocarbons.

The Thermo FID-ES has a wide dynamic range with a Low limit of detection <math><0.01\text{mg/m}^3</math> and is capable of measuring up to



T90 response time is dependent on the concentration measured, for the typical low levels associated with Energy from Waste processes fitted with good abatement the T90 response time is <math><0.5\text{sec}</math>.

The analyser benefits from using Hydrogen as its fuel therefore a hydrogen cylinder will last a lot longer than a hydrogen helium fuelled FID.

For Combustion air and Zero gas the analyser uses a built-in Air catalyser running at

The Thermo FID ES will take its sample from the exhaust of the Gasmeter FTIR.

1-A-4 Integrated Dust Monitor (250- 700mm diameter duct)

The QAL 991 is an approved Particulate CEM (Continuous Emission Monitor) designed to meet and exceed CEN standard EN 14181 / EN 13284-2. Particularly suited to monitoring emissions from industrial processes regulated under IED (Industrial Emissions Directive) the QAL 991 is also proven in other industrial processes controlled with high efficiency bag filtration. The instrument holds QAL1 approval specified in EN 15267-3, under both MCERTS and TUV.



The patented ElectroDynamic™ Probe Electrification technology extracts a specific frequency band from the induced AC current signature and filters out the DC current caused by particle collisions. The technology outperforms conventional DC triboelectric systems and alternative AC systems by extending the velocity range over which the instrument has no cross sensitivity to changing velocity, and is unaffected by contamination of the sensor rod, eliminating concerns of signal drift.

System self-checks, with logging of Zero and Span check data for QAL3 reporting and probe rod short circuit check to detect (hence avoid) electrical shorting to the stack

The Standard control unit, which will be placed inside the SWIPCEM IIe instrument cabinet, comes with advanced graphics and user interface screens, features including alarming, graphical trending, data logging, 4-20mA output

Our proposal also includes the option to purchase an ElectroDynamic® Audit unit, which is an approved reference method for conducting linearity tests as part of AST or QAL2 procedures. When using this accessory, the sensor is inserted in the audit chamber. Signal levels are applied to the sensor as references and these are measured to ensure linearity and performance against specifications.



1-A-5 CEM Data Acquisition System (DAS)

The measurement data generated from the Gasmeter system is compatible with most PC based Data Acquisition Systems (DAS) which are generally deployed for logging, averaging and report generation.

We always recommend that the CEMS system raw measurement, transfers the data to the DAS so all the necessary corrections are made and the DAS can then provide Raw Data, Corrected Data and perform connection to DCS and other PC's to provide data to others such as the authorities.

Package includes intuitive reporting software, industrial PC and printer etc.

OPTIONAL

1-A-6 *Stack Flow, Temperature and Pressure measurement.*

Due to the size of the duct on the outlet of the SWIP being less 300mm, there is no currently MCERTS QAL 1 Certified stack flow device currently available on the market.

Options for providing a Stack Temperature Thermocouple can be provided on request.

Emission Parameters Measured by the Gasmeter SWIPCEMS IIe

The proposed system is an extractive gas analyser system and for ease a list of measurement parameters, typical ranges and which part of the system is providing the measurement of each parameter, is presented. As you can see additional measurement parameters are available and provided at no extra charge to future proof your investment in case additional parameters are requested by the authorities due to changes in legislation. Any parameters that are not required can be removed from the measurement setup.

Element	Daily Average Emission Limit (mg/Nm ³)	Half-Hourly Average Emission Limit (mg/Nm ³)		Measurement Type	Comments
		100th Percentile	97th Percentile		
Total Particulate (PM)	10	30	10	Continuous	All continuous measurements are referenced to 11% Oxygen, Dry, 273K and 101kPa. Therefore Oxygen, Water, Temperature and Pressure measurement is required. Flow is required for calculation of Emission rate
Oxides of Nitrogen (NO _x) separate measurement of Nitrogen Monoxide (NO) and Nitrogen Dioxide (NO ₂) expressed as NO ₂ .	200	400	200	Continuous	
Sulphur Dioxide (SO ₂)	50	200	50	Continuous	
Hydrogen Chloride (HCl)	10	60	10	Continuous	
Hydrogen Fluoride (HF)	1	4	2	Continuous	
Total Organic Carbons (TOC)	10	20	10	Continuous	
Carbon Monoxide	50	150	100	Continuous	100mg/Nm ³ as 10 minute average
Cadmium and its compounds expressed as (Cd)	0.05			Periodic	Over 30 minutes or maximum of 8 hours
Thallium and its compounds expressed as (Tl)	0.05			Periodic	Over 30 minutes or maximum of 8 hours
Mercury and its compounds (Hg)	0.05			Periodic	Over 30 minutes or maximum of 8 hours. (Continuous or long term sampling in draft Bref)
Other heavy metals (As, Pb, Cr, Co, Cu, Mn, Ni, V)	0.05			Periodic	Over 30 minutes or maximum of 8 hours
Dioxins and Furans	0.1			Periodic	Over 6 - 8 hours. (Long term sampling in draft Bref)
See Continuous Emission Monitoring Check List to determine IED compliance					

important note: The Gasmeter SWIPCEMS IIe also measures the gas formaldehyde. The system uses this measurement to correct the HCl concentration should formaldehyde be present in your stack. Without formaldehyde compensation other CEMS systems often report HCl incorrectly. Formaldehyde is also certified.