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Continuous Emission Monitoring System Meets State and Local Regulations

Sponsored by: AMETEK Land

When thinking about industrial combustion processes emitting toxic gases and particulate matter into the environment, it is the large plants and utilities that come to mind. Naturally, this level of pollution requires constant monitoring and control. While it is true that the larger the process, the greater the demand for emission reporting, virtually all combustion processes are subject to environmental regulations. What varies between the two is the amount of oversight on measurement complexity. In general, local authorities are charged with the oversight of small processes and national authorities govern larger processes.

Emissions measurement is a continuous and major challenge for process operators requiring substantial training of personnel, the choice of measurement equipment and an appropriate measurement methodology. Requirements continue to become more stringent. In the U.S., for example, rules first developed for utilities and the power sector are now applicable for smaller industrial processes.

Fortunately, monitoring equipment that was historically used to target large, complex processes is being highly integrated and is now available to ease regulatory requirements of small- to mid-size industrial processes.

Regulatory Oversight

The continuous monitoring of emissions involves substantial regulatory oversight. Large processes involve complex measurement and reports to such national authorities as the Environmental Protection Agency (EPA) in the U.S. and the Environment Agency in the U.K.

There are, however, many gas-fired package boilers, biomass boilers, reciprocating engines and heating boilers in operation that are small in nature and that are therefore subject to local air pollution specifications. The State Department of Protection in the U.S. and local authorities under Part B of the Environmental Permitting Regulations in the U.K. are typically the supervising agencies. European regulations often necessitate independent approval to EN 15267 standards.

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These regulators enforce emission limits and minimize emissions spanning end users, test facilities and the continuous emission monitoring equipment suppliers. The goals of programs large and small include:

- Providing public health protection
- Establishing compliance requirements to set emission limit values
- Ensuring demonstrable adherence to established requirements
- Applying the best available technologies and techniques (BAT)

Continuous Emission Monitoring Systems (CEMS) are required by regulators to support these goals. The monitoring capabilities must be appropriate for the application at hand and must maintain appropriate quality assurance over the life of the equipment, thereby requiring ongoing testing and calibration.

The Role of CEMS

A continuous emissions monitoring system (CEMS) constantly measures released pollutants. Its role is to demonstrate compliance with emission limits and provide industrial process emission feedback.

A typical CEMS comprises of a sample probe, sample line, filter, conditioning system, calibration system and analyzer.

The species to be measured depend on the process and on the local environmental regulations. The most common are NOx and carbon monoxide, with oxygen measured as a diluent. Sulphur dioxide is also required in coal- and oil-fired applications.

Industry challenges involving CEMS include equipment selection, proper installation, CEMS proper calibration for stack and minimizing CEM drift over time. The equipment must ensure that measurements are accurate and stable over time, that CEMS noise does not overtake the emission signal and that there isn't cross interference with other pollutants or unrepresentative measurements.

In addition to equipment considerations, establishing reliable emissions data within a rugged environment that is operational 24/7 requires highly trained and competent personnel.

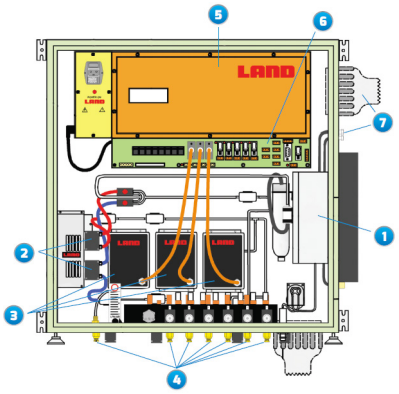
Rather than using multiple and costly components to address emissions in smaller facilities, the use of an integrated CEMS approach is appropriate.

The AMETEK Land FGA 900 Series

An All-In-One Approach

Traditionally, multiple analyzers that each addressed a specific pollutant were assembled and mounted in an air-conditioned shelter. This took considerable time, skill and financial resources to specify, build and test, often outside of the capabilities of smaller facilities.

Using an all-in-one analyzer such as the AMETEK Land FGA 900 Series provides an attractive alternative. The analyzer integrates the sample conditioning, gas analysis, calibration and data processing functions within one weatherproof enclosure. Outputs can be connected to a suitable data acquisition package and measurement records are sent directly to the appropriate regulatory authorities.



1: SAMPLE CHILLER, 2: SAMPLE AND AIR PUMPS, 3: SENSOR MODULES, 4: AUTOMATIC CALIBRATION MANIFOLD (OPTIONAL), 5: POWER SUPPLY AND CONTROL ELECTRONICS, 6: RELAY AND 4-20 mA CONNECTIONS, 7: SAMPLE INLET

Figure 1: Inside the box of the FGA 900 Series. Source: AMETEK Land

AMETEK Land's FGA 900 Series is a compact and fully integrated CEMS that combines sample conditioning, gas analysis, calibration and data processing functions into a robust, reliable and easy-to-use analyzer. It collects flue gas measurements on processes that burn natural gas and biomass and use reciprocating engines. The extractive sampling multi-gas analyzer provides accurate measurement of carbon monoxide (CO), nitric oxide (NO) and oxygen (O2) in flue gases and calculates carbon dioxide (CO2) and nitrogen oxide (NOX).

Internationally, the FGA 900 Series meets MCERTS QAL1 approval to BS EN 15267 in Europe and U.S. EPA Performance Specifications 2, 3 and 4 for the relevant gases.

The device is suitable for indoor or outdoor use given its weatherproof housing with optional heating or cooling for extreme environments. It can be mounted onto a structure enabling outdoor monitoring in close proximity to a measurement point.

FGA features include:

- Sample conditioning: Removes sample moisture and transports the condensate via peristaltic pump to the drain.
- Sample transport: A reliable diaphragm pump pulls sample through long sample tubes while flow monitoring detects blockage and monitors pump effectiveness.
- Sensors: Dual-sensor technology (DST) delivers high sensitivity and very low drift for reliable, long-term

CEMS monitoring.

- Calibration: An automated calibration system provides efficiency in gas flow control and in the adjustment of calibration constants when required.
- User interface: Integrating the user interface provides for local display and easier configuration and troubleshooting.
- I/O: Measured values are transmitted via a 4-20 mA signal with relays providing status indications.
- Climate control: In tropical and subtropical climates a vortex cooler extends operating temperature ranges. It is fully weatherproofed, inexpensive and has no moving parts. A thermostatic valve turns off the cooler when not needed.

The highly integrated solution provides lower cost, advantageous placement of the analyzer and the elimination of custom engineering.

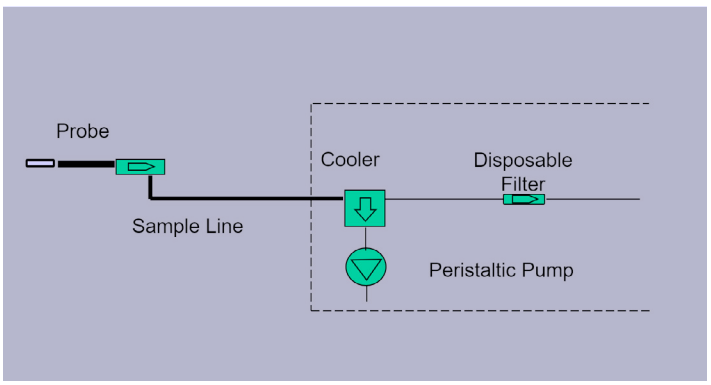


Figure 2: The principal components of an FGA sampling system. Source: AMETEK Land

The compact analyzer contains built-in sample conditioning, automatic calibration and an IP65 enclosure. It is easy to install and requires low maintenance. Simple to operate, the FGA 900 works via a pair of electrochemical sensors for each measured species. The dual-sensor technology provides accuracy, stability, low drift and self-check (Figure 3).

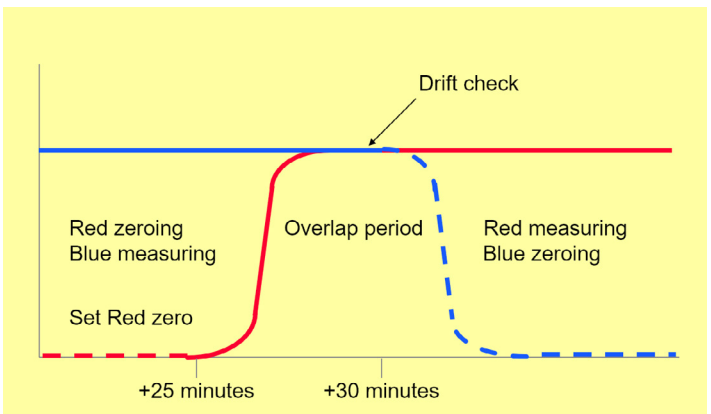


Figure 3: Dual sensor technology. Source: AMETEK Land

These electrochemical sensors feature extremely high sensitivity, with a detection limit of approximately 1 ppm. They measure gas concentration rather than partial pressure and are unaffected by ambient pressure changes. They are, however, affected by extended exposure to sample gas. A dual-sensor switching mechanism allows the sensors to effectively recover.

DST takes advantage of the high reliability, high accuracy and low maintenance costs made possible by modern electrochemical cells. Each sensor uses a pair of cells to detect a specific flue gas component and a range of cell types can be incorporated into a single analyzer. An onboard microprocessor provides switching for continuous uninterrupted output. DST automatically corrects any zero-drift and detects span drift. Switching ensures that oxygen and water content of the electrolytes in the cell are balanced for long cell life and high accuracy. CEMS using DST are certified by USEPA and QAL1 approved under the MCERTS scheme in Europe.

Sample Probe Features

A simple and inexpensive unheated sample probe features a small sintered filter on a probe tip. Used for clean processes where little dust exists, it includes a connection for calibration gas.

A more sophisticated probe employing an external heated filter is required for more challenging processes and is mandatory for applications requiring MCERTS QAL1 approval.

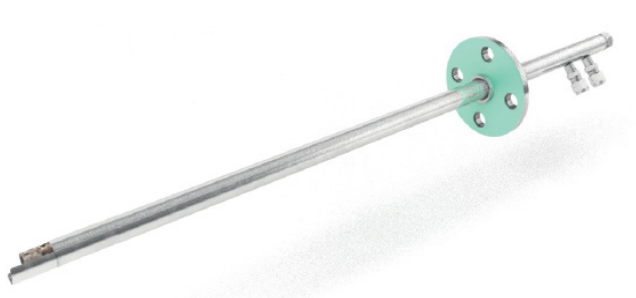


Figure 4: The unheated sample probe can be used in many applications where there are low levels of particulate matter in the stack

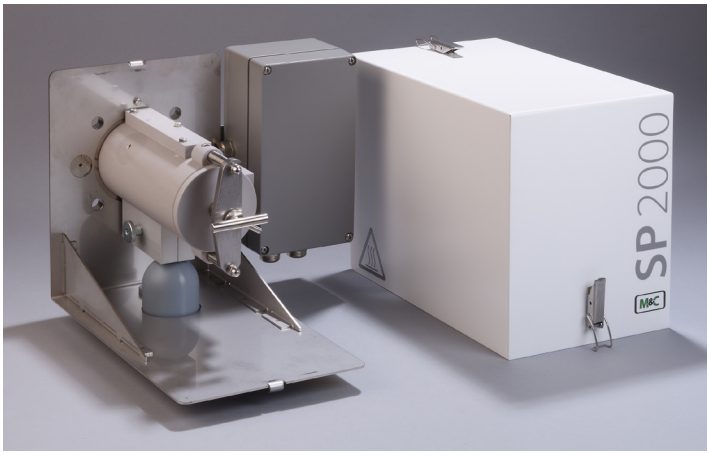


Figure 5: The M&C SP2000 Probe is required for MCERTS applications and is also electrically heated and has an external filter. Source: M&C Tech Group

Summary

An integrated CEMS offers an attractive, easy-to-use and cost-effective method for emissions measurements in a variety of applications. There is no need for custom engineering, installation costs are reduced and the analyzer can be located close to the measurement point. The technology is well-proven and can be used in many different types of processes.

High-quality monitoring technology previously targeting larger processes now addresses the challenges and requirements of local pollution control. AMETEK Land's FGA 900 Series provides a low cost yet highly reliable, accurate and effective solution for small- to mid-size operations.

AMETEK LAND

Stubley Lane
Dronfield, S18 1DJ
United Kingdom
Tel: +44 1246-417691

ENGINEERING 360 MEDIA SOLUTIONS

201 Fuller Road, Suite 202
Albany, NY 12203-3621
Tel: +1 518 880 0200

ABOUT AMETEK LAND

AMETEK Land is the world leader in the design and application of infrared temperature measurement for industry. The company is known as an innovator and manufacturer of high quality precision radiation pyrometers and pyrometer systems and its position is unrivalled with over 60 years' experience in temperature measurement. AMETEK Land products are used extensively in applications as diverse as steel, glass, electronics, mineral processing, power generation, utility and aircraft gas turbines, as well as within a wide range of other industries. Ongoing development creates products for new applications and the continuous improvement of an expanding product range.