Handheld Industrial Analyzers make Emission Monitoring FAST, ACCURATE and PAINLESS

Ensuring that your equipment is safe and up to code is a necessary part of the job. **ECOM** makes it easy with fast and reliable handheld emission analyzers.

Rapid changes in the combustion process have enabled companies to key in on technologies to monitor, analyze, control and automate their assets. Handheld industrial analyzers have bridged the gap from decades of expensive, cumbersome permanently mounted devices to compact, field friendly (wireless) emission analyzers. This modernization has greatly increased the demand for fast and reliable, robust handheld technologies. From lightweight design to a rugged build, engineers needed to deliver instant, accurate results every time. The primary goal is to provide the ability for you to quickly test so you can get back to work.

An Industrial Emissions Analyzer is a device containing either electrochemical, infrared or photoionization detector (PID) sensors. The electrochemical sensor offered from **ECOM** comes in two versions, handheld and portable. Handheld units easily fit in the palm of your hand or as a case mounted analyzer, the ECOM-D is built with you in mind. Powerful magnets on the back of

the analyzer allow your technician to work hands free during any combustion analysis for increased efficiency.

Available with up to six sensors, this analyzer is engineered to adapt to your individual need, and allows for custom configuration by adding optional features such as a thermal quick-printer for instant documentation, **Wi-Fi** data transfer and mini-gas cooler for better NOx efficiency at sub10 ppm levels.

How does it work?

Each sensor has a circuit housed within an electrolyte solution and when the target gas is introduced into the sensor, the half reactions (oxidation and reduction) at the electrodes generate a flow of current through the circuit. The voltage drop across the electrodes is measured by the analyzer and corresponds directly to the target gas concentration (i.e. the higher the concentration of gas, the more reaction that takes place, the higher the current).

In each of the electrochemical sensors used, there is also a third reference electrode which maintains a baseline potential for increased accuracy.

Several advantages of electrochemical sensors include: They can be **specific to a particular gas** or vapor **in the PPM range**, **linear output**, **low power** requirements and good **resolution**. Once calibrated to a known concentration, they offer **excellent repeatability** and **accuracy**. They **do not get poisoned** by other gases, the presence of **other ambient vapors will not shorten** or curtail the **life** of the sensor. Electrochemical sensors and are **less expensive** than most other gas analyzer technologies.

One disadvantage of using electrochemical sensors is that greater exposure to target gas, the shorter the life span. Generally, a one- to three-year life expectancy is specified. Low humidity and high temperatures can cause the sensors electrolyte to dry out. Exposure to target gas or cross-sensitivity gases also depletes the electrolyte.

THE KEY TO EXTENDING SENSOR LIFE IS CONSISTENTLY PURGING THE UNIT OF GASES BEFORE AND AFTER THE TEST.

Shown here is a typical Wi-Fi configuration when the ECOM application is installed on a smart phone. Change settings remotely that provides good feedback of the sensor to the magnetically mounted hand-held unit.

ECOM-D STANDARD FEATURES

- Up to 6 Electrochemical Sensors including IR
- Sensor Options: O2, CO, NO, NO2, SO2, H2S, CxHy CO2, CH4 (IR)
- CO Purge Pump to Prevent Oversaturation
- Condensate Trap with Electronic Shutoff
- Flue Gas, Ambient, & Sensor Temperature
- Averaging Test Feature
- Onboard Calculations for CO2, Efficiency, Excess Air and O2 Correction
- 1ft Inconel Probe* with 9ft or 15ft Standard Sample Line*
- Ambient or Peltier Cooler Sample Conditioner

What are the core testing environments?

OIL & GAS Challenges

Producing maximum horsepower with the lowest emissions is critical for power generation, natural gas compression, landfill, biogas and CHP applications. For proper operation, engine efficiency and environmental compliance need to be considered. Accurate exhaust measurements allow for proper adjustments of ignition timing and fuel flow, verification of catalyst performance and efficiency. Also, for monitoring of the emission permit and testing and reporting for US EPA.

Air surplus, fuel pressure, engine setting and ambient temperature or humidity have a significant effect on emissions. These effects must be considered when optimizing or adjusting the engine and maintaining a minimum emission level. If the wrong adjustment is performed due to a bad emission reading, it can have negative consequences:

- Misfiring
- Mechanical knocking
- Increased temperature in the engine components and operating materials
- Increased wear
- Higher service and repair costs
- An expensive failed test or notice of violation (NoV)

BOILER and BURNER Challenges

Everyone wants the highest efficiency, but on-site condition and environmental permits are often contrary for optimal efficiency. Knowledge of current and pending regulations can make or break a project. Dropping emissions limits (in some areas of the country, approaching 5 ppm total NOx) have been the driving factor in improving combustion control while still improving system efficiency. Accurate emissions measurements are critical during commissioning and maintenance.

When evaluating the burner's characteristics, the focus of attention is on fuel, and air delivery, flame behavior, and of course the measured flue gas and emissions values. Experienced service engineers also know that other combustion systems need to be checked:

- Optimized fuel density and delivery and air supply is crucial in order to maintain a wide operating range, stable flame, and the best efficiency with lowest emissions.
- Correct set-points must be confirmed. Ensure that fan capacity, the blowers and air ducts are controlled and coordinated with one another. These items combined with well-designed furnace dimension, burner spacing, and wind-box, all contribute to better controlled combustion.
- Your tools and combustion analyzer need to work correctly all the time. You want to be certain the installation is operating correctly.

When analyzing the burner's behavior, the focus of attention is often on fuel supply, atomization, control behavior and emissions values. However, experienced service engineers know: optimum air supply is crucial for a wide adjustment range, stable combustion and the best emissions values. This means it is vital to ensure that **blowers**, **air ducts and controls** are coordinated with one another.

There is therefore an optimum fuel to air supply ratio for every combustion process: the combustion plant operates with a stable flame, optimum efficiency and lowest emissions in this range. The challenge for service engineers lies in determining the optimum air ratio and setting the system on that basis.

The details of how the differences in terms of the fuel-air mixture can be best set vary according to the boiler manufacturer, type of fuel and control plan. Some burners control the quantity of air which is taken into the boiler, others the quantity of fuel and still more allow the setting of both parameters. In any case, it is important to know the exact oxygen content in the process to ensure reliable & cost-effective operation.

CONCRETE, LIME and CEMENT Challenges

Worldwide, no material is used more for building than cement – and the demand is increasing daily. Accordingly, supply is growing, and the competition on the market is becoming tougher. As a result, impeccable product quality as well as time- and cost-efficient production are of crucial importance. On top of this, numerous environmental protection regulations must be adhered to. The use of the most modern measurement technology, such as that of the ECOM-D, is thus indispensable.

In cement production, three main areas of use for the monitoring and analysis of occurring emissions can be defined.

Testing furnace atmosphere in brick production

In this area, average temperatures of 1,100 °C to 1,300 °C is reached. In addition to this, concentrations of 2 Vol. % O_2, max. 500 ppm CO and approx. 1,000 ppm NO are to be expected. A possible site for recording these values can be at the rotary furnace exit, for example. Here it is easy to establish whether incorrect air intake occurs between the pre-heating input and the pre-heating exit.

Testing furnace atmosphere in the pre-heater

In the core process of cement production, the raw material is passed down through a cyclone tower, where it is treated with hot process air from the opposite direction in order to drive out the CO_2. At the exit from the pre-heater, measurement values of 700 °C, 3 Vol. % O_2, 500 ppm CO and 400 ppm NO are to be expected. Daily measurement of these parameters is recommended.

Compliance with environmental stipulations

Cement production is a raw material- and energy-intensive process which produces an accordingly high level of emissions which are harmful to humans and nature. For example, the regular drying and heating cause exhaust gases which contribute to the extremely dusty exhaust air from the process as a whole. Among the emissions are carbon dioxide emissions which occur in combustion.

In order to ensure that all emissions remain within the environmental protection regulations, the emissions must ideally be measured and analyzed directly at the flue. This is the only way to allow the responsible people to react in time, optimizing the respective processes and plants if limit value violations occur.

GAS TURBINE Challenges

Not only in industry, but also in the field of communal power and heat supply, gas turbines have proven themselves as reliable and crucial components in combined heat and power plants (CHP), for example, or combined gas and steam power stations. The optimally adjusted operating parameters of a gas turbine are a deciding factor in whether the respective plant really works efficiently, productively and economically.

The complex interrelationship between the exhaust gas parameters and the adjustment of the combustion process forms the basis for an optimum performance. For this reason, it is important for efficient operation to have a reliable, highly precise measuring instrument on hand.

Very low as well as very high gas concentrations have to be measured for emissions on gas turbines.
Very low CO and NO_X emissions at the correct adjustment and the right operating point of the gas turbine:

- In order to achieve as high a measurement accuracy as possible, the influencing factor of the

exhaust gas humidity must be reduced. This includes above all the dilution of the exhaust gas parameters by a high exhaust humidity (gaseous state) as well as leaching due to chemical reactions between the exhaust gas parameters and condensate (liquid state).

Very high gas concentrations when starting up the plant and at differing load level:

- During this procedure, a gas concentration peak can occur, which cannot be compensated by a low-sensor without dilution.

ALUMINUM PLANT Challenges

Thanks to numerous advantages such as its infinite ability to be recycled, aluminum is one of the most commonly used raw materials worldwide. However, the production of pure aluminum is very complex, and because of the harmful emissions, is subject to various environmental protection guidelines.

In order to be successful in this field, the use of the most modern measurement technology is indispensable

The production of aluminum by electrolytic smelting is an extremely energy-intensive process which causes an accordingly high level of emissions. In addition to dust and fluoride (also fluoride compounds), these include SO_2 and CO, which occur due to carbon electrode consumption. All these parameters must be regularly monitored, analyzed and, if necessary, optimized. This is the only way to adhere to the stringent environmental stipulations and to ensure the efficiency of the smelting furnace.

In emission monitoring in exhaust gas from electrolysis furnaces and in the gas extracted from the furnace building, regulations apply which for example define limit values for particulate emissions and limit values for the mass ratio of aluminum. The fluoride emissions and their anorganic compounds (hydrogen fluoride) are also subject to regulations.

In addition to CO, SO_2, fluoride and hydrogen fluorides, the high combustion temperatures in aluminum production can also lead to high nitrogen oxide values. These must also be monitored and analyzed using a suitable measuring instrument.

METAL and STEEL PLANT Challenges

In a market characterized by increasing demand, constantly growing quality demands and a multitude of environmental protection regulations, metal and steel producers must work not only efficiently but also in impeccable quality.

<u>In raw iron production</u>

Raw iron is produced by reduction (oxygen withdrawal) of iron ore in a blast furnace, or by direct reduction. Coke, natural gas or coal are used as reduction materials.

In the blast furnace process, the prepared ore (pellets, sinter) and the additives are charged into the blast furnace from the top, together with coke. A hot blast flows in from below as a further energy carrier. The mixture of hot blast and reduction gases climbs up in the opposite direction to the sinking raw materials, and is drawn off at the top as stack gas. The liquid raw iron collects on the floor of the furnace together with the slag, and is regularly drawn off, and usually transported to a steel works for further processing.

The composition of the stack gas during the entire process is a crucial factor influencing the quality of the combustion in the air heaters.

<u>In coking plants</u>

Coking plants are thermal refinement plants for mineral coal, in which the coal is heated to at least 800 °C in dry distillation under exclusion of air (pyrolysis). The objective of this coking is the production of coke for industrial use, in particular in metallurgy. Coke is characterized by a very high carbon content (>97 %) and only very few volatile components. During the process, coke oven gas is produced, which is used further. The especially suitable coal is dry-distilled ("cooked") over approx. 15 hours in a coke oven, and then transferred to a cooling process. The previously common wet cooling has been largely replaced by dry cooling in a slag cooler. This allows the recovery of heat via a heat recovery boiler, and a reduction of pollutant emission.

Relevant pollutants which occur in coke production are, in addition to dust, above all SO_2, NO_x, CO and organic components. With regard to permitted limit values, the exhaust gases are subject to certain limit values, and their composition allows conclusions to be drawn on the monitoring and optimization of the production process.

MARINE ENGINE Challenges

Emission control areas in marine waters are becoming more heavily regulated. Any exhaust emissions that are subject to MARPOL Annex VI and the MEPC.103 (49) guidelines are easily measured with our line of portable analyzers, where you need them. A need for a rugged portable unit that is convenient and will meet the demands of maritime conditions for a variety of gases.

- Measures O_2, CO, NO_X (NO + NO_2, separate), SO_2, – high precision and long-term stable
- Ready to measure in a couple of minutes
- Simple, accurate testing with the emission measurements quickly seen on the large, back-lit display
  Determination of the fuel Sulphur content by means of SO_2/CO_2/ ratio

The handheld emission analyzer for diesel ship engines is approved for MARPOL Annex VI and the NO_x Technical Code. Built to meet the demands of maritime conditions, it measures O_2, CO, and NO_x more easily and less costly than other methods.

Currently Wi-Fi communications on a smart phone is being implemented whenever a spot-specific solution is required.

Conclusion on hand-held emissions analyzer

Hand-held emissions analyzers with electrochemical sensors are a proven technology that have been used for many years, and will continue to be along with portable emissions analyzers (the cornerstone of gas analyzer sensors). The convenience of small and hearty sensors always will be of use for industrial and commercial gas analyzer devices. But when using them in your gas analyzer equipment within a specific application, always remember the sensors' limitations. ECOM has a broad offering for both hand-held and portable emissions analyzers.

ECOM family of portable and hand-held emissions analyzers

GAS MEASUREMENT SOLUTIONS SINCE 2004

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