FASTER, MORE ACCURATE GAS ANALYSIS FOR CLEAN AIR STRATEGIES

As the global expert in gas analysis, Servomex has always been laser-focused on providing industries with solutions that make processes cleaner, safer, and more efficient.
To meet the challenges of modern gas analysis, the Servomex team developed the SERVOTOUGH Laser 3 Plus range creating an advanced, high-performance Tunable Diode Laser (TDL) analyzer with digital processing, reliable accuracy, and a compact footprint.
TDL sensing is a fast-response, accurate measurement that is highly specific to the gas of interest.

Laser 3 Plus

It uses a single-line "monochromatic" spectroscopic technique that offers highly stable calibration, a continuous, fast, in-situ measurement, and the avoidance of optical cross-interference from other gases.

The TDL system consists of a laser light source, transmitting optics, an optically accessible absorbing medium, receiving optics, and detector(s).

The signal information is held in the gas absorption line shape, which is obtained by scanning the laser wavelength over the specific absorption line. This causes a reduction of the measured signal intensity, which is detected by a photodiode and used to determine the gas concentration and other properties.

Servomex's TDL analyzers use a second harmonic detection (2f) modulation technique that delivers greater accuracy, sensitivity, and reliability of measurement, especially in low ppm-level measurements.

With this high-performance technology, industrial operators can achieve the measurements required to control process efficiency and reduce emissions, with the added benefits of ease-of-use and low maintenance requirements.

TDL makes clean air a breeze

Clean air and decarbonization strategies not only have to meet regulatory standards, but must also help industrial operators to achieve their carbon reduction targets.

These strategies rely heavily on gas analysis, which is used to measure the harmful emissions created and to help reduce emissions by improving the efficiency of the process.

In any clean air policy, controlling combustion efficiency plays an essential role, lowering the level of key pollutants emitted, reducing fuel consumption, and improving safety.

To achieve these goals, accurate measurements are required for the relative concentrations of oxygen (O_2) and combustibles (COe) in the reaction mixture, to keep the ratio between fuel and air at the optimum level.

The combustion process mixes fuel with O_2 – usually from air or an enriched oxygen feed – in a fired heater. This creates heat energy which can then be used for power generation or as part of a wider industrial process, such as chemical manufacturing. Typically, the combustion process needs a sizeable quantity of fuel, generates harmful byproducts as emissions, and creates possible safety hazards.

Before accurate gas analyzer technologies became widely used, fired heaters were usually operated in conditions of high excess air. This was extremely inefficient and increased the level of fuel consumption, but helped to avoid unsafe, explosive conditions in the heater.

Excess air also means there is extra O_2 in the process to combine with nitrogen and sulfur from the fuel, creating unwanted emissions such as oxides of nitrogen (NOx) and sulfur (SOx).

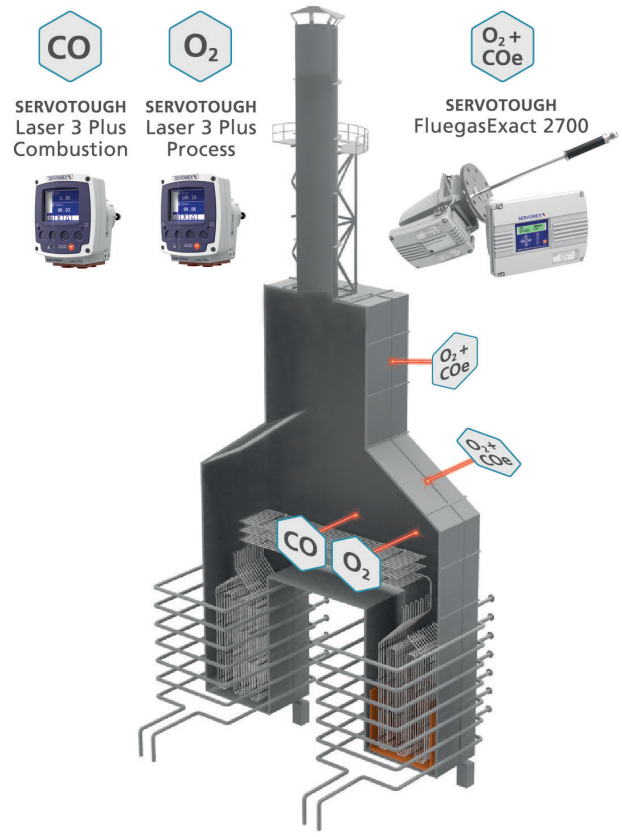
Accurately measuring the levels of O_2 and COe – and particularly the combustible, carbon monoxide (CO) – means that operators can balance the air-to-fuel ratio to ensure process safety and achieve optimal fuel efficiency. Controlling the combustion reaction in this way can also significantly reduce emissions of NOx, SOx, CO, and CO_2.

On large-scale furnaces, such as the bigger ethylene crackers, it has become common practice to use multiple oxygen analyzers for combustion monitoring. It has long been understood that on these larger processes there are different zones of combustion, with the effects of layering and convection giving different concentrations along the length of the furnace.

TDL sensing technology measures across the top of the furnace, providing an average result for gas concentration rather than a single-point result. This ensures a better overall picture of conditions within the fired heater. However, since TDL sensing is highly specific to the gas being measured, separate analyzers are required for O_2 and CO.

Servomex's SERVOTOUGH Laser 3 Plus Combustion TDL analyzer, for example, can be configured to measure either O_2 or CO. It can also be configured for a joint measurement of CO and methane (CH_4), and provides a rapid-response measurement for safety in natural gas-fired heaters and boilers.

TYPICAL FURNACE CONFIGURATION



Safety in combustion

In recent years, the knowledge that a fuel-rich situation – one where carbon monoxide levels are high – is a potential source of explosions has caused the measurement of CO to move from a supporting combustion measurement to a key safety measurement.

This has also been driven by the increasing use of low-NOx burners, which are highly effective at reducing unwanted emissions, but run with a cooler, larger, and more complex flame which can be inherently less stable than older, high-NOx-producing burners.

Flame instability leads to a requirement for improved flame-out detection, and customers who use natural gas as a fuel have turned to TDL analyzers as a key part of their safety system.

TDL measurements for CO show a much better performance compared with alternative analysis techniques such as pellistors or thick film sensors. TDL's faster speed of response and superior sensitivity makes it ideal for both efficiency and safety monitoring.

A TDL analyzer can be configured to measure CH_4 and CO at the same time, and this highly specific measurement also provides more detailed data and analysis of conditions inside the furnace.

The cross-stack measurement allows TDL analyzers to detect any developing flame-out situation quickly, across the whole process. As it is a light-based technology, with no sample extraction, TDL sensing delivers a rapid response to changes in the boiler condition, typically within a few seconds.

This speed is vital to safety monitoring, as a boiler can shift from safe to unsafe conditions very quickly. The faster the analyzer can respond, the more time the operator has to take corrective action.

Additionally, the non-contact nature of TDL sensing means that it is not seen as a potential source of ignition in the presence of flammable gases, enhancing safety without the requirement for a flame arrestor, such as those used by other sensor technologies.

Solutions for combustion and process oxygen

Servomex's Laser 3 Plus range is designed to make TDL sensing easy to install and use, for applications across the power generation and hydrocarbon processing markets.

The Laser 3 Plus Combustion model measures O_2, CO, or CO and CH_4 in in-situ cross-stack applications, delivering exceptional performance benefits. It is designed for process heaters, incinerators, thermal crackers, thermal oxidizers, power stations, coal mills, and furnaces.

The Laser 3 Plus Process version provides the most stable, repeatable results for the measurement of O_2 in process temperatures up to 500°C. This makes it ideal for applications including oxidation control, inerting, safety monitoring, process control, flare gas monitoring, combustion control below 500°C, and coal to chemical processes.

The analyzer's compact design means it can be installed, configured, and calibrated by just one person, with a multi-directional mounting assembly that ensures precision alignment from the outset. This combines with the quick-release mechanism to help make reinstallation simple after maintenance.

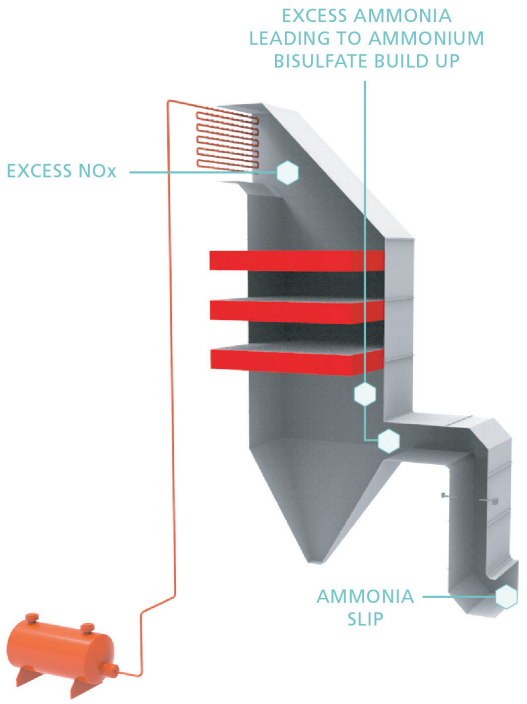
A built-in line lock cuvette system helps to ensure measurement reliability, which is particularly key to process control and safety applications.

In the absence of the gas of interest, older-generation TDL analyzers would drift to measure a nearby, incorrect absorption line instead. For example, a CO analyzer that had no CO present to measure might pick up an adjacent water line and deliver an incorrect reading.

With the line lock cuvette system, the analyzer has a secondary detector targeted on a cuvette filled with the required gas. This means the analyzer always has a known target gas to sense, enabling the main detector to stay locked-in, and delivering an accurate measurement even if the measured gas is zero.

The line lock cuvette system requires no maintenance and has built-in self-diagnostics to monitor the concentration within the cuvette, triggering an alarm if this concentration is not detected.

For applications where incorrect measurements may lead to heavy fines for non-compliance, the line lock system provides confidence that the measurement is stable and secure.



Conclusion

With application requirements becoming increasingly demanding, and a greater focus on clean, efficient processes, accurate and reliable gas analysis is more important than ever.

Digital TDL technology delivers a reliably accurate and fast-response measurement for the key gases, particularly process oxygen and combustion gases.

When combined with the compact, easy-to-operate Laser 3 Plus analyzer, it ensures a laser-focused solution for processes and helps deliver cleaner air as part of a larger overall strategy.

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