

# ES

EXPERT SOLUTIONS

# INDUSTRIAL PROCESS & EMISSIONS

ISSUE: 24

THE GAS ANALYSIS MAGAZINE

## THERMAL POWER COMBUSTION

Efficient and safe control for coal-based processes

## TUNABLE DIODE LASERS

A fast, accurate solution for  
combustion measurements

## MONITORING HARMFUL EMISSIONS

Solutions for reducing NO<sub>x</sub> and SO<sub>2</sub>

INNOVATIVE SUPPORT FOR  
**COMBUSTION  
APPLICATIONS**

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a spectris company

# IMPROVE YOUR GAS ANALYSIS

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**SAFETY, PROCESS CONTROL, AND COMBUSTION.**

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## SUPPORTING CONTROL OF COMBUSTION APPLICATIONS

Welcome to the latest issue of our Expert Solutions magazine, focusing on our Industrial Process & Emissions (IP&E) division's support for the power generation, hydrocarbon processing, and emissions monitoring industries.

In this issue, you can learn more about how our analyzers can be used to optimize and control combustion processes within these industries, in order to reduce fuel costs, lower harmful emissions, and improve safety.

We highlight our analytical solutions for measuring oxygen and combustibles, including Zirconia, Thick Film Catalytic, and Tunable Diode Lasers (TDL). We also examine how TDL sensing can provide a critical methane measurement for safety applications.

To show how these solutions can work within combustion applications, we take an in-depth look at the thermal power process, and showcase our range of emissions monitoring solutions.

Our IP&E team is ready to help you find the right solution for your combustion process.

Get in touch at [servomex.com/contact-us](https://servomex.com/contact-us)



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## SPOTLIGHT ON SPARES

Access to the right spare parts and consumables at the right time is essential. We strongly recommend that you have an approved spares pack on hand throughout this current crisis.

To help, our global sales and distribution network is getting essential equipment to critical sectors, ensuring customers have the resources they need. The Servomex global service team is on hand to help you select the right part for your analyzer, avoiding unnecessary downtime.

Visit: [servomex.com/service](https://servomex.com/service)

# THE NEED FOR SPEED: TDL COMBUSTION ANALYSIS



To reduce fuel costs and support safety, well-controlled combustion requires an optimized air-to-fuel ratio, which in turn requires accurate measurements for oxygen (O<sub>2</sub>) and carbon monoxide (CO).

Tunable Diode Laser (TDL) analyzers, such as Servomex's SERVOTOUGH Laser 3 Plus range, show a marked improvement in CO measurements compared to alternatives such as pellistor or thick film sensors. This includes a faster speed of response and better sensitivity, ideal for both efficiency and safety.



SERVOTOUGH Laser 3 Plus

## A REVOLUTION IN COMBUSTION MEASUREMENT

TDL systems can be installed to make in-situ, cross-stack measurements for process and combustion control. There is no physical or mechanical interaction with the process, other than molecular absorption, so the measurement is very stable.

The sensor provides a fast-response measurement that is highly specific to the gas of interest, even in hot, wet, corrosive and dusty process conditions. While their O<sub>2</sub> measurements are comparable, Zirconia analyzers only measure a single point, but TDL analyzers take

an average path measurement for O<sub>2</sub> across all the burners.

When the laser analyzer is installed, it is positioned across the process. It is important to keep the laser aligned as the process heats up, which can cause the walls to flex.

The Laser 3 Plus analyzer uses divergent optics and a mounting assembly for multi-directional adjustment to overcome this issue. Additionally, the ability to monitor transmission levels means that alignment is maintained and monitored between shutdowns.



Laser 3 Plus offers multi-directional mounting adjustment

### CRITICAL SAFETY PROTECTION

Methane (CH<sub>4</sub>) monitoring is a key safety requirement, as a fuel-rich environment is a potential source of explosion.

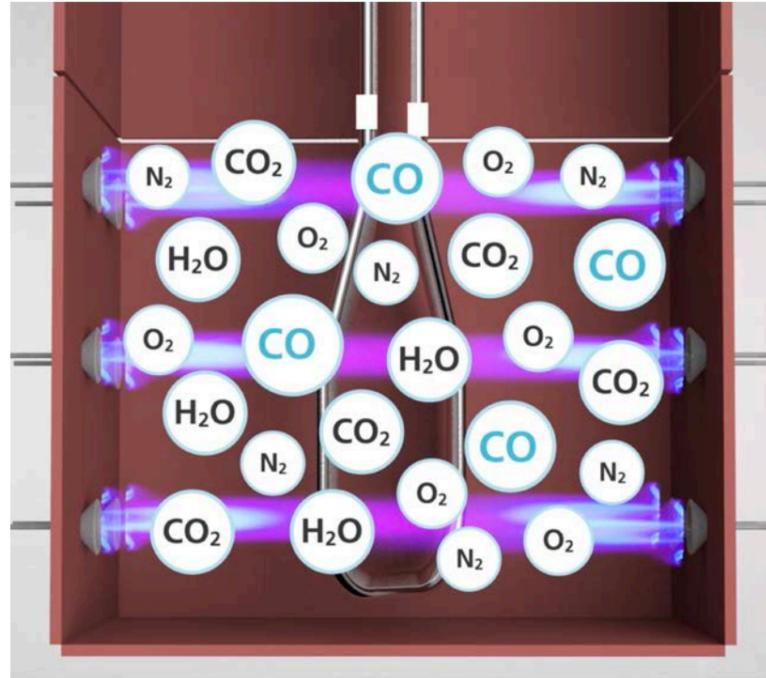
This situation has been driven by the increasing use of "low-NOx" burners which reduce oxides of nitrogen (NOx) emissions, but run a cooler, less stable flame than older burners.

The Laser 3 Plus Combustion's cross-stack measurement provides an average result across the process, so any flame-out situation is picked up quickly – in contrast to point measurement techniques.

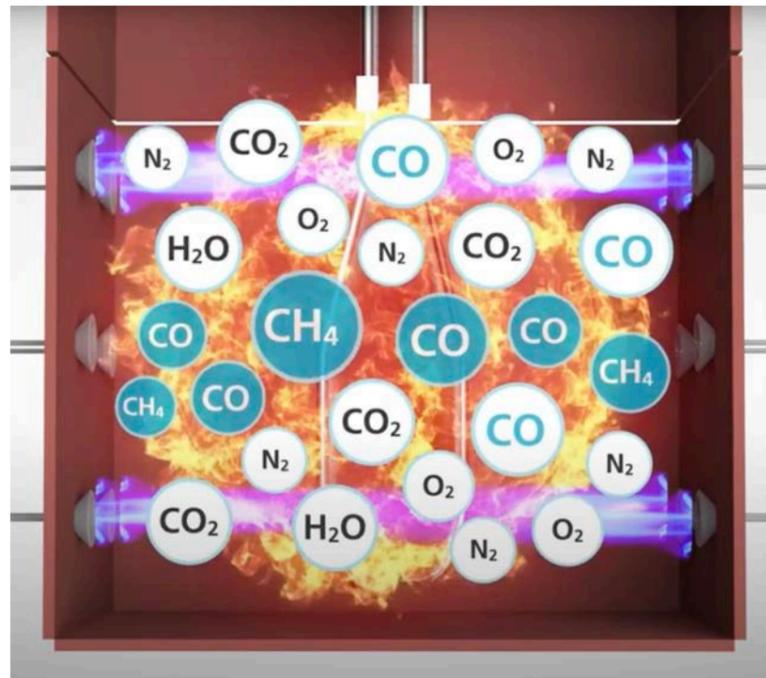
Since it has a light-based measurement with no sample extraction, the Laser 3 Plus Combustion provides a very fast response to changing boiler conditions.



SERVOTOUGH Laser 3 Plus Combustion  
CO + CH<sub>4</sub> MONITORING



All burners working properly



Flame-out increases potential of explosion as methane can rise

# SHINE NEW LIGHT ON YOUR COMBUSTION CHALLENGES



FAST, ACCURATE RESPONSE FOR PROCESS CONTROL  
**IMPROVES SAFETY**

**COMPACT** FOR EASY, TIME-SAVING INSTALLATION THAT ONLY NEEDS ONE ENGINEER

LINE LOCK CUVETTE TECHNOLOGY PROVIDES **RELIABLE SAFETY INTEGRITY**

**HAZARDOUS AREA APPROVED** AND **SIL ASSESSED** FOR TROUBLE-FREE INTEGRATION

The SERVOTOUGH Laser 3 Plus Combustion is a highly compact Tunable Diode Laser (TDL) analyzer optimized for in-situ, cross-stack combustion gas measurements.

It provides an exceptional, fast-response performance, and is easy for a single engineer to install, configure and calibrate.

Three different versions are available, configured to measure oxygen (O<sub>2</sub>), carbon monoxide (CO), or a combination of CO and methane (CH<sub>4</sub>).

The non-depleting, light-based measurement technique significantly reduces maintenance requirements and costs.



SERVOTOUGH Laser 3 Plus Combustion

See the fired heaters application video: [servomex.com/firedheaters](http://servomex.com/firedheaters)

# HIGH-RESPONSE COMBUSTION CONTROL THAT IS RELIABLE

Using an integral, custom-designed sampling system and close-coupled extractive measurement technique, the SERVOTOUGH FluegasExact 2700 is designed for operation in the hottest, most extreme combustion environments.

Ideal for high temperature processes up to 1750°C (3182°F), it measures both oxygen (O<sub>2</sub>) and combustibles (COe), using a Zirconia sensor for O<sub>2</sub> and a Thick Film Catalytic COe sensor.

Resilient and reliable, it is designed for safe area, Zone 2 Division 2, and ATEX Cat. 3 hazardous area rated locations.



SERVOTOUGH FluegasExact 2700

ALL-IN-ONE SOLUTION FOR COMBUSTION CONTROL  
**SAVES ON SPACE AND COSTS**

LONG-LIFE, LOW MAINTENANCE SENSING TECHNOLOGIES  
**REDUCE OPERATION COSTS**

EXTRACTIVE SAMPLING DESIGN  
MEANS LESS FREQUENT REPAIR OR REPLACEMENT OF ANALYZER

A SULFUR-RESISTANT COMBUSTIBLES SENSOR  
ENABLES USE IN ELEVATED SULFUR LEVELS

Watch our experts compare the benefits of Zirconia and TDL analyzers for combustion: [servomex.com/vid-combustion](http://servomex.com/vid-combustion)

# MORE EFFICIENCIES, LOWER EMISSIONS



## EFFECTIVE GAS ANALYSIS FOR THERMAL COAL POWER GENERATION

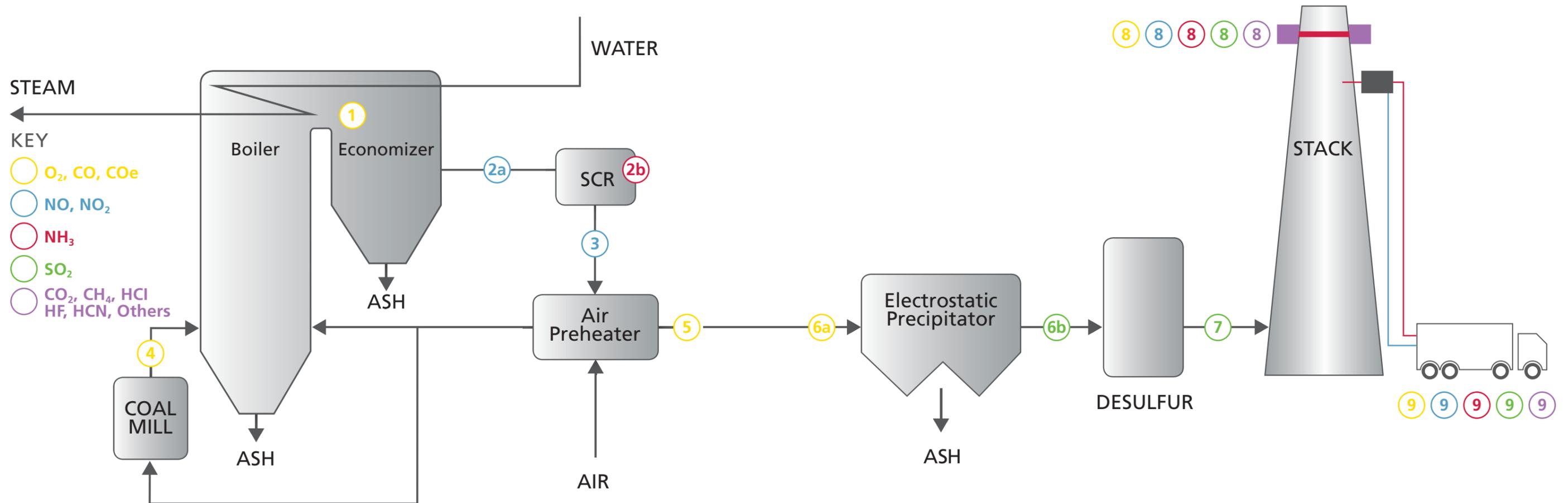
Coal-fired power plants need to deliver an efficient process while maintaining safety, controlling fuel costs, and meeting emissions targets. This requires precise monitoring of the furnace to optimize combustion efficiency.

Servomex offers a total gas analysis solution. Our cutting-edge combustion analyzers can save up to 4% of your fuel costs, while reducing emissions and maintaining the highest standards of safety.

**FULL PROCESS SHOWN ON NEXT PAGE**

See our full SERVOTOUGH range: [servomex.com/servotough](http://servomex.com/servotough)

# OUR ANALYZERS DROP DIRECTLY INTO YOUR POWER PROCESS



## ANALYZERS FOR THE INDICATED MEASUREMENT POINT:

- 1. SERVOTOUGH FluegasExact 2700
- 2a. SERVOPRO 4900 Multigas or SERVOPRO NOx
- 2b. SERVOTOUGH Laser 3 Plus
- 3. SERVOPRO 4900 Multigas or SERVOPRO NOx
- 4. SERVOTOUGH Laser 3 Plus
- 5. SERVOTOUGH FluegasExact 2700 or SERVOTOUGH Laser 3 Plus
- 6a. SERVOTOUGH Laser 3 Plus
- 6b. SERVOPRO 4900 Multigas or SERVOTOUGH SpectraExact 2500
- 7. SERVOPRO 4900 Multigas or SERVOTOUGH SpectraExact 2500
- 8. SERVOPRO 4900 Multigas
- 9. SERVOPRO 4900 Multigas

Pre-heated air and pulverized coal are fed into the boiler, where combustion takes place. The SERVOTOUGH FluegasExact 2700 continuously monitors the amount of oxygen (O<sub>2</sub>) and combustibles to support optimum combustion conditions.

Following combustion, Selective Catalytic Reduction (SCR) or Selective Non-Catalytic Reduction (SNCR) is

typically used to reduce harmful NO<sub>x</sub> emissions. The SERVOTOUGH Laser 3 Plus Ammonia Tunable Diode Laser (TDL) analyzer is specifically optimized for precise monitoring and control measurement of ammonia (NH<sub>3</sub>). See page 12.

Further process monitoring and control feedback is provided by the SERVOPRO 4900 Multigas or SERVOPRO NO<sub>x</sub> analyzers.

The flue gas then moves through the air preheater – O<sub>2</sub> is monitored by the FluegasExact 2700 or Laser 3 Plus Combustion to measure any air leakage across the preheater.

An upstream process upset may cause a high concentration of carbon monoxide (CO) to enter the electrostatic precipitator (ESP), potentially causing a catastrophic explosion. The Laser 3 Plus provides

a vital CO safety measurement before the ESP, allowing the plant operator to shut the ESP down.

The levels of sulfur dioxide (SO<sub>2</sub>) are measured by the 4900 Multigas or Photometric SERVOTOUGH SpectraExact 2500 before desulfurization of the flue gas. The gas is then vented to the stack, where a Continuous Emissions Monitoring System (CEMS) is required. The SERVOPRO 4900 Multigas provides all the necessary measurements. See page 14.

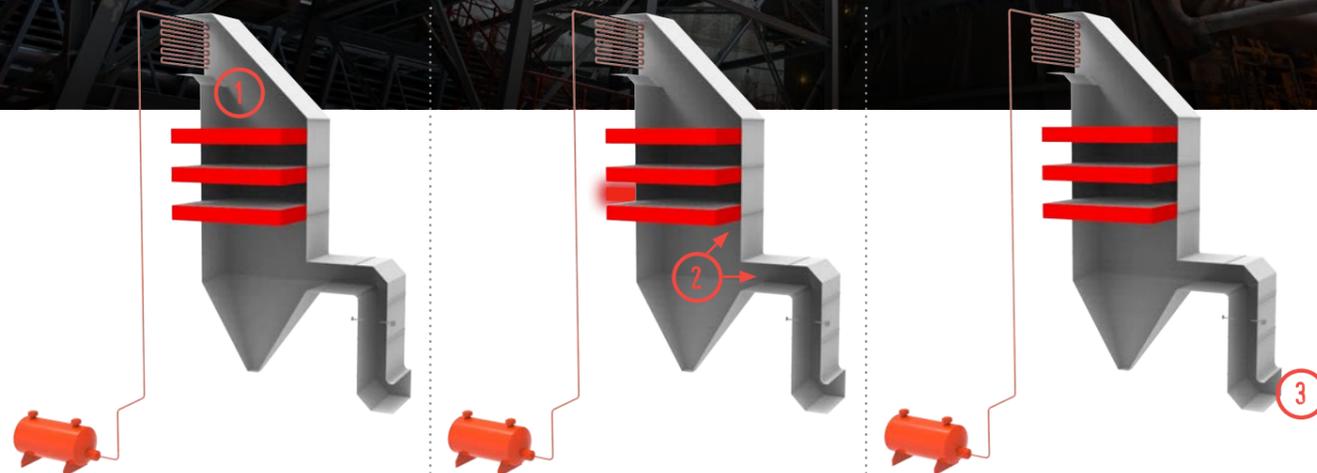


Safety across the plant can also be improved through the SERVOFLEX MiniHD 5200 portable analyzer, which can be used to make spot checks of O<sub>2</sub> levels.



See how we can improve your process. Speak to an expert: [servomex.com/contact-us](http://servomex.com/contact-us)

# TAKE CONTROL OF YOUR NOx EMISSIONS



EXCESS NOx

To suppress harmful emissions of nitrogen oxides (NOx) caused by combustion, ammonia (NH<sub>3</sub>) or urea can be used. These NOx reduction strategies involve either Selective Catalytic Reduction (SCR) or Selective Non-Catalytic Reduction (SNCR).

EXCESS NH<sub>3</sub> LEADING TO AMMONIUM BISULFATE BUILD UP

Both methods rely on accurate NH<sub>3</sub> dosing to reduce NOx formation. If too much NH<sub>3</sub> is used (referred to as ammonia slip), a white powder called ammonium bisulfate (ABS) forms when sulfur trioxide is present – this is particularly likely when coal is burned.

AMMONIA SLIP

ABS can plug the NOx reduction catalyst in SCR, cause fouling or corrosion of the boilers, and reduce the value of the fly ash by-product, which is often sold by power plants to the cement industry. To prevent this, it is important to control the level of ammonia slip to between 2-3 parts per million of NH<sub>3</sub>.

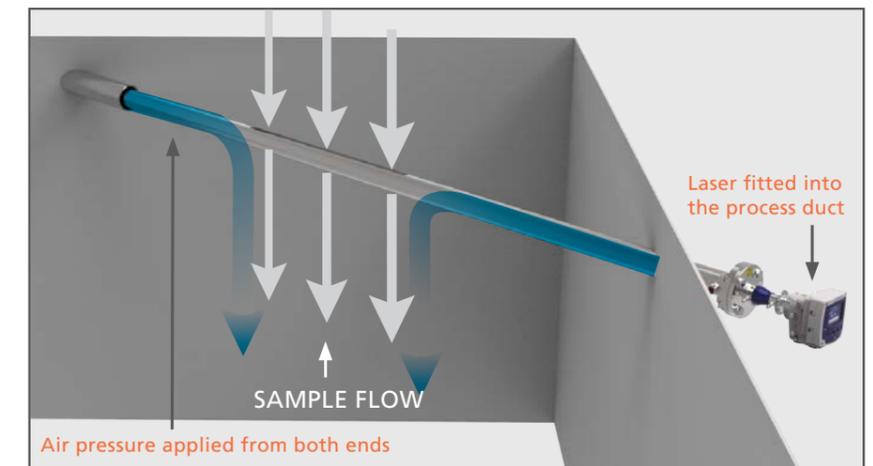
## BENEFITS OF TDL OVER EXTRACTIVE MEASUREMENT

Monitoring NH<sub>3</sub> using extractive sampling is difficult. The sample must be kept above 290°C (554°F) to prevent formation of ABS and sulfuric acid, which both damage the sampling and analytical equipment.

Without direct gas analysis, many parameters will influence the NH<sub>3</sub> measurement, including inlet NOx concentration, fuel composition and catalyst performance. Infrared-based extractive systems may also be affected by signal interferences from gases formed by the process – including sulfur dioxide (SO<sub>2</sub>) or water (H<sub>2</sub>O) – and high levels of dust.

A Tunable Diode Laser (TDL) analyzer can be installed directly into the process ducts, providing a signal that is averaged across

the duct, giving a more accurate NH<sub>3</sub> reading even in uneven flow conditions.

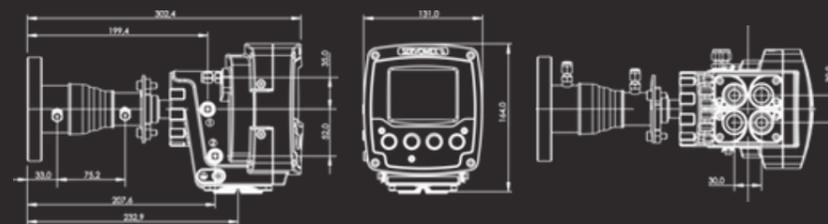


## A PURPOSE-BUILT SOLUTION

The SERVOTOUGH Laser 3 Plus Ammonia is specifically designed for the ammonia slip DeNOx process, meeting the challenges of high dust levels while providing a highly sensitive measurement.

It is unaffected by hot, dusty DeNOx environments, using a bright laser with unique optics that minimize light loss. A fixed pipe solution is also available for high dust content applications.

It also offers market-leading intervals between calibrations and cleaning, so is ideal in applications where uptime is critical.



Get expert insight: [servomex.com/measuringammonia](http://servomex.com/measuringammonia)

See our solution for ammonia slip: [servomex.com/l3plusammonia](http://servomex.com/l3plusammonia)

# EMISSIONS CONTROL SUPPORT

Servomex offers a comprehensive range of solutions for customers requiring emissions monitoring, supporting environmental regulations around the world.

## MULTI-COMPONENT CEMS ANALYSIS:

Designed for Continuous Emissions Monitoring Systems (CEMS) analysis for flue gas, the 4900 Multigas provides up to four simultaneous gas stream measurements. It combines Servomex's advanced digital sensing technologies with a modern analytical platform for accurate, highly sensitive monitoring of nitric oxide, sulfur dioxide, carbon monoxide, oxygen, carbon dioxide, nitrous oxide and methane.

- Measures criterion pollutants, greenhouse gases, and reference oxygen, all in one analyzer
- Low maintenance, operational requirements, and cost of ownership
- Advanced digital communications for future-proof integration

Find out more: [servomex.com/4900multigas](http://servomex.com/4900multigas)



SERVOPRO 4900 Multigas GAS FILTER CORRELATION INFRARED PARAMAGNETIC

## CONTROL OXIDES OF NITROGEN:

Provide ambient air monitoring, the NOx analyzer is ideal for the continuous monitoring of industrial stationary source emissions, especially gas turbines. Using a non-depleting, long-lasting photodiode to detect chemiluminescent light, the analyzer offers a fast response time, ideal for applications requiring low-level emissions detection of oxides of nitrogen (NOx).

- Can be calibrated for four measurement ranges for flexible operation
- Non-depleting light-based measurement and electronic flow control keeps costs low
- Meets a wide range of emissions standards and compliances

Find out more: [servomex.com/nox](http://servomex.com/nox)



SERVOPRO NOx CHEMILUMINESCENCE

## REAL-TIME HYDROCARBON ANALYSIS:

With heated-oven Flame Ionization Detection (FID) sensing technology and an integral non-methane cutter, the HFID delivers fast, accurate analysis of total hydrocarbons, methane, and non-methane hydrocarbons, with measurements from parts-per-million to percentage levels. The heated oven keeps the sample gas at 190°C (374°F), preventing heavier hydrocarbons in the sample from being lost through condensation.

- User-definable measurement ranges are reconfigurable in the field, for maximum flexibility
- High accuracy FID technology supports maximum operational uptime
- Heated oven provides measurement stability and allows "hot wet" sampling

Find out more: [servomex.com/hfid](http://servomex.com/hfid)



SERVOPRO HFID FLAME IONIZATION DETECTOR

# A RANGE OF GAS ANALYZERS TO

# SUPPORT YOUR PROCESS NEEDS

## SERVOPRO

The SERVOPRO range makes Servomex's reliable, stable and accurate gas measurements available to a diverse range of safe area applications.

An extensive range of non-depleting Servomex gas sensing technologies – including Paramagnetic, Zirconia, Flame Ionization Detection, Plasma and Gas Chromatography – are integrated into flexible analyzers. These either meet specific measurement requirements, such as for syngas, hydrocarbons or trace gas mixtures, or provide multi-gas monitoring capabilities for applications including ASU production and Continuous Emissions Monitoring Systems (CEMS).

Designed for benchtop use, or mounting in a 19" rack, all SERVOPRO analyzers feature extensive functionality, remote communication options and can be operated directly via intuitive onboard software.

## SUPPORTING



## SAFE AREA



## SERVOFLEX

With the precision sensing technology of Servomex fixed analyzers in a compact, easy to use package, SERVOFLEX analyzers deliver high performance portable gas analysis for safe or hazardous area use.

Utilizing Servomex's non-depleting Paramagnetic and Infrared sensor technology, SERVOFLEX analyzers provide stable and reliable measurements for oxygen, carbon monoxide and carbon dioxide.

Ergonomically designed for easy handling, and powered by resilient lithium-ion batteries to ensure long usage with every charge, each analyzer offers an extensive range of features that includes audible alarms, data-logging and RS232 outputs.

Certified to a range of safety requirements, Servomex's SERVOFLEX analyzers make the grade wherever they are used.

## SUPPORTING



## PORTABLES



## SERVOTOUGH

Built to meet the extreme challenges of measuring gases in hot and hazardous environments, the SERVOTOUGH process and combustion analyzers integrate Servomex's exceptional analytical performance into a highly robust and resilient design.

Optimized for hazardous area use, and utilizing both extractive and in-situ analysis techniques, common gas measurements receive higher level analysis for light hydrocarbons and combustibles; this makes SERVOTOUGH analyzers ideal for extensive use within most hydrocarbon processing applications.

Manufactured to the highest specifications using custom-designed stainless steel enclosures, SERVOTOUGH analyzers are intrinsically safe and certified to the uppermost safety standards.

## SUPPORTING



## HAZARDOUS AREA



## DF

When your processes need high-purity gas measurements for oxygen and moisture, DF analyzers deliver industry-leading performance that reaches down to the very lowest ultra-trace levels.

Utilizing the exceptional sensing capabilities of Servomex's Coulometric and TDL sensing technologies for the measurement of oxygen and moisture respectively, DF analyzers are optimized for a sensitive and stable analysis at ppm, ppb and ppt levels.

Delivered through the DF-500 ultra-trace oxygen range and DF-700 moisture range, DF products are the recognized standard for ultra-low measurements in the semiconductor, specialty gas, industrial gas and hydrocarbon processing industries.

## SUPPORTING



## HIGH PURITY



Discover our full analyzer range at [servomex.com](http://servomex.com)

# A COMBINED SOLUTION FOR YOUR INDUSTRIAL GAS PROCESS

SERVOMEX PROVIDES A COMPREHENSIVE, SINGLE-SUPPLIER SOLUTION FROM PRECISION GAS ANALYSIS TO ENTIRE SYSTEMS AND EXPERT GLOBAL SUPPORT.



Discover our analyzer range:  
[servomex.com/gas-analyzers](https://servomex.com/gas-analyzers)

Servomex's analyzer range is the most comprehensive available from a single manufacturer, setting the standard for the industrial gas (IG) market for decades with a unique 'all of market' solution.

Powered by reliable, ground-breaking sensor technologies, our range delivers accurate, stable measurements for every point

in your process, with a full range of percent to ultra-trace measurements.

Servomex analyzers support quality control, maintaining gas purity during the production process and detecting impurities during processes such as medical gas supply or semiconductor production.

We also provide solutions for process control and ensure safety and emissions monitoring for potentially hazardous processes.

Our commitment to ongoing development ensures that even the most trusted measurements are continuously improved, with added features that increase ease of use and reduce the cost of ownership.



Discover our systems solutions:  
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In addition to individual analyzers, Servomex also supplies complete system solutions designed to order for your project. State-of-the-art systems engineering centers in

the US, China, India and Europe provide a global service, offering solutions ranging from simple utilities panels to fully-contained air-conditioned shelters.

Proven experience ensures the optimum level of efficiency, safety and cost-effective operation for your application.



Discover our service solutions:  
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Servomex support doesn't end with the supply of your analyzer or system. Our expert team delivers gas analysis expertise directly to your plant. With global coverage provided by service centers and

mobile engineers worldwide, the Servomex Service Network ensures your processes run efficiently, safely and profitably. Support offered includes service contracts, spares, calibration kits,

commissioning, health checks, training, and equipment rental. We also provide expert support from our extensive network of service centers, or on-site at your facility.

# SERVOMEX SPARES

SUPPORTING CRITICAL INDUSTRY SECTORS  
THROUGHOUT THE GLOBAL PANDEMIC

A RELIABLE, RAPID-RESPONSE SERVICE

Delivered by our network of regional support teams.

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