

UHP GASES

GAS ANALYSIS MAGAZINE

ISSUE
ONE - 2017

SUPPORTING YOUR UHP GAS AND
SEMICONDUCTOR APPLICATIONS

PRODUCT FOCUS

DF-760E NanoTrace analyzer

APPLICATION STUDY

Advanced-TDL moisture analysis

EXPERT ADVICE

Designing a multi-gas
monitoring system



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SERVOMEX OxyDetect

Our non-depleting Paramagnetic oxygen monitor available for safe and hazardous areas – see the benefits



DF-500 SERIES

Servomex's ultra-trace ppt oxygen analyzer series, relaunched with updated firmware



INSIDE SERVOMEX USA

Explore our manufacturing base for oxygen and moisture analyzers, and hub for global IG and semiconductor support



DF-700 SERIES

See all the benefits of our ultra-trace moisture analyzers, monitoring high performance in specialist environments



Watch at servomex.com/videos

DEAR READER

MEET OUR UHP/SEMICONDUCTOR TEAM

Welcome to the first edition of our new magazine focused on the UHP gases market and its applications in the semiconductor manufacturing industry.

Accurate, stable analyzers with the lowest detection limits available are vitally important to this market. As the only company to provide a complete measurement portfolio for every UHP application in the semiconductor industry, our dedicated and experienced team will help you tailor a custom solution that will meet your UHP process requirements.



The team is led by Market Sector Manager Jim Belanger (jbelanger@servomex.com) who is based in Woburn, Massachusetts, and is responsible for setting the company's semiconductor strategy and action plan.



Douglas Barth (dbarth@servomex.com) is Senior Global Product Manager for UHP products which are manufactured in the US Technical Center (US TC) in Woburn, MA. The products he manages include the UHP market-leading Delta F (DF) brand: the DF-500 and DF-700 series. Douglas brings to Servomex a wealth of experience working in the industry globally to assist customers in their complex application needs.



Charles Segar (csegar@servomex.com) has been with Servomex for 23 years in leadership roles in product management and marketing. He is the Senior Global Product Manager for products manufactured at the Servomex UK Technical Centre (UK TC) in Crowborough. Charles manages the UHP process gas chromatograph product line (SERVOPRO Chroma and NanoChrome) that supports UHP analysis of various hydrocarbon impurities in semiconductor process gases.



Based in Germany, Patrick Hellberg (phellberg@servomex.com) leads our semiconductor marketing and business development efforts in EMEA. He joined Servomex four years ago from a global leading gas supplier to the semiconductor industry. Patrick has vast experience in the gas supply side of the semiconductor industry and understands the demanding customer requirements for the market.



Dividing his time between Shanghai and Singapore, Leong Kee Keat (KK) (kleong@servomex.com) manages our marketing in the high-growth Asia Pacific region. He also serves as our Asia Pacific Service Manager, which allows him to closely understand the needs of the end user. KK has been a champion for the semiconductor customers in the fast-paced Asia Pacific region, allowing Servomex to grow along with the market in this key region of the world.

Together, our team stands ready to offer the experience and expertise you need to find the most efficient, accurate and cost-effective solution to your semiconductor requirements in 2017 and beyond. Get in touch with us today.

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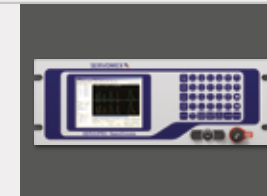
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EXPERT FOCUS

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See our latest product ranges.
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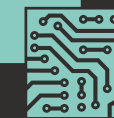
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FOR THE FULL RANGE OF ANALYZERS VISIT servomex.com/gas-analyzers

FOR THE FULL RANGE OF ANALYZERS VISIT servomex.com/gas-analyzers

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THE GLOBAL SEMICONDUCTOR MARKET OUTLOOK

Semiconductor worldwide capital spending is projected to increase by 3% in 2017, to \$69.9 billion. This is down from 5% growth in 2016. The semiconductor manufacturing market's outlook is expected to improve in the years ahead, due mainly to the higher demand for memory chips used in smartphones. Other areas of growth are LEDs, logic chips, MEMS and analog devices.

THE GROWTH OF REGIONAL CAPITAL SPENDING

From a worldwide view, the Europe/Middle East region and South Korea are expected to see the largest growth rates this year, with 48% growth and 45% growth respectively, year-over-year. Japan will increase spending by 28%, followed by the Americas with a 2% year-over-year growth.

In 2017, China is building or expanding 48 semiconductor fabrication plants (fabs), with equipment spending of \$6 billion. Looking ahead to 2018, it is predicted that more than 50 fabs will be built or expanded, with spending of about \$10 billion.

FAB EQUIPMENT SPENDING IN 2017



FAB EQUIPMENT SPENDING IN 2018



DATA: WORLD FAB FORECAST REPORT, FEB 2017, SEMI

SEMICONDUCTOR PRODUCTION GROWTH IN CHINA

With more than 20 new fab projects under way or announced in China since 2016, spending on fab equipment will increase to \$10 billion or more, annually, by 2018. By 2019, China's semiconductor capital spending is expected to surpass that of South Korea and Taiwan. Not only will China emerge as the largest spending market for fab equipment, the spending level will likely approach all-time-record levels for annual spending in a single region.

The driver behind this investment growth is changing. Prior to 2017, investments by overseas multinational companies have led spending on semiconductor fab equipment. These companies, will continue to invest in China, although

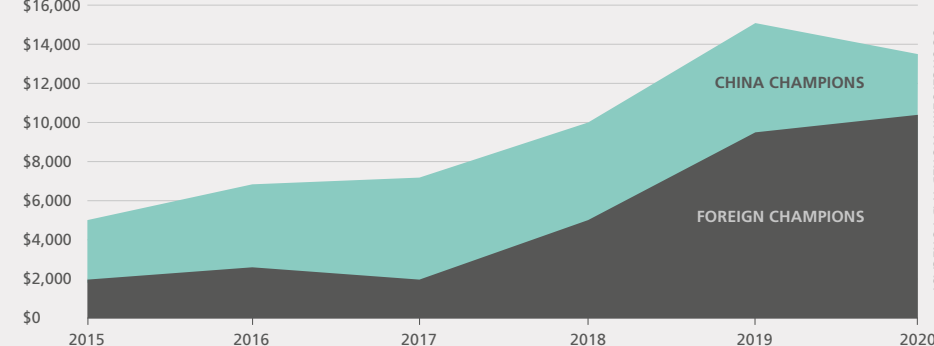
Chinese companies will increasingly invest more, and drive much of the growth in capital spending through 2020.

Chinese domestic foundries will increase their spending going forward. China-based companies will dominate semiconductor spending in 2019-2022. These grass-roots projects will accelerate wafer fab equipment spending in China to record high annual spending levels.

Within four to five years, China will become the largest market for wafer fab equipment, thus representing an important market opportunity for every company providing equipment, materials, services, critical systems and more.

Servomex's Asia Pacific semiconductor team, led by Marketing Manager Leong Kee Keat, supports fabs in China through its business centre in Shanghai.

CHINA FAB INVESTMENT BY PARTIES



SOURCE: SEMI WORLD FAB FORECAST

Contact our Asia Pacific Business Centre: +86 (0)21 6489 7570 or asia_sales@servomex.com

LEEDEN CHOOSES SERVOMEX FOR SINGAPORE PROJECT

Servomex has been selected to provide a comprehensive analyzer solution for electronics gas supplier Leeden National Oxygen Ltd.

Leeden is the supplier to end-user GlobalFoundries for their tank farm and purifier room expansion project in Tampines, Singapore.

With the existing purifier and tank room now more than 10 years old, the new

purifier required a reliable, accurate monitoring solution that ensured no downtime in the manufacturing process. The company was also looking to select the right Continuous Quality Control (CQC) solution for after-purifier monitoring.

Their key requirement was to find a vendor who could offer a simple solution with good, reliable products and strong local support.

Servomex was able to supply four SERVOPRO NanoChrome analyzers, three DF-760E NanoTraces and a DF-750 NanoTrace to meet these criteria. These analyzers provide the necessary high standard of ultra-trace monitoring, ensuring that gas of the right quality is supplied to the end-user.

The project is currently at the commissioning stage and will be handed over to the customer shortly.



"The customer chose the Servomex solution for their product based on the good local support we can provide and the strong reputation we have in the semiconductor market."

Jyh Shyn Ling - Servomex Sales Manager, Singapore.
Email: jliling@servomex.com

THE SERVOMEX SOLUTION

SERVOPRO NanoChrome



A high-performance analyzer specifically designed for the semiconductor manufacturing industry, the SERVOPRO NanoChrome provides ultra-trace monitoring of UHP gases, using Plasma Emission Detector sensing technology. It offers the highest reliability monitoring of H₂, CH₄, CO, CO₂ and NMHC in a wide range of common background gases including He, H₂, N₂, Ar and O₂.

DF-760E NanoTrace



Combining industry-leading Coulometric and Tunable Diode Laser (TDL) sensing technology in a single, compact unit, Servomex's sophisticated DF-760E NanoTrace is ideal for quality control and leak detection in semiconductor fabs. It provides simultaneous monitoring of ultra-low contaminant levels of H₂O and O₂ within background gas blends of N₂, H₂, He, O₂ and Ar (only H₂O can be measured in the case of a background of oxygen).

DF-750 NanoTrace



The leading choice in moisture analysis in the semiconductor industry, the DF-750 NanoTrace is designed to make trace and ultra-trace measurements in a range of ultra-high-purity gases. Using non-depleting, high-stability TDL sensing technology, it measures moisture as a contaminant in electronics grade N₂, H₂, He, Ar and O₂.

Find out more: see page 9

Find out more: see page 10

Find out more:
servomex.com/df-750

APPLICATION STUDY

ADVANTAGES OF ADVANCED-TDL TECHNOLOGY TO MEASURE MOISTURE LEVELS

Achieving accurate and repeatable low-level moisture analysis, while minimizing instrument maintenance, has long been a challenge.

Several different technologies have been employed over the years, but Tunable Diode Laser (TDL) Spectroscopy has emerged as the clear technology leader, and continues to develop, with instruments using several versions of this technique available to the market.

The latest laboratory moisture analyzers are based on a technique known as Advanced-TDL, and can operate for years in non-ideal environments without requiring re-calibration. They are capable of yielding moisture measurements with ppb sensitivity in a wide variety of single and multi-component gas mixtures.

As with all TDL techniques, high-performance measurements are enabled by virtue of the ultra-narrow diode laser bandwidth, which in turn enables selection of a single fine-structure water absorption line.

The Advanced-TDL method uses additional information buried within the shape of the water infrared (IR) absorption line which, after correction for absolute pressure, is subtly dependent on the chemical composition of the host gas or gas matrix being investigated.

Using this additional data, Advanced-TDL analyzers can measure moisture levels across a diverse range of background gases without needing re-calibration. These analyzers remain highly tolerant of "real world" environmental effects such

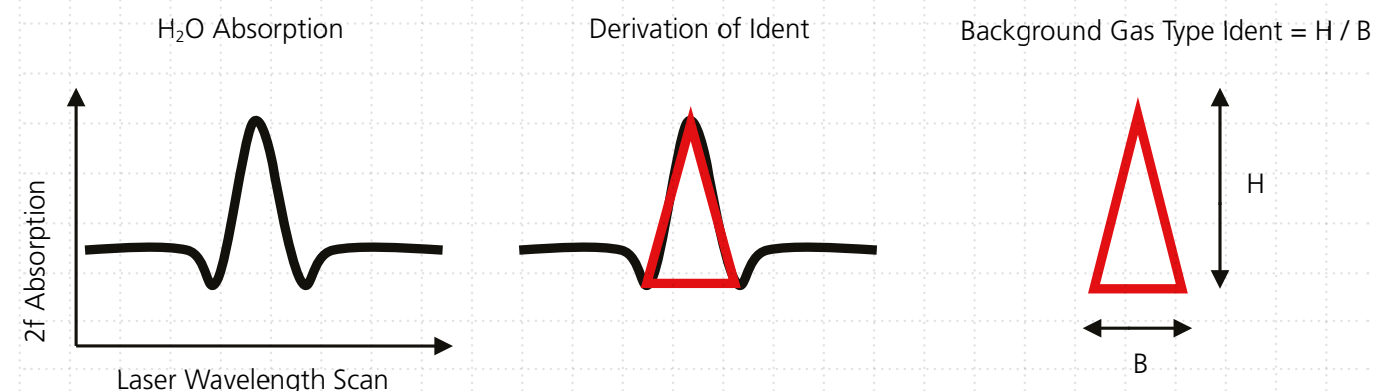
as temperature, pressure, vibration and contamination of the optical surfaces.

This unique feature of Advanced-TDL can be better understood by looking at how it determines the shape factor and area under the H_2O absorption line to improve the stability and sensitivity of the moisture measurement.

Absorption line-shape factors are analogous to the unique "idents" used by air traffic controllers to mark an individual aircraft on their monitoring screens.

Key information about the composition of the background gas or mixture is derived by determining the shape factor of the absorption line. Moisture concentration is derived by measuring the area under the absorption line.

DERIVATION OF MOISTURE CONCENTRATION FROM MOISTURE ABSORPTION LINE USING ADVANCED-TDL



Note the characteristic "valley, hill, valley" shape of the fine structure water line in the 1854nm region of the IR spectrum. This comes about through the second harmonic detection technique used in Advanced-TDL analyzers.

The ident triangle is created by joining the turning points of this spectral absorption curve. The area of this triangle relates to the moisture concentration. Lower concentrations result in a smaller triangle. Yet, for a

constant background gas, in all cases the height-to-base ratio remains the same (i.e. a continuous set of similar triangles).

The ratio of the base to the peak of this triangle yields the background gas ident shape factor.

Comparing the water absorption lines and their associated triangle idents over a range of concentrations in both helium and nitrogen backgrounds clearly illustrates the constant shape of the triangle ident.

This fingerprints the background gas composition. In the case of gas mixtures, the resultant ident is made up of the weighted average shape of all the components.

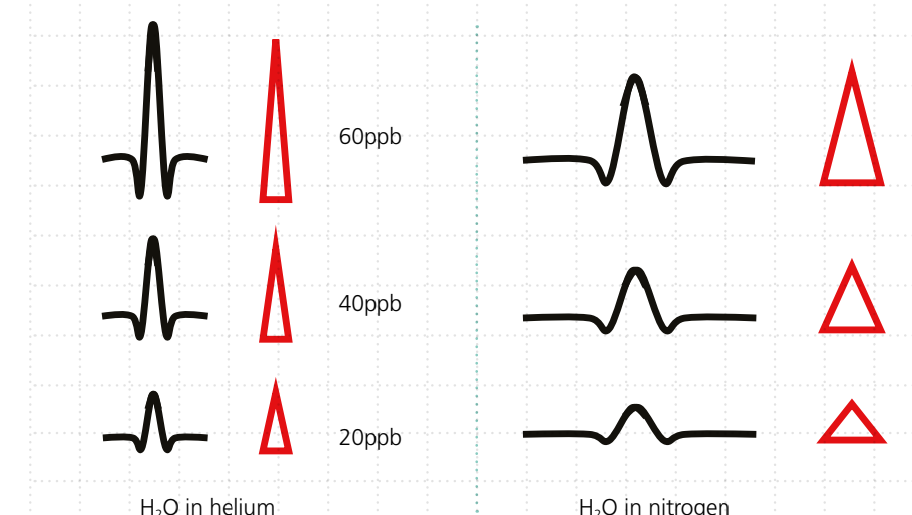
Servomex's DF-700 range of Advanced-TDL analyzers incorporate a robust Herriott gas cell, which is virtually immune to mechanical disturbances in the field. In addition, the low signal-to-noise ratio from the Advanced-TDL technique requires only a short optical path length, enabling it to tolerate significant "real world" contamination of the optical surfaces with no effect on measurement accuracy or noise.

Earlier TDL techniques such as Cavity Ring-Down Spectroscopy (CRDS) do not

continuously measure the target gas directly. CRDS monitors the moisture concentration discontinuously through changes in the rate of decay of light within a highly reflective optical cavity.

The CRDS method, therefore, is unable to "ident" the nature of the sample gas, as it cannot distinguish between the gas type and degraded optical transmission within its measurement cell.

COMPARISON OF MOISTURE MEASUREMENTS IN He AND N_2 BACKGROUNDS



THE LEADING CHOICE IN MOISTURE ANALYSIS FOR THE SEMICONDUCTOR INDUSTRY



DF-750 NanoTrace

Advanced-TDL analyzers use an internal reference cell made up of a sealed moisture ampoule. A portion of the laser light is redirected through this cell and is used to lock laser wavelength onto the exact moisture line of interest.

Both the sample and reference absorption lines can be displayed in real-time on the display of the analyzer. This allows even a novice user to confirm, at a glance, the health and relative accuracy of the system performance.

Get more advice from the experts: servomex.com/expert-guidance



DF-560E NanoTrace FOR SEMICONDUCTOR APPLICATIONS



RELIABLE OXYGEN MONITORING IN
UHP ELECTRONIC GRADE GAS

A gas analyzer that provides performance, stability and reliability is essential for the measurement of ultra-trace oxygen as a contaminant for quality control or leak detection purposes.

With an improved chassis and updated software providing quieter processing, the DF-560E monitors ultra-trace O₂ in multiple background gases, delivering an industry-best Lower Detection Limit (LDL) of 45 parts per trillion (ppt).

This ability to make these oxygen measurements in ultra-high-purity (UHP) electronic grade gas, using reliable Coulometric technology, makes the

DF-560E an ideal choice for the semiconductor industry.

Optimized for ease of use and portability, the DF-560E is perfectly suited to both semiconductor fabs and analytical carts. It can be operated from the front panel or via digital communications options, with various hand-carry options making it easy to transport.

The high-stability Coulometric technology negates the effects of upset-prone applications while delivering a fast response in the presence of sample and flow rate changes. Non-depleting and factory calibrated, it also reduces

operational costs, ensuring cost-effective set-up and configuration.

The sole ongoing maintenance requirement is an annual span calibration, with no need for a programmable cell replacement.

The DF-560E offers comprehensive automated data logging, with four-day and 30-day graphical reading records, and an automatic maintenance log which records water additions, sensor data and calibration activity to ensure ISO record-keeping requirements.

Servomex also offers a DF-550E model, which measures ultra-trace oxygen down to 100ppt.



NanoChrome FOR SEMICONDUCTORS

MULTIPLE
GASES

GAME-CHANGING SERVOPRO NanoChrome SETS THE STANDARD FOR UHP GAS ANALYSIS

Specifically designed for the semiconductor manufacturing industry, the high-performance SERVOPRO NanoChrome offers reliable, ultra-trace measurements of ultra-high-purity (UHP) gases in a wide range of common background gases.

Its innovative, high-sensitivity Plasma Emission Detector (PED) enables the monitoring of H₂, CH₄, CO, CO₂ and non-methane hydrocarbon impurities in gases including He, H₂, N, Ar and O₂.

DID YOU KNOW...

Servomex's PED sensor is between 10-100 times more sensitive than a FID measurement, depending on the carrier gas.

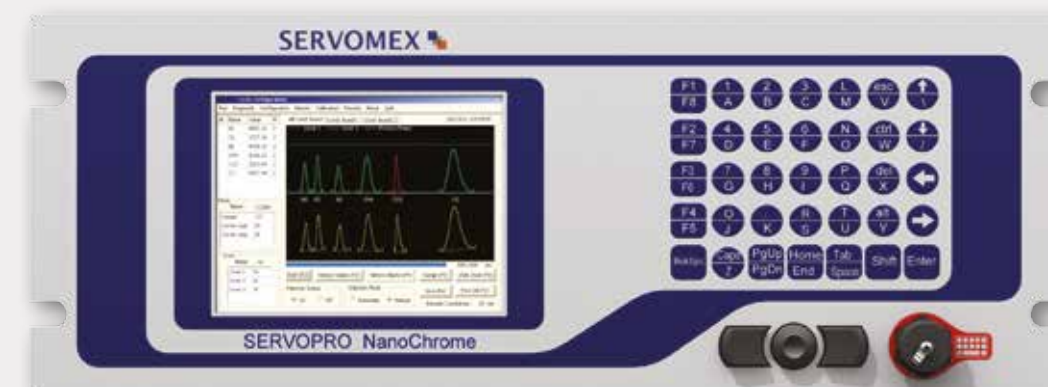
The PED sensing technology and sensitive ProPeak signal processing software were both developed by Servomex, providing the NanoChrome with considerable advantages over traditional Flame Ionization Detector and Reduction Gas Detector technologies in terms of performance, safety and the ability to reduce ongoing costs.

In addition, the NanoChrome removes the need for flammable fuel gas, delivering an enhanced safety solution.

This also simplifies installation, while the non-depleting sensor and intelligent software extends the interval between calibrations, considerably reducing ongoing costs across the life of the product.

Advanced signal processing ensures the highest grade of accuracy, maximizing process uptime, while comprehensive digital communications protocols and access via a network or web browser facilitate flexible remote device interaction.

The NanoChrome is an ideal solution for quality control measurements and stationary analytical systems in semiconductor production. When combined with Servomex's DF-500 ultra-trace oxygen and DF-700 moisture series analyzers, it provides a complete, single-supplier analysis solution for UHP gas purity monitoring.



DID YOU KNOW...

THE DF-500 ANALYZERS OFFER THE LOWEST DETECTION LEVELS AVAILABLE AT 45PPT

THAT'S LIKE FINDING 45 HAIRS



ON ALL THE HEADS



OF EVERY SINGLE PERSON
IN NEW YORK CITY



IN SECONDS



"The DF-560E NanoTrace delivers oxygen measurements to the very lowest levels, while reducing ongoing costs and providing operational efficiencies. Along with automated maintenance and data logging, it's a no-compromise solution for any semiconductor application."

Douglas Barth - Senior Product Manager. Email: dbarth@servomex.com



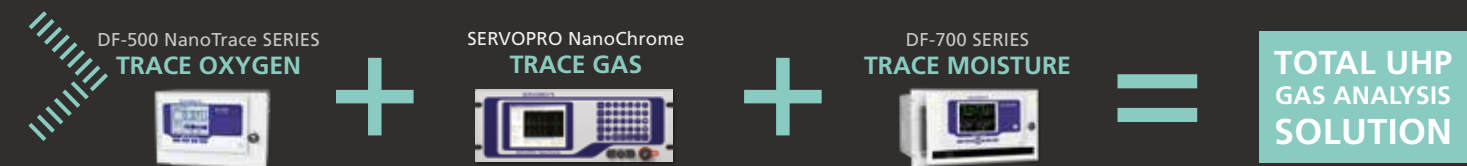
"When monitoring UHP gases used in semiconductor wafer manufacture, the highest sensitivity and performance is essential. The NanoChrome is a game-changing analyzer that delivers the best accuracy and selectivity available. It is the standard to which all other UHP gas monitoring analyzers will be compared."

Charles Segar - Senior Product Manager. Email: csegar@servomex.com



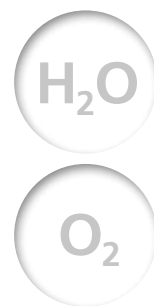
To find out more watch the video at servomex.com/df500-video

Learn more about game-changing UHP gas analysis at servomex.com/nanochrome



DF-760E NanoTrace

THE 'ONE BOX' SOLUTION FOR TRACE MOISTURE AND OXYGEN



In the manufacture of integrated circuit boards, the quality control of electronics-grade ultra-high-purity (UHP) gas is vital, requiring a highly sensitive measurement of oxygen and moisture down to the lowest levels.

Servomex's DF-760E NanoTrace provides a unique 'one box' analyzer solution for the simultaneous monitoring of trace moisture and trace oxygen for the quality control of UHP bulk gases.

The combination of the powerful, industry-leading properties of Servomex's non-depleting Coulometric sensor and robust Tunable Diode Laser

(TDL) sensing technology within a single, compact unit makes the DF-760E ideal for the monitoring of those UHP gases used in semiconductor device and circuit board manufacturing.

This dual-sensor approach allows it to measure ultra-low contaminant levels of H₂O and O₂ within background gas blends of N₂, H₂, He, O₂ and Ar. In the case of a background of oxygen, only H₂O can be measured.

It also ensures the DF-760E reduces the footprint, infrastructure and maintenance costs associated with using separate analyzers for moisture and oxygen,

a notable benefit for semiconductor fabs, where space is always at a premium.

Moisture detection comes from the TDL sensor, a simple, durable design that produces a stable reading over time and does not require calibration. A Herriott Cell is used to increase the laser path length, ensuring extremely high sensitivity.

The Coulometric sensor, which is unaffected by reasonable changes in flow rate, and is not consumed when exposed to oxygen, is used for the measurement of O₂. It also reacts very quickly to changing oxygen concentrations.

PROCESS STUDY

SEMICONDUCTOR WAFER MANUFACTURE



SERVOMEX OFFERS A TOTAL GAS ANALYZER SOLUTION FOR SEMICONDUCTOR WAFER MANUFACTURE, IMPROVING YIELD AND ENSURING PRODUCT PURITY

This unique, single-supplier analysis solution measures every impurity present in the manufacture process, with a complete turnkey integrated Continuous Quality Control (CQC) system available to collect and trend gas purity data.

The wafer manufacturing process requires the use of ultra-pure gases, as the smallest of impurities can result in major defects in a wafer, causing costly scrap and waste.

To avoid contamination, semiconductor customers employ a variety of resources, including strict gas supplier specifications,

multiple gas purification techniques, real-time continuous gas purity monitoring and post-process inspection to ensure ultra-pure gases are delivered to the manufacturing process.

Servomex offers semiconductor manufacturers a complete set of analyzers and systems that continuously monitor their process gases prior to entering the wafer manufacturing process.

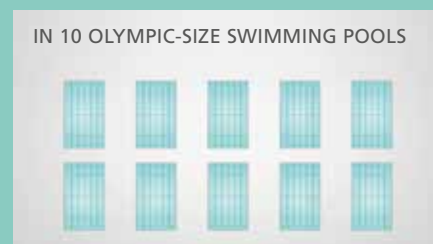
This unique solution can continuously monitor all critical process gases, including O₂, N₂, H₂, He, Ar, CO, CO₂ and more, enabling users to monitor all major

process impurities including O₂, H₂O, CH₄, non-methanated hydrocarbons and many others at part-per-trillion (ppt) detection levels.

Servomex also offers the customer a turnkey CQC system designed to meet specific customer requirements. Complete with a Servomex-built software package to collect and trend real-time gas analysis data, Servomex is the only company to offer a full suite of technologies and CQC systems (see page 14) to meet every impurity analysis need of the wafer manufacturing process.

DID YOU KNOW...

THE DF-700 ANALYZERS MEASURE MOISTURE AS LOW AS 100PPT



"With industry-leading Lower Detection Limits (LDL) of 100 parts per trillion (ppt) of H₂O and 45ppt for oxygen, the DF-760E gives a rapid speed of response, unsurpassed stability, and immunity from trace acid damage. These qualities make it ideal for quality checking and leak detection in semiconductor fab applications."



Douglas Barth - Senior Product Manager. Email: dbarth@servomex.com

SERVOMEX SOLUTIONS FOR UHP ANALYSIS IN WAFER PRODUCTION

SERVOPRO MonoExact DF310E



Advanced touchscreen ppm and % oxygen analyzer for IG applications.

SERVOPRO Chroma



Versatile trace gas analyzer platform configurable for a variety of applications.

SERVOPRO NanoChrome



Sub-ppb trace measurement of UHP gases for the semiconductor industry.

DELTA F DF-550E/560E NanoTrace series



Oxygen analyzer designed to monitor ppt-level semiconductor UHP gas.

DELTA F DF-749/750 NanoTrace series

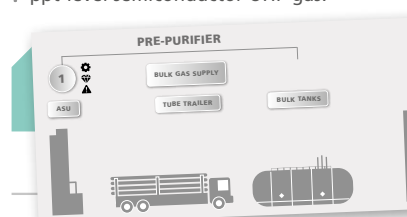


Trace/ultra-trace moisture measurements of UHP gases in semiconductor fabs.

DELTA F DF-760E NanoTrace

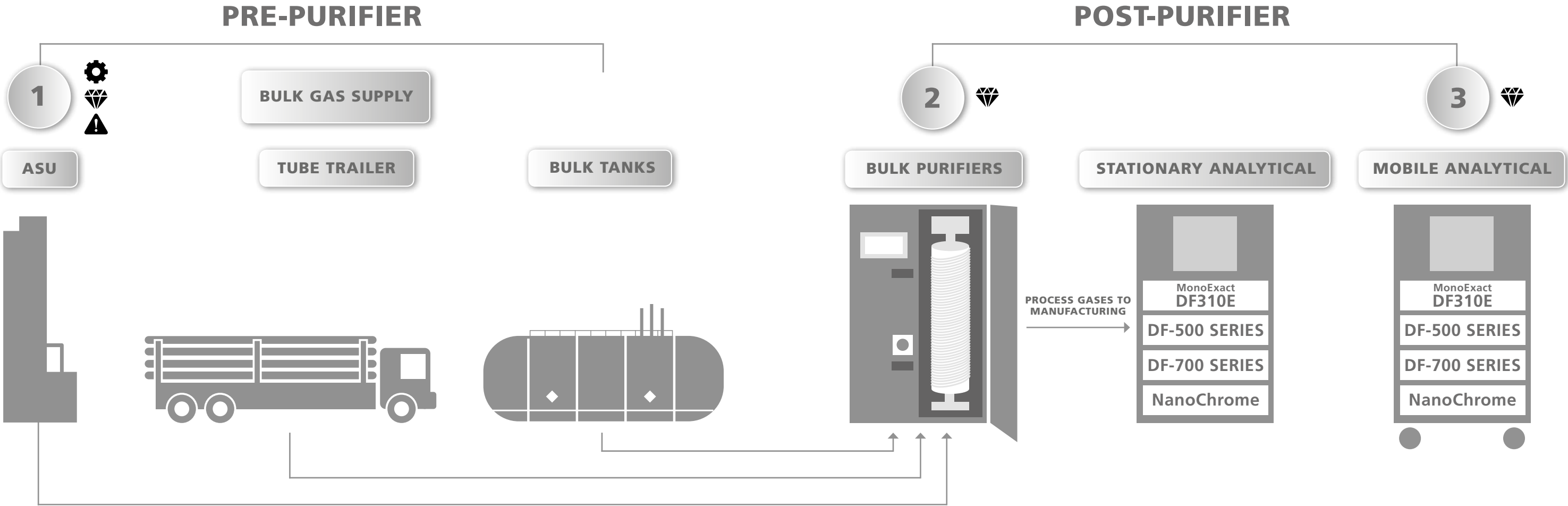


Ultra-trace dual measurement of moisture and oxygen for PCB bulk gases.



See our analyzers across the process **OVERLEAF**

SEMICONDUCTOR MANUFACTURE



1. PRE-PURIFIER BULK GAS SUPPLY

Gases are supplied to the semiconductor customer from one of a variety of industrial gas suppliers. They are supplied in multiple forms, including from an on-site Air Separation Unit (ASU), bulk tube trailers and bulk tanks.

These gases are designed to meet a specific purity grade from the industrial gas supplier, but are typically monitored at their point of production or entry into the facility.

A full set of analyzers can typically be found at the ASU location in a control room, operated by the industrial gas company. Some semiconductor end-users may also require a rack of analyzers to be installed at the point of use for the tube trailers or bulk tanks.

2. POST-PURIFIER

Bulk gases are sent through various gas purification techniques. These include bulk (house) purifiers that purify large flows of gas as they enter the building, or point-of-use (POU) purifiers that purify smaller quantities of gas before they enter the process equipment.

Many leading semiconductor companies employ both bulk and POU purifiers to ensure that they have the most pure gases prior to entering the process environment.

Stationary analytical systems are installed at multiple locations in a large wafer manufacturing environment. They will typically contain multiple analyzers for each bulk process gas.

It is common to have 10-20 analyzers installed in each stationary analytical system to monitor the bulk gases post-purifier. Each stationary analytical system is integrated and digitally connected to the building management system to collect and trend gas purity data.

3. MOBILE ANALYTICAL CARTS

Widely utilized at most wafer manufacturing locations, mobile analytical carts are used for multiple purposes to ensure the quality of specific gas line installations.

Each new gas line installed in a semiconductor plant must be “qualified” prior to being used in production. This qualification process includes testing of various parameters of the new gas line, including impurity analysis.

A semiconductor plant may have multiple mobile analytical carts so multiple new gas lines and/or process gases can be monitored simultaneously.

In addition, mobile analytical carts are used in lieu of stationary analytical systems during maintenance activities, as the process gas impurities must always be monitored.

APPLICATION MEASUREMENT SOLUTIONS

- ASU KEY ANALYZERS**
Quality control, process control and safety applications:

 - MultiExact 5400 for multi-gas analysis
 - MonoExact DF310E for O₂
 - MultiExact 4100 for multi-gas analysis
 - Plasma for N₂
 - Chroma for multi-gas analysis
 - FID for hydrocarbons
 - AquaXact 1688 for moisture
- SEMICONDUCTOR FABRICATION ANALYZERS**
Quality control for bulk gases:

 - MonoExact DF310E for O₂ impurities
 - DF-550E or DF-560E for O₂ impurities
 - DF-749 or DF-750 NanoTrace for moisture impurities
 - DF-760E NanoTrace for O₂ and moisture impurities
 - Chroma or NanoChrome for other impurities such as CH₄, NMHC, CO, CO₂, organics, etc.

SOFTWARE SOLUTIONS FOR MULTI-GAS MONITORING

BUILDING A CONTINUOUS QUALITY CONTROL (CQC) INFRASTRUCTURE FOR BULK AND PROCESS GAS DISTRIBUTION SYSTEMS

Many processes involving industrial gases need to monitor different impurities at the same time, requiring several gas analyzers working together reliably. In recent years, there has been a steady decline of on-site personnel with the adequate experience or time to operate and calibrate existing analytics packages. This has led to an increase in requests for automated solutions enabling the remote operation and calibration of devices, systems and even entire plants.

Servomex's multi-gas monitoring system (MMS) offers a holistic and scalable solution for the analysis and quality control of trace and ultra-trace industrial and electronic gases. Utilizing analyzers including Servomex's DF range of analyzers for sub-ppb oxygen and moisture, and SERVOPRO NanoChrome for sub-ppb methane and NMHC, the systems can be used to effectively monitor impurities in bulk gases such as H₂, N, Ar and He. Analysis of medical, beverage and food grade gases is also available.

The experienced Servomex system design and integration team ensures that the MMS captures the full potential of each analyzer used, whatever the customer application or measurement range.

Each component is specially chosen to meet the particular requirements of the application and to ensure longevity and ease of operation. Analyzers and technologies are carefully selected to cover desired ranges and response times, and to comply with current legislation and industry standards.

The systems are available as fixed racks or in a mobile cart configuration and can be operated manually, or partially or fully automated – continuously monitoring or on-demand – just as required.

The MMS provides a modular Continuous Quality Control (CQC) infrastructure for bulk and/or process gas distribution systems.



Servomex offers fixed and mobile MMS system options

It manages data collection, data storage and alarm notifications, and provides a facility for remote operation and diagnostics, via an Ethernet connection, all in one place.

It provides analysis and control systems for gaseous applications including: aerospace, air separation plants, medical, semiconductors, filling plants and food.

All systems are designed to meet the most stringent safety requirements for handling hydrogen and other explosive gases. Gas detection, fans and shut-off valves are all incorporated when hazardous gases are present.



IGS – THE BRAIN OF THE SYSTEM

The Servomex Intuitive Gas Software (IGS) is the brain of the MMS and its data acquisition system.

A modular, Windows 10-based software package developed to meet customer needs in an intuitive and efficient way, IGS can monitor a process continuously or on-demand for quality purposes like cylinder or truck filling applications, and allows for monitoring and reporting of several analysis points.

Data is collected and displayed on a touchscreen PC. Historical analysis, certificates and calibration data is saved to the hard disk and an external drive as back-up memory.

As the IGS software offers full traceability and multi-user access management, including audit trail, and does not allow deletion of entries, it is in full accordance with medical validation rules, like CFR21 part 11.

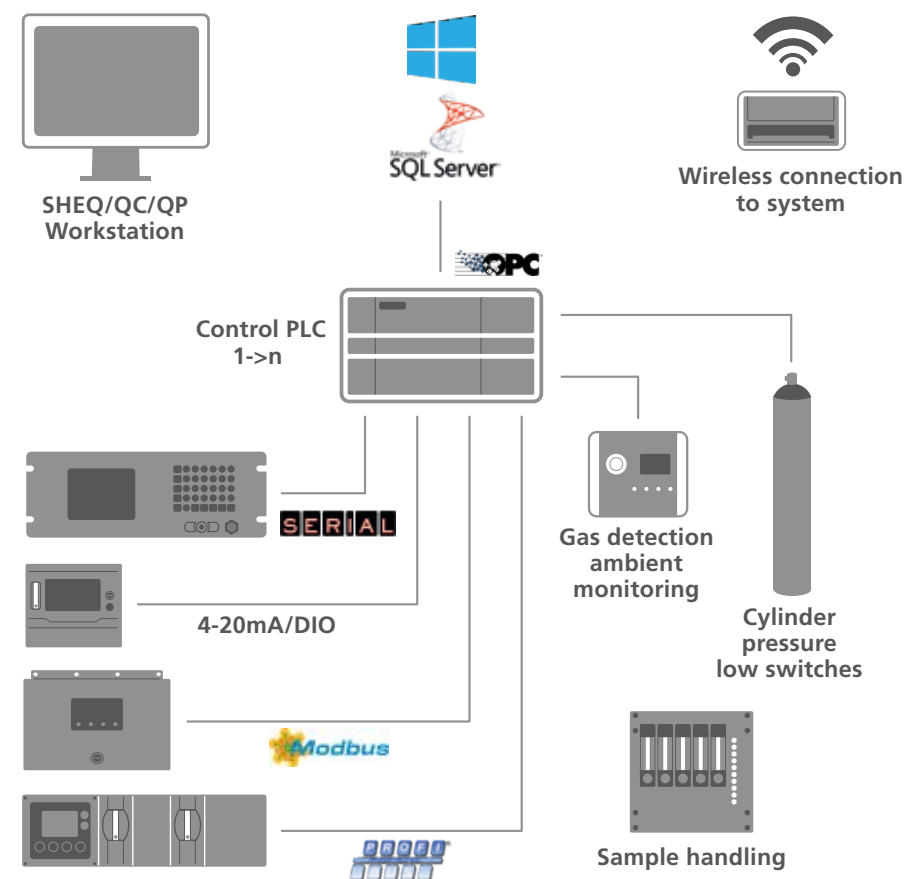
Trends and graphs are available on a selectable time frame, with analysis certificates available in several formats. Statistical analysis and abnormal states during measurements or calibrations can be added as a trend overlay and then printed directly to facilitate reporting. These functionalities greatly support the operator with regard to preventive maintenance and troubleshooting.

Certificates of past analysis are stored in a secure archive and can be generated at any moment. Servomex's world-class direct support is available with remote VPN access for prompt assistance, and there is also online help.

The software allows multiple operators to log in with varying permission levels, and can handle and manage several applications at the same time, producing a summary table with all current readings, warnings and alarms.

DID YOU KNOW...
IGS can use historic data to generate preventive maintenance indicators, reducing the risk of unplanned down time.

IGS – THE BASIC CONCEPT AND OVERVIEW



TURN-KEY ANALYTICS MANAGEMENT SOLUTION

- Single-device to multi-cabinet concepts
- Flexible application background
- IG, semiconductors, specialty & cylinder filling

RELIABLE & AVAILABLE

- Siemens PLC control of analytics devices, sample handling and hardware interlocks
- SQL database and PC GUI can be separated. Inbuilt redundancy to prevent system crash

COMPLIANT

- Design & operation according to GMP
- Operating in Germany and being rolled out in Central Europe on multiple Tier 1 & 2 IG filling plants

EXPANDABLE

- Supplied alongside SERVOMEX analytics systems
- Implementation of existing infrastructures or measurement devices possible

"Since the IGS software enables real-time monitoring, MMS analyzer performance is constantly under review. Any issues are flagged in real time, allowing engineers to resolve them immediately, ensuring optimum performance at all times."

Patrick Hellberg - Key Account Manager at Servomex. Email: phellberg@servomex.com



Find the right system for your process: talk to our team at europe_sales@servomex.com

DF-700 REMOTE CERTIFICATION

SERVOMEX'S INNOVATIVE REMOTE CERTIFICATION PROGRAM AVOIDS ANALYZER DOWNTIME AND SAVES ON-SITE SERVICE COSTS.



Servomex's DF-700 series uses Tunable Diode Laser (TDL) sensing technology to deliver robust reliability and the highest level of sensitivity when analyzing moisture at ultra-trace levels.

With Servomex's exceptional TDL sensing technology providing an industry-leading 100ppt Lower Detection Limit (LDL), the DF-700 series products give a stable, highly accurate measurement that meets the precise monitoring needs of semiconductor production.

The DF-700 analyzers also offer attractive affordability over product life. The durable sensor construction has low lifetime maintenance requirements and delivers zero-drift stability that eliminates the need for routine calibration intervals. The DF-700 measurement ranges are optimized for semiconductor, LED and specialty gas applications that depend on

exceptional ultra-high-purity (UHP) gas quality.

Typically, customers working with these high-purity gas analysis applications need to qualify the performance of their analyzers on an annual basis. This often means returning the analyzer to the factory so it can undergo performance qualification.

However, sending the analyzer away for any length of time can be a major problem when it is critically needed for process control. The alternative, arranging an on-site visit from a qualified engineer, reduces the downtime but is still an expensive option.

Servomex's solution for the DF-700 series is the Analyzer Remote Certification Program, a new service product that provides a remote analysis of all the important parameters and signals for your analyzer.

THE ANALYZER REMOTE CERTIFICATION PROGRAM IS A THREE-STEP PROCESS:

STEP 1



Firstly, the customer downloads the system data files from the analyzer and saves them onto a USB memory stick for transfer to a PC.

STEP 2



The diagnostic and system files are then sent via email to a certified Servomex engineer at our US Technical Center, along with a purchase order for the service.

STEP 3



This expert engineer analyzes the records and generates an analyzer health verification certificate, which is then sent to the customer as a PDF file.

By following this process, customers can avoid the costly downtime associated with losing the analyzer for the period of time necessary to return it to the factory, have it qualified, and then returned. There is also a considerable cost saving when compared to paying for an engineer to make an on-site visit to qualify the analyzer.

HEALTH CHECK



COMMISSIONING



ON-SITE SERVICE SUPPORT



SERVICE CONTRACTS



SPARES



SERVICE CENTER SUPPORT



RENTAL EQUIPMENT



TRAINING



CALIBRATION KITS



For information on all our nine service products visit: servomex.com/service

> UHP PRODUCT GUIDE

Servomex has set the standard for gas analysis in the UHP gases and semiconductor market for many years, pioneering the monitoring technologies and ground-breaking systems solutions that deliver unparalleled performance and reduced cost of ownership.

Servomex offers the most extensive range of analyzer technologies available from a single gas analysis manufacturer, ensuring delivery of the precise, correct solution for every point in your process.

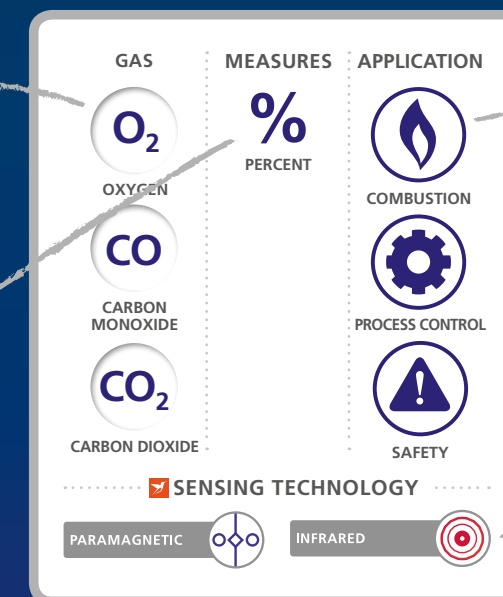
Leading the field in measurement sensitivity, Servomex provides accurate, stable monitoring from percent levels down to the very lowest ultra-trace levels demanded by the semiconductor market. When these exceptional technology range and measurement capabilities are combined, Servomex is unique in offering a genuine 'all of market' solution to the industry.

FIND YOUR PRODUCT NOW

> HOW TO GUIDE

Some analyzers are optimized for single gas measurements while others monitor multiple gas types.

We offer all measurement ranges from percentage to ultra trace parts per trillion analysis.



We identify which application types the analyzer is suitable for operating in.

The Hummingbird sensing technologies used are listed.

For the full range of Servomex analyzers, visit servomex.com/gas-analyzers

DELTA F

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 series and DF-700 moisture series, DF products are the recognized standard for ultra-low measurements in the semiconductor, specialty gas, industrial gas and hydrocarbon processing industries.

SUPPORTING



PROCESS
CONTROL



PROCESS
SAFETY



EMISSIONS
MONITORING



COMBUSTION
CONTROL



PRODUCT
QUALITY

DELTA F DF-730 NanoTrace

HIGH PURITY



TUNABLE DIODE LASER (TDL) TRACE MOISTURE MEASUREMENTS, SUITABLE FOR MONITORING ELECTRONIC GRADE HCI GAS PRODUCTION IN SEMICONDUCTOR FABS

Designed to analyze moisture contamination in electronics grade HCl used in semiconductor fabs, the DF-730 NanoTrace's highly sensitive performance is ideal for quality control and leak detection applications, with a fast-response measurement that is stable, accurate and consistent.

- TDL sensing provides high stability and minimal moisture contact with optical elements
- Broad detection range: 1ppb – 10ppm
- High reliability; repeatable baseline measurements unaffected by loss in mirror reflectivity

GAS	MEASURES	APPLICATION
H ₂ O	ppb ULTRA TRACE	QUALITY
WATER	ppt ULTRA TRACE	
	ppm TRACE	

SENSING TECHNOLOGY



DELTA F DF-550E NanoTrace

HIGH PURITY



AN ULTRA-TRACE OXYGEN ANALYZER OPTIMIZED FOR QUALITY MEASUREMENTS IN HIGH-PURITY ELECTRONIC GASES

Suitable for use with multiple background gases, the DF-550E NanoTrace is designed to deliver ultra-trace measurements of O₂ as a contaminant in ultra-high-purity electronic gases, and is unaffected by sample and flow rate changes, delivering sensitive and dependable process monitoring.

- Ultra-trace Coulometric sensing (200ppt Lower Detection Limit)
- Recovers quickly from process upsets and compensates for sample and flow rate fluctuations
- Various portability options

GAS	MEASURES	APPLICATION
O ₂	ppb ULTRA TRACE	QUALITY
OXYGEN	ppt ULTRA TRACE	

SENSING TECHNOLOGY



DELTA F DF-740 NanoTrace

HIGH PURITY



TUNABLE DIODE LASER (TDL) TRACE MOISTURE MEASUREMENTS, SUITABLE FOR QUALITY CONTROL OF ELECTRONIC-GRADE AMMONIA GAS PRODUCTION IN LED PLANTS

Designed to monitor trace levels of moisture in electronics-grade ammonia, the DF-740 NanoTrace uses industry-leading TDL sensing technology and a robust, long-path-length Herriott Cell for an exceptionally broad measurement range of 10ppb to 10ppm.

- Simplified ongoing maintenance requirements with no consumables required
- High reliability; repeatable baseline measurements unaffected by loss in mirror reflectivity
- Trace-level TDL sensing provides high stability and minimal moisture contact with optical elements

GAS	MEASURES	APPLICATION
H ₂ O	ppb ULTRA TRACE	QUALITY
WATER	ppm TRACE	

SENSING TECHNOLOGY



DELTA F DF-560E NanoTrace

HIGH PURITY



ULTRA-TRACE COULOMETRIC OXYGEN MEASUREMENTS IN ULTRA-HIGH-PURITY ELECTRONIC GRADE GAS FOR QUALITY CONTROL

Designed to measure ultra-trace oxygen to the very lowest levels, the flexible and adaptable DF-560E NanoTrace delivers to the semiconductor sector an industry-leading 45ppt Lower Detection Limit and can monitor O₂ in multiple background gases while logging data in a variety of formats.

- Industry-leading 45ppt Lower Detection Limit
- Flexible portability
- Compensates for sample and flow rate fluctuations and ideal for upset prone applications

GAS	MEASURES	APPLICATION
O ₂	ppm TRACE	QUALITY
OXYGEN	ppb ULTRA TRACE	
	ppt ULTRA TRACE	

SENSING TECHNOLOGY



DELTA F DF-745 NanoTrace

HIGH PURITY



TUNABLE DIODE LASER (TDL) TRACE/ULTRA-TRACE MOISTURE MEASUREMENTS FOR ULTRA- HIGH-PURITY ELECTRONIC GAS CHECKS IN LED/LCD MANUFACTURING PROCESSES

Able to monitor multiple background gases, the DF-745 NanoTrace delivers exceptional performance and operational flexibility in a compact unit, using industry-leading TDL sensing technology to offer a Lower Detection Limit of 2ppb.

- Analysis immune to gas cell concentration: DF-745 operates to specification with up to 90% signal loss
- Simplified ongoing maintenance requirements with no consumables required
- High reliability; repeatable baseline measurements are not affected by a loss in mirror reflectivity

GAS	MEASURES	APPLICATION
H ₂ O	ppm TRACE	QUALITY
WATER	ppb ULTRA TRACE	
	ppt ULTRA TRACE	

SENSING TECHNOLOGY



DELTA F DF-745 SGMMax

HIGH PURITY



TUNABLE DIODE LASER (TDL) SENSOR-BASED TRACE MOISTURE ANALYZER, DESIGNED FOR MEASURING DIVERSE GAS MIXTURES IN SPECIALTY GAS BLENDING APPLICATIONS

This device includes a database of 17 standard background gases – with blends of up to 8 gases – providing an adaptable solution for diverse application needs. Thirty custom gas mixtures can be predefined directly via the front panel interface.

- Trace-level TDL sensing provides high-stability measurements through minimal moisture contact with optical elements
- Integrated LCD display shows real-time analysis and reference spectrum for increased user confidence
- 5ppb Lower Detection Limit lowest available without need for a pump

GAS	MEASURES	APPLICATION
H_2O WATER	ppb ULTRA TRACE ppm TRACE	QUALITY

SENSING TECHNOLOGY



DELTA F DF-749 NanoTrace

HIGH PURITY



TUNABLE DIODE LASER (TDL) SENSOR TRACE/ULTRA-TRACE MOISTURE MEASUREMENTS FOR CHECKS OF ULTRA-HIGH-PURITY ELECTRONIC GASES

Ideal for quality checking of UHP gases used in LCD and LED manufacture, the compact DF-749 NanoTrace provides trace and ultra-trace moisture contaminant measurements in various background gases including nitrogen, hydrogen, helium, argon and oxygen.

- Ultra-sensitive Lower Detection Limit of 250ppt
- Compact with a low weight; moves easily from port to port and is ideal for other mobile applications
- Trace-level TDL sensing provides high-stability measurements through minimal moisture contact with optical elements

GAS	MEASURES	APPLICATION
H_2O WATER	ppb ULTRA TRACE ppt ULTRA TRACE ppm TRACE	QUALITY

SENSING TECHNOLOGY



DELTA F DF-750 NanoTrace

HIGH PURITY



TUNABLE DIODE LASER (TDL) ULTRA-TRACE MOISTURE MEASUREMENTS FOR QUALITY CONTROL IN SEMICONDUCTOR FABs

Designed specifically to make trace and ultra-trace measurements in a range of ultra-high-purity gases, the DF-750 NanoTrace is the leading choice in moisture analysis for the semiconductor industry, measuring moisture as a contaminant in electronics grade nitrogen, hydrogen, helium, argon and oxygen.

- Industry-leading 100ppt Lower Detection Limit
- Simplified ongoing maintenance requirements through the use of non-depleting, high-stability TDL sensing technology with zero drift
- High reliability; repeatable baseline measurements are not affected by a loss in mirror reflectivity

GAS	MEASURES	APPLICATION
H_2O WATER	ppm TRACE ppb ULTRA TRACE ppt ULTRA TRACE	QUALITY

SENSING TECHNOLOGY



DELTA F DF-760E NanoTrace

HIGH PURITY



UNIQUE DUAL-MEASUREMENT TRACE/ULTRA-TRACE MOISTURE/OXYGEN ANALYZER FOR QUALITY CONTROL OF UHP BULK GASES

Combining the industry-leading properties of Servomex's non-depleting Coulometric sensor and robust Tunable Diode Laser (TDL) technology, the DF-760E NanoTrace is a compact integrated solution for monitoring UHP bulk gases used in the manufacture of integrated circuit boards.

- Unique industry solution for ppt monitoring of moisture and O_2
- Industry-leading Lower Detection Limits of 100ppt (H_2O) and 45ppt (O_2)
- Single analyzer can be used for multiple background gases: N_2 , H_2 , He, Ar and O_2

GAS	MEASURES	APPLICATION
O_2 OXYGEN	ppb ULTRA TRACE ppt ULTRA TRACE	QUALITY
H_2O WATER	ppm TRACE	

SENSING TECHNOLOGY



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, Zirconium Oxide, Thermal Conductivity, Plasma and Gas Chromatography – are integrated into flexible analyzers that 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 (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



PROCESS CONTROL



PROCESS SAFETY



EMISSIONS MONITORING



COMBUSTION CONTROL



PRODUCT QUALITY

SERVOPRO Chroma

SAFE AREA



HIGHLY VERSATILE TRACE GAS ANALYZER PLATFORM CONFIGURABLE TO A WIDE RANGE OF APPLICATIONS

Offering a unique, non-depleting plasma emission detector, the Chroma (K4000) analyzer is one of the most versatile gas analyzers for trace gas measurement available. Most applications will be satisfied by a single 4U rack analyzer configuration, making the Chroma a compact, cost-effective solution for continuous process control or quality monitoring.

- PlasmaHC measurement system requires no FID for THC measurement
- Fully automated - tune to the application - system for unique simplicity of use
- Standalone systems requires no third-party software or computer to operate

GAS	MEASURES	APPLICATION
MULTIPLE	% PERCENT ppm TRACE ppb ULTRA TRACE	QUALITY PROCESS CONTROL

SENSING TECHNOLOGY



SERVOPRO NanoChrome

SAFE AREA



SUB-PPB TRACE MEASUREMENT OF H₂, CH₄, CO, CO₂, N₂, Ar AND NMHC FOR THE SEMICONDUCTOR INDUSTRY

Incorporating the latest advances in gas sensing technology and signal processing methodology, the NanoChrome revolutionizes ultra-trace purity measurements for the semiconductor industry.

- In compliance with Low Voltage, EMC and applicable Directives
- New PED sensor technology enables sub-ppb measurements of H₂, CH₄, CO, CO₂, N₂, Ar and NMHC
- Enables unique total Servomex solution for UHP gas analysis

GAS	MEASURES	APPLICATION
MULTIPLE	ppb ULTRA TRACE ppt ULTRA TRACE	QUALITY

SENSING TECHNOLOGY

GAS CHROMATOGRAPHY	PLASMA
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SERVOPRO MultiExact 4100

SAFE AREA



A SOPHISTICATED, NEXT-GENERATION MULTI-GAS ANALYZER PROVIDING A HIGHLY ADAPTABLE ANALYSIS SOLUTION

The SERVOPRO MultiExact 4100 is a high-performance multi-gas analyzer designed to provide up to four simultaneous gas stream measurements including: O₂ (trace, control, and purity), CO₂, CO, N₂O, CH₄ (trace), Ar in O₂, N₂ in Ar, O₂ or air, and He in Ar, O₂ or N₂.

- Comprehensive solution for industrial and medical gas manufacture and for pharmacopeia applications
- Integrated support for the AquaXact 1688 Aluminum Oxide moisture transmitter
- Uses ultra-stable, non-depleting digital sensing technologies that help extend maintenance intervals

GAS	MEASURES	APPLICATION
MULTIPLE	% PERCENT ppm TRACE	PROCESS CONTROL QUALITY

SENSING TECHNOLOGY

GAS FILTER CORRELATION	ZIRCONIA
PARAMAGNETIC	THERMAL CONDUCTIVITY
INFRARED	ALUMINUM OXIDE

SERVOPRO MonoExact DF150E

SAFE AREA



TOUCHSCREEN PPM OXYGEN ANALYZER FOR GENERAL INDUSTRIAL APPLICATIONS

With a brand new digital, programmable touchscreen and easier navigation, the MonoExact DF150E combines the reliability of Servomex's tried and tested Coulometric oxygen sensor with a more user-friendly package.

- Advanced touchscreen GUI for intuitive hands-on setup and operation
- Back-compatible with DF-150E platform, including hardware wiring inputs and gas inlets
- Servomex proprietary software makes reporting and parameter control simple

GAS	MEASURES	APPLICATION
O ₂ OXYGEN	ppm TRACE ppb ULTRA TRACE	PROCESS CONTROL QUALITY

SENSING TECHNOLOGY

COULOMETRIC

AquaXact 1688

SAFE AREA



A FAST, ACCURATE AND RESILIENT MOISTURE MEASUREMENT SOLUTION

A rugged ultra-thin film Aluminum Oxide moisture sensor that enables the measurement of moisture in a wide variety of gas phase process applications, such as glove boxes, air separation units, natural gas processing, transportation, and instrument air, with no calibration required after sensor replacement or dry-out.

- Functions as a standalone 4-20mA transmitter or remotely interfaces with the AquaXact 1688 Controller, SERVOPRO MonoExact DF310E and MultiExact 4100 gas analyzers
- High-performance field-replaceable sensor element unaffected by condensation and liquid water
- Stainless steel, weatherproof casing. North America C1D2 and IECEx Zone 1 approvals pending

GAS	MEASURES	APPLICATION
H ₂ O WATER	DEW POINT ppmv	PROCESS CONTROL

SENSING TECHNOLOGY

ALUMINUM OXIDE

SERVOPRO MonoExact DF310E

SAFE AREA



NEXT-GENERATION DIGITAL OXYGEN ANALYZER DESIGNED FOR INDUSTRIAL GAS APPLICATIONS

Designed specifically to accurately measure oxygen in industrial gas applications, the MonoExact DF310E is a next-generation digital oxygen analyzer that combines precision trace-level measurement with new performance benefits and extended digital communications compatibility.

- Advanced touchscreen GUI for intuitive hands-on setup and operation
- Back-compatible with DF-310E platform, including hardware wiring inputs and gas inlets
- Field-proven Servomex Coulometric electrochemical performance and reliability

GAS	MEASURES	APPLICATION
O ₂ OXYGEN	% PERCENT ppm TRACE ppb ULTRA TRACE	PROCESS CONTROL QUALITY

SENSING TECHNOLOGY

COULOMETRIC	PARAMAGNETIC
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GAS DETECTION OxyDetect

SERVOMEX



NON-DEPLETING PARAMAGNETIC OXYGEN MONITOR DESIGNED FOR LIFE SAFETY APPLICATIONS

Life safety monitor designed for safe area or hazardous area environments, utilizing superior performance of non-depleting Hummingbird Paramagnetic O₂ sensing technology.

- IP66 (indoor use only)
- The most reliable O₂ detector on the market
- No more false readings or false alarms caused by depleting cell technologies
- SIL 2 approval

GAS	MEASURES	APPLICATION
O ₂ OXYGEN	% PERCENT	SAFETY

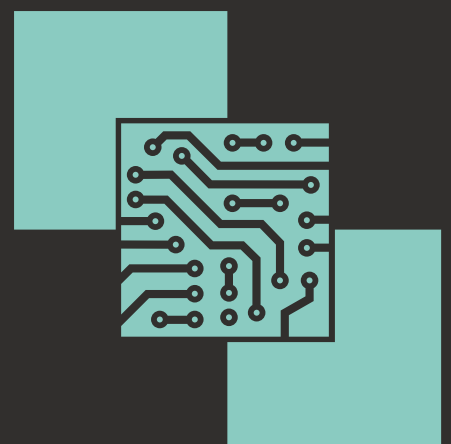
SENSING TECHNOLOGY

PARAMAGNETIC

UHP GASES

WE'RE READY TO HELP

WHATEVER YOUR UHP GAS REQUIREMENTS, WHEREVER YOU ARE



SERVOMEX 

A MEASURABLE ADVANTAGE

SERVOMEX.COM