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multi EA® 3100

Quality is the difference

Systems from Analytik Jena - the pacesetter in elemental analysis

Modern techniques for sum parameter and elemental analysis are increasingly applied in environmental monitoring, as well as in process and quality control. The challenge facing modern analytical systems lies in reliable automation for an extensive range of samples. Analytik Jena AG is the leader in the development of reliable sum parameter and elemental systems designed to satisfy the diverse modern demands posed in today's age.

With this aim in mind, Analytik Jena developed a flexible future-oriented series of instruments: the multi EA® series. Automation and reliability are combined in unmatched quality thanks to patented innovative solutions.
A system has been created to cope with the most diverse sample matrices. On the basis of the experienced gained in this field over decades, Analytik Jena AG has developed into a worldwide leading provider. You profit from this extensive experience with the multi EA® series.

The long tradition of analytical instrument manufacture in the Ilmenau region dates back to the early 19th century. Analytik Jena has continued this tradition since 1990 and produces high performance analytical instruments for TOC, AOX and elemental analysis.

1945 Manufacture of the first instruments, representing the start of today's titration technique and elemental analysis

1952 Electrolytic unit for coulometric measurement mass analysis

1982 Launch of the first nitrogen and chloride titrator

1991 First simultaneous elemental analyzer and special TOC/TN and AOX/TOX analyzers
multi X® – first AOX/TOX analyzer with automatic sampler

1994 multi N/C® – first simultaneous TOC/TN analyzer worldwide

2002 Double furnace – first innovative concept for combustion analysis of the most diverse matrices

2003 multi EA® 3100 – flame sensor technology for intelligent elemental analysis


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multi EA® – C, N, S and Cl analytics on the highest level

The multi EA® series – elemental analyzers for every application

With the EA® series, Analytik Jena has developed a family of elemental analyzers to fulfil the demands of modern analytical technology in the determination of carbon, nitrogen, sulfur and total chlorine in the most varied of sample matrices. The EA® series offer an enormous range of configuration options. The wide selection of different modules for detection, sample introduction and sample digestion opens up an almost universal range of applications.

multi EA® 3100 - multi-matrix C, N, S, Cl analyzer

The multi EA® 3100 elemental analyzer represents a new generation of elemental analyzers for the determination of C, S, N and Cl in solid, liquid, paste, viscous and gaseous samples. It is especially well suited for the analysis of petrochemical and related samples, such as oil, fuel, solvents, polymers, gas and liquid gas analysis, as well as fine chemical, EOX and AOX analytics. Previously outstanding variety combined in a single instrument opens new horizons in elemental analysis.

Carbon, sulfur, nitrogen and chlorine analysis is performed fully automatically and controlled. The concept offers the simplest possible operation and satisfies the highest demands for quality analytical results.

Advantages at a glance:

- **Multi-element:** carbon, sulfur, chlorine and nitrogen determination in a single instrument
- Simultaneous determination of nitrogen and sulfur
- Automatic switching for chlorine measurement without retrofitting
- **Multi-range:** extended chlorine measuring range up into the percent range with a low maintenance combination electrode
- Highly sensitive and stabilized coulometer cell for chlorine determination in the trace range
- Unique sensitivity for S and N determination in the trace range
- Ultra-modern detectors from ppb to the percent range
- **Multi-application:** an analyzer for fluid samples, solids, gases and LPG
- Optimized combustion with patented flame sensor technology
- **Multi-matrix** through double furnace technology: Vertical and horizontal operation for optimal adaptation to the sample matrix
- Previously unattained high-sensitivity gas measurements
- **Multi-functional:** a single autosampler for vertical and horizontal operation, fluid and solid samples
- **Multi-safety:** Self Check System (SCS) for trouble-free operation
- Simple operation with minimal maintenance
- **Multi-modular:** freely selectable and extensible combination of analyzer modules
- **Multi-conform:** conformity with a multitude of common international and national standards

Intelligent combustion with flame sensor technology

The controlled reaction management in excess oxygen is the key to precise and reliable measurement results. The flame sensor technology ensures soot-free combustion of the sample.

Optimal adaption to the sample matrix with double furnace technology

To facilitate thermal oxidation of the samples, the furnace can be set up horizontally or vertically. Simple and fast changeover by the operating personnel. This means the respective advantages of each configuration can be fully exploited.

Easy to use

Predefined standard methods for various applications enormously simplify work and save valuable measuring time. The parameters for oxidation, sample introduction and detection are optimally adapted to the respective task with just a few mouse clicks, so even the most difficult sample matrices can be processed effortlessly.

Optimal operational reliability with the Self Check System (SCS)

The multi EA® 3100 comes equipped with a Self Check System (SCS) as standard for optimal operational reliability with the minimum operating effort. The system autonomously checks all the relevant parameters to guarantee trouble-free, fully automated operation. Flame sensor technology is an integral part of the SCS.

Versatility through multi-detection

Besides highly sensitive UV fluorescence and chemiluminescence detectors, coulometric sulfur determination is also available. New, powerful and stabilized coulometers have been developed for chlorine determination over a wide measuring range. Carbon determination is selective and precise with the aid of an NDIR detector. The systems satisfy the common ASTM, EPA and ISO standards.

Multi-functional autosampler for every task

The autosampler enables fully automated determination of solid and fluid samples in vertical or horizontal furnace configurations. Simple changeover from fluid to solid samples and vice versa in just a few minutes.

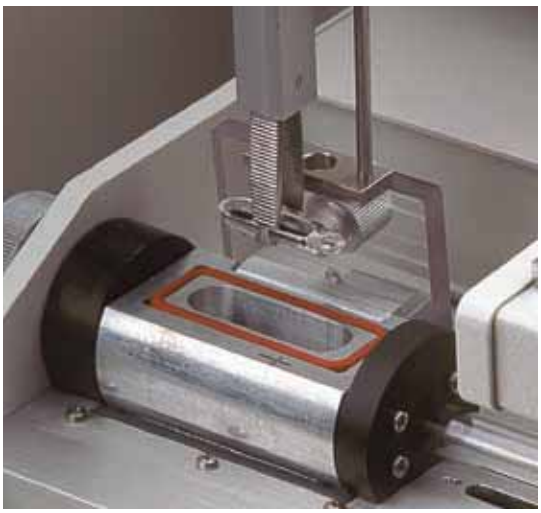


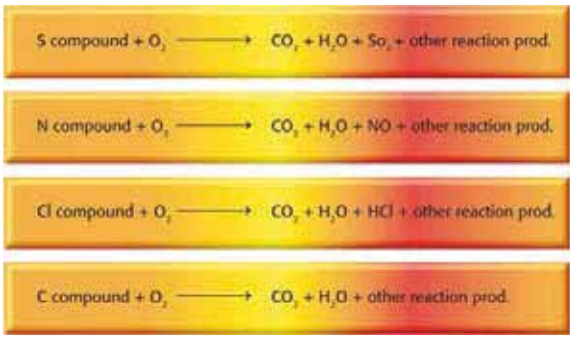
Fig. from left to right

- *The multi EA® 3100 with xyz autosampler for vertical and horizontal sample insertion*
- *Sample introduction through maintenance-free lock systems*

Intelligent Combustion with flame sensor technology

Complete sample digestion

Fluid, solid and gaseous samples are completely oxidized at 1050°C in the stream of oxygen. Products such as SO_2, NO and HCl are formed and analytically measured.



The principle of complete oxidation with high temperature combustion

Optimized combustion with flame sensor technology

Complete, i.e. soot-free combustion, is achieved by means of intelligent combustion management, whereby the sample is initially pyrolyzed in an inert gas.

In the second step, the pyrolysis products are burned in the stream of oxygen. This is where the actual oxidation process takes place.

Control of the flame formation

Controlling the flame is the key to complete oxidation, the avoidance of soot build-up and measurement results of the highest precision. A flame sensor monitors the flame and conveys the information to the sample feed. Sample insertion is automatically regulated such that oxidation is complete and soot-free. All secondary reactions are effectively suppressed as a result.

Advantages at a glance:

- No system sooting
- Significantly reduced maintenance work
- Improved precision through complete oxidation
- Reduced matrix effects
- One method for almost all sample matrices
- Simple and fast programming of the feed speed
- Matrix-related adaptation of the gas flows and gas composition not required
- Matrix-related adaptation of the combustion temperature not necessary
- No prior knowledge of the sample combustion properties necessary

Controlled oxidation with flame sensor technology

Efficient, modular and automated

Double furnace: horizontal and vertical sample insertion in a single system

Depending on the task and sample matrix, horizontal or vertical sample insertion can be advantageous.

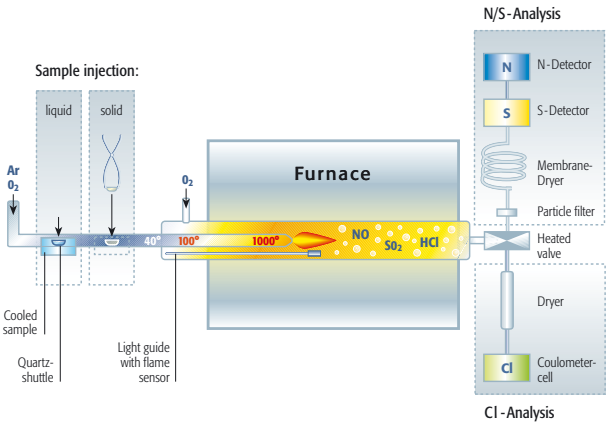
Solvents and fuels, such as diesel, oil and petrol, can be determined quickly, simply and conveniently with vertical direct injection. Viscous fluids and solids, however, require horizontal sample insertion on a tray.

A concept was born with the multi EA® 3100 of unifying vertical and horizontal sample insertion in a single device.

Consequently, the user can choose the configuration best suited for the respective task with a simple and unaided conversion.

Advantages of horizontal sample insertion:

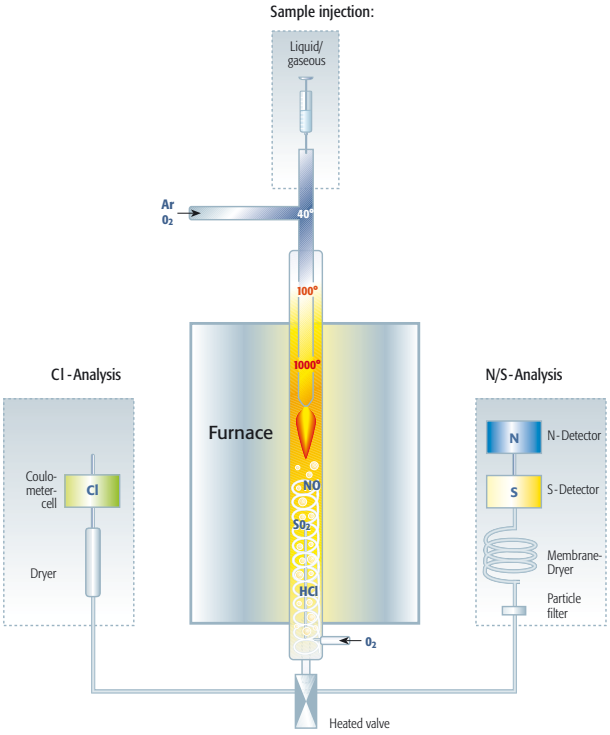
- Suitable for fluid samples of low and high viscosity
- Suitable for solids
- Flame sensor technology is effective in preventing soot formation



Functional principle of the multi EA® 3100 in horizontal operation

Advantages of vertical sample insertion:

- Fast analysis
- Ideal for fluid samples of low viscosity
- Ideal for fluid samples of high volatility



Functional principle of the multi EA® 3100 in vertical operation

multi EA® 3100

Multi-detection: previously unattained detector diversity

The multi EA® 3100 offers a unique diversity of detection systems, which can be combined at one's convenience.

Sulfur determination:

- UV fluorescence detector for sulfur
- Determination down to the lower ppb range
- Coulometric sulfur determination for an extended measuring range

Nitrogen determination:

- Chemiluminescence with integrated converter for determining nitrogen down to the lower ppb range

Chlorine determination:

- *Highly sensitive* coulometer for chloride determination in the trace ranges
- *Sensitive coulometer* with low-maintenance combination electrode to extend the measuring ranges
- *High concentration* upgrade for high to very high chlorine concentrations

Carbon determination:

- NDIR determination of carbon for low and high concentrations up to the percent range

Multi-functional: an autosampler for fluid and solid samples, vertical and horizontal application

Fluid and solid samples can be analyzed with a single autosampler without laborious retrofitting. This eliminates the otherwise time-consuming connection and adjustment of a second autosampler; the combustion system remains unaffected. The resulting time-saving achieved when switching from fluid to solid samples or vice versa is enormous.

Horizontal sample insertion on a boat or vertical direct injection – two additional functions for the same autosampler. It therefore allows high precision dosing at different speeds and rinses the injection syringe with the sample and any solvent selected.

The automation of the multi EA® 3100 gives rise to the best sample throughput to date, both in vertical and horizontal operation for fluid and solid samples.

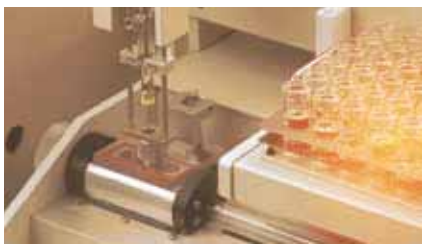


Fig. from left to right

- *The multi EA® 3100 with xyz autosampler for vertical and horizontal sample insertion.*
- *Insertion of solid samples using a quartz tray with the xyz autosampler*
- *Just one autosampler for fluid and solid samples*

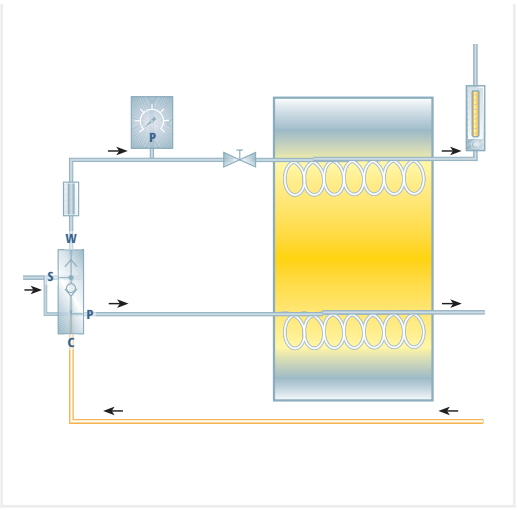


Fig. from left to right

- *The multi EA® 3100 with LPG*
- *Functional diagram of the LPG module*

Automatic injection also without an autosampler

An automatic injector is also available for injecting fluids, which allows sample injection in vertical and horizontal operation without an autosampler.

Operation is absolutely simple. The injection syringe is clamped in the holder. The auto-injector then injects the sample with a preset speed thus facilitating the reliable and simple insertion of fluid samples.

The auto-injector works with a variable, freely programmable dosage speed and dosage volume.

Highly sensitive gas analysis

Special modules are available for gas analyses, which have been optimized for the respective task.

Gas analysis is performed with high sensitivity and precision with the aid of a multiple dosage Cavro syringe thereby achieving sample volumes of a size previously unattained.

The sensitivity achieved in this process is unique.

Advantages of the gas analysis:

- Simple operation
- Unparalleled high dosage volume
- Unique gas analysis sensitivity
- Continuous sample dosage

Liquefied Petroleum Gas (LPG) analyses also at low sample pressure

LPG samples are precisely evaporated and dosed fully automatically with the aid of the LPG module.

A special sample loop is Peltier-cooled for dosing the LPG, which is effective in preventing bubble formation. The subsequent evaporation takes place in a heated evaporation chamber.

The evaporated LPG passes from here into the combustion system where complete oxidation takes place.

The cooled sample loop allows sample dosage at significantly reduced sample pressure compared with conventional uncooled LPG systems.

This eliminates the otherwise complex pressurisation of samples.

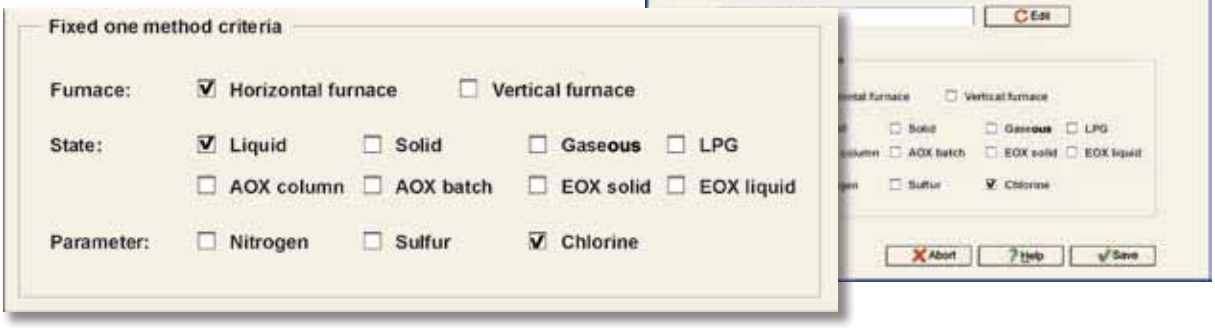
Advantages of the LPG analysis:

- Peltier-cooled sample loop
- Analyses possible at low sample pressure
- No bubble formation
- Sample dosing volumes of up to 50 µl from the liquid phase
- Plug and start: swagelock connectors for the sample cylinder connection
- Heated evaporation chamber for controlled sample evaporation
- Highest possible safety standard

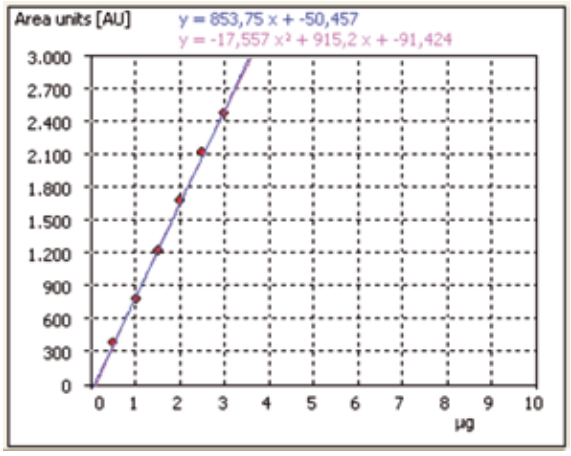
Easy to use: intuitive user guidance

The multi EA® 3100 is operated with the aid of an external computer. The modern multiWin® software offers the user the best possible operating convenience. It monitors the system parameters and provides a clear representation of the analysis results.

The simple and logical menu navigation is unchallenged in elemental analysis. Even beginners are led safely through the software. Complex method settings are superfluous thanks to the preset methods and flame sensor technology.



The uniquely versatile and at the same time, clearly structured user software multiWin®, offers free editability of sample data also during the measurements, as well as the option of individual post calculation. It also includes all necessary statistical information for calibration and on the measurement data.



Easy to use: sulfur, nitrogen and chlorine analysis without retrofitting

Sulfur and nitrogen analysis is simultaneous and highly sensitive. Fully automated chlorine determination is then performed. For the first time, all three elements – sulfur, nitrogen and chlorine – can be determined in a single fully automated run.

Easy to use: chlorine analysis made easy

Chlorine measurements in the trace range are highly dependent on the stability of the coulometer. To avoid electronic and chemical interference, the multi EA® 3100 works with an electronically stabilized micro-coulometric measuring cell. Automatic endpoint titration and drift correction confer unequalled stability. As a result, detection goes down to the ppb range without difficulty even in routine operation.

A coulometric detector with combination electrode is optionally available for chlorine analyses in the low to high concentration range. The combination electrode requires very little maintenance and works without inner electrolytes, membrane or diaphragm. Switching can take place between low and very high chlorine concentrations without any retrofitting, resulting in a uniquely wide measuring range for chlorine analysis.

Easy to use: Self Check Systems (SCS)

The multi EA® 3100 comes equipped with the Self Check System (SCS) to safeguard trouble-free and fully automatic operation. The SCS checks and monitors all relevant parameters, which affect measuring results as well as the instrument and operating safety.

Advantages at a glance:

- Constant gas flow through electronic regulation
- No sooting due to gas flow fluctuations
- High level of operational reliability thanks to electronic gas pressure control
- System shutdown in the case of pressure loss
- No sooting in the case of oxygen shortage
- Software-controlled furnace temperature regulation
- Electronic control of the detectors
- Simultaneous control of the CLD converter
- Automatic ozone control
- Integrated chlorine drift correction

Countless features meeting everybody´s expectations


Natural gas and crude oil production


Chemical industry


Petrochemical industry and refineries


Pharmacy


Biotechnology


Water analytics


Recycling


Petrochemistry


Environmental monitoring


Agricultural industry


Power stations


Materials testing / Quality control

Gases	Element	c [µg/l]	RSD [%]	Detection	Operating mode
Butane gas [1]	Sulfur	65,00	0,6	UV luminescence	vertical
Butane gas [2]	Sulfur	20,4	1,8	UV luminescence	vertical

Gases	Element	c [mg/l]	RSD [%]	Detection	Operating mode
Butane LPG [3]	Nitrogen	0,91	4,6	Chemiluminescence (CLD)	vertical
Butane LPG [4]	Sulfur	16,9	0,6	UV luminescence	vertical

The unique versatility of the multi EA® 3100, with its modular structure and free selection between vertical and horizontal operating modes, opens up manifold applications.
Fluids with the most diverse properties, i.e. oxidation behaviour, viscosity and wide ranging element content, for example in fuels, oils, naphtha can be analyzed without difficulty using the EA® 3100 in its vertical and horizontal modes. Quantitative digestion of solid samples, such as paraffins, waxes, polymers and even coal succeeds with flame sensor technology in the horizontal operating mode, also without restrictions. Gas and liquid petroleum gas (LPG) analyses are performed by virtue of large sample volumes with the highest precision and sensitivity in the vertical operating mode.

Liquid samples	Element	c [mg/kg]	RSD [%]	Detection	Operating mode
Petrol [1]	Sulfur	9.87	0.2	UV luminescence	vertical
Fuel [1]	Sulfur	0.11	3.3	UV luminescence	vertical
Diesel oil [1]	Sulfur	5.11	2.5	UV luminescence	vertical
Diesel oil [2]	Sulfur	21.02	2.7	UV luminescence	vertical
Diesel oil [3]	Sulfur	199.2	0.7	UV luminescence	vertical
Petroleum [1]	Chlorine	3.32	2.3	Coulometry	horizontal
Petroleum [2]	Chlorine	1761	1.7	Coulometry	horizontal
Petroleum [3]	Nitrogen	1380	2.3	Chemo detector	horizontal
Petroleum [4]	Nitrogen	6540	1.6	Chemo detector	horizontal
Petroleum [5]	Sulfur	3440	0.8	Chemo detector	horizontal
Petroleum [6]	Sulfur	2206	2.6	Chemo detector	horizontal
Naphta [1]	Chlorine	0.133	8.6	Coulometry	vertical
Naphta [2]	Chlorine	1.24	2.8	Coulometry	vertical
Naphta [3]	Nitrogen	3.88	2.7	Chemiluminescence (CLD)	vertical
Naphta [4]	Nitrogen	3.92	2.1	Chemiluminescence (CLD)	vertical
Naphta [5]	Sulfur	0.33	1.3	UV luminescence	vertical
EOX [1]	Chlorine	112.1	1.5	Coulometry	horizontal
EOX [2]	Chlorine	0.53	2.3	Coulometry	horizontal

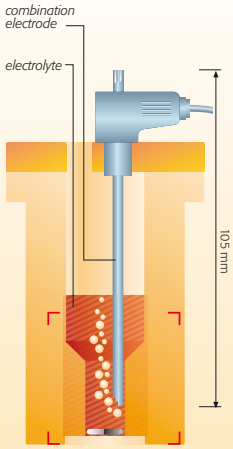
Solids	Element	c [mg/kg]	RSD [%]	Detection	Operating mode
Coal [1]	Sulfur	23.5	2.8	UV luminescence	horizontal
Coal [2]	Sulfur	138.2	2.3	UV luminescence	horizontal
Paraffin [1]	Sulfur	9.7	2.0	UV luminescence	horizontal
Paraffin [2]	Nitrogen	11.6	2.2	Chemiluminescence (CLD)	horizontal
Paraffin [3]	Chlorine	0.33	7.4	Coulometry	horizontal
Wax [1]	Sulfur	41.1	1.3	UV luminescence	horizontal
Wax [2]	Nitrogen	28.5	2.1	Chemiluminescence (CLD)	horizontal
Wax [1]	Chlorine	0.40	6.4	Coulometry	horizontal
Polymer [1]	Sulfur	3.6	2.8	Chemo detector (CHD)	horizontal
Polymer [2]	Nitrogen	11.3	2.3	Chemo detector (CHD)	horizontal
AOX [1]	Chlorine	10.5	1.4	Coulometry	horizontal
AOX [2]	Chlorine	0.17	3.2	Coulometry	horizontal

Fig. from left to right

Automatic sample preparation for AOX/TOX determination using the column method (APV 26)

Coulometer cell with combination electrode for AOX/TOX determination

Sectional view of a coulometer cell



AOX/TOX/EOX determination on the highest level

The multi EA® 3100 is outstandingly well suited for the determination of AOX/TOX parameters (Adsorbable Organic Halogens) and EOX (Extractable Organic Halogens).

These parameters, which mainly occur in water analytics, are based on the concentration of the sample over active carbon (AOX/TOX) or extraction and constriction (EOX). The active carbon or the extract is also oxidized by high temperature combustion at 950°C.

The low-maintenance combination electrode is also available for coulometric chlorine determination in AOX/TOX/EOX operation.

Simple, automated AOX/TOX/EOX determination

The parameters AOX/TOX and EOX are selected in the user interface of the multiWin® software. The measuring procedure of the system then proceeds fully automatically. The universal autosampler automates AOX/TOX analysis using both the column method and the batch method. Flame sensor technology is used in EOX determination and ensures the complete and soot-free conversion of the organic bound halogens.

Standard conformant with the highest aspirations

The AOX/TOX- and EOX-analyses comply with the standards EN 1485, ISO 9562, ASTM 4744, EPA 9020, EPA 9076.

Sample preparation system for AOX/TOX determination

Various adsorption systems for sample preparation in AOX/TOX determination using the column method or batch method provide the basis for fast routine analytics. Using the column method, two samples can be enriched simultaneously or up to 26 samples sequentially.

The technical data of the adsorption systems for the column method hardly leave a wish unfulfilled.

- Variable sample volumes
- Preselectable rinsing volume
- The sample currently processed is stirred
- Optional use of duplex or triplex columns with two or three active carbon columns
- Simple and convenient operation using an external control unit

Unique triplex columns ensure complete adsorption on active carbon.

Technical Service & Application Support

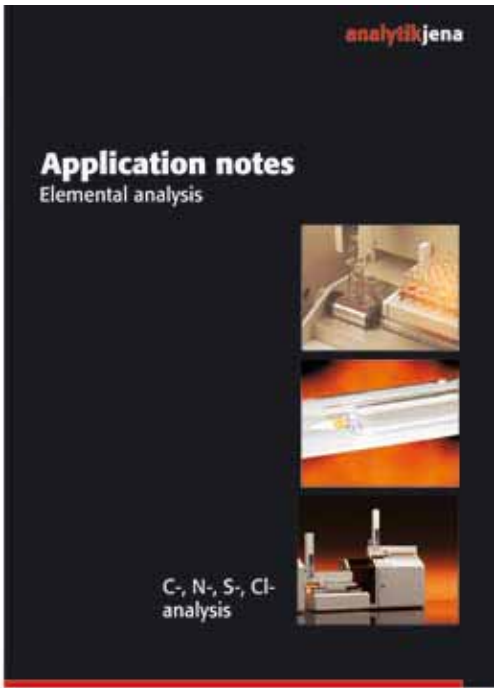
Premium quality from Analytik Jena

Our high-precision analytical systems, based on Carl Zeiss technology and produced according to a stringent quality management system, guarantee the premium quality our customers are used to obtain from us.

Before our high-performance instruments are delivered, all technical parameters are tested, the results recorded and entered in a test certificate. Only those instruments that have passed the complete range of tests, as confirmed by the inspector's signature, will be delivered.

Reliability and certainty

Well-deliberated design concepts, the expertise of our staff, individual application consulting and comprehensive customer service ensure the certainty and reliability of your results. All service operations and safety tests are recorded in the device logbook. Software updated at regular intervals satisfies the requirements of the FDA for conformity to 21 CFR Part 11 and guarantees the safe and reliable electronic documentation of your data.



Our prompt delivery of parts and consumables allows you to work without losing time.

We take time for you

While installing the device, our specialists will intensively train your personnel in operating it, demonstrate the analytical performance of the device and record the obtained results. Our application specialists also provide comprehensive qualification of your personnel enabling them to solve specific analytical problems.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Certificate

Certificate of software validation of multiWin®

This is to certify that planning, development, manufacturing and maintenance of the software product

multiWin®

for use with all multiEA® Analyzers from Analytik Jena AG is in accordance with the development procedures using a software life-cycle model.
The software product has been released after internal and external beta testing.
The source code can be made to entitled regulatory authorities.

Thomas Stratesteffen
Product Manager Sum Parameters and Elemental Analysis

Dr. Reiner Löck
Quality management

Technical Service

Our world-wide service network guarantees nearness to our customers thus ensuring quick response times, short travel times and low costs for you.

With comprehensive solutions, such as:

- Continuous quality control by our service engineers
- Individual maintenance and service contracts
- Full-time advisory phone service via our hotline
- Documentation of performed service operations and safety tests in a logbook
- Continuous software update service
- Factory-trained staff employed by our subsidiaries and sales representatives

we provide total service support.

Application Support

A strong team of application specialists is available to you at any time to assist you in your everyday laboratory work.

With our services and staff giving you advice around the globe, we ensure optimum customer care and support at any time:

- Individual advice on specific questions of application
- Development of analytical method packages
- Validation of analytical systems
- Individual hands-on user training in specific applications
- Organization of user workshops
- Preparation of application newsletters

Our well-trained, globally active staff ensures optimum customer care and support at any time, as we are keenly aware that this, together with product quality, is the key to customer satisfaction.

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