

# High Performance TOC Analyzers multi N/C Series

Sum Parameter Analysis – TOC/TN<sub>6</sub>



## multi N/C Series

Working with multi N/C means measuring parameters like TOC, NPOC, POC, TC, TIC and TN<sub>b</sub> quickly, easily and without any system conversion – and a guarantee for compliance with the valid national and international standards.



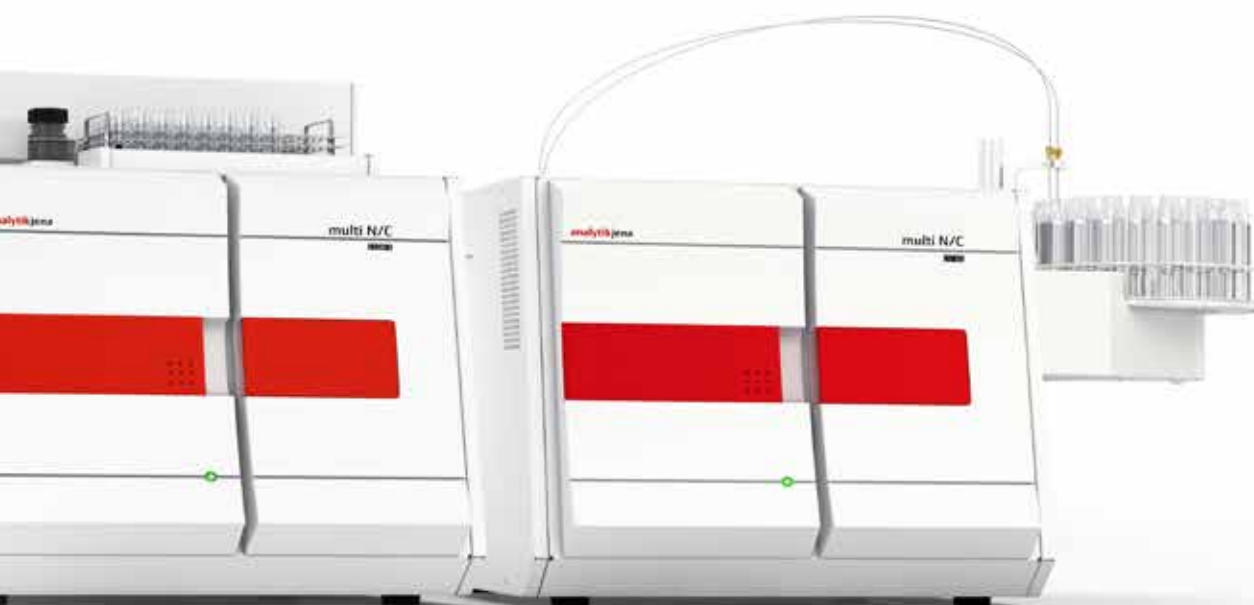
### multi N/C series – features

- **Focus Radiation NDIR detector**  
Highest radiation density for highest sensitivity and precision
- **VITA Flow Management System**  
Continues to work where classical TOC analyzers reach their limits
- **Easy Cal**  
Calibration has never been so easy
- **High Power Long Life UV Reactor**  
Convincing performance in wet chemical oxidation



# multi N/C Series

High Performance TOC Analyzers



## **multi N/C 2100S**

Compact and universal for environmental analysis

## **multi N/C 3100**

The all-rounder for almost all TOC applications

## **multi N/C UV HS**

Extremely well proven even in complicated matrices

## **multi N/C 2100S duo | multi N/C 3100 duo**

Fully automated for liquid and solid TOC determination

## multi N/C – Unique

The multi N/C series offers the right solution for a wide range of applications. Quality and ease of use save time and operating costs.

Examinations of surface and waste water in environmental applications up to ultrapure water in power station operations or semiconductor industries – the modular versatility of the multi N/C series permits individual adaptation to your applications.

Multiple automation options, various nitrogen detectors and several solids modules, partly with automation option, for TOC determination in soil, sediment, waste materials and more are available.

multi N/C is versatile, reliable and easy to use. The intelligent series offers intuitive user guidance and has been designed for tough routine analytical work. High-quality materials and long-living components ensure low wearing. The few number of consumables are arranged in the system for easy access. Few wearing parts, long maintenance intervals and fast replacement guarantee minimum operating costs.

### TC, TOC, TIC, NPOC, NPOC plus, POC or TN<sub>b</sub> – all methods at the click of a mouse

**TOC determination:** Total carbon (TC) and inorganic carbon (TIC) are determined separately. The difference results in the TOC,  $TOC = TC - TIC$ . With this method you can determine both volatile and nonvolatile compounds. It is used in particular for the TOC determination of samples with a high TOC content and a low TIC content, e.g., in waste water.

**NPOC determination:** The TIC is removed from the sample. To this end the sample is automatically acidified and the resulting CO<sub>2</sub> then purged by a carrier gas stream. The residual non-purgeable organic carbon (NPOC) is subsequently determined by direct measurement. By the multi N/C models utilizing the flow injection principle the parallel purging and inject feature is used to purge the next sample during the measurement. This leads to time savings of up to 50% compared to the TOC differential method. Especially useful is the automatic TIC control function to verify for a complete TIC elimination during NPOC operation.

For most environmental and ultra-pure water samples with negligible amounts of light volatile organics, NPOC can be set equal to TOC results.

For particularly high sample throughput of drinking, well or ground water with high natural carbonate matrix, it is recommended to use our **NPOC plus mode**. Thanks to the clever combination with the TOC difference method most reliable results and time savings up to 50% can be achieved.

**POC determination:** If only the volatile components of a water sample are of interest, the POC method quickly provides the desired information that is easy to understand.

For the **TN<sub>b</sub> determination** two highly sensitive detectors are available. With the chemiluminescence detector (CLD) or the solid state chemodetector (ChD) all organic and inorganic nitrogen compounds are measured completely and reliably. The multi N/C 2100S is therefore also suited e.g., for the total protein determination in the pharmaceutical vaccine production.

The TN<sub>b</sub> measurement runs simultaneously to the TOC determination from the same injection. A catalyst or combustion tube replacement is not required. This saves time and operating costs.

A separate brochure for **pharmaceutical TOC/TN** applications is available as well. Here we provided detailed information about multi N/C pharma devices.



# Focus Radiation NDIR Detector

A combination of high-quality optics and the latest detector technology provide a detection system of unchallenged performance.

All our TOC analyzers are characterized by innovation, highest quality, and durable optical components. The core element of the multi N/C series models is the Focus Radiation NDIR detector which allows for most efficient detection and a long service life.

We are proud to grant all customers a long-term warranty of 10 years for the Focus Radiation NDIR detector.

## Focused energy

Energy-rich radiation is focused onto the microdetector with the help of integrated optics. The radiation density obtained surpasses classical detectors many times. The energy efficiency is almost 100%. There are no losses, as with corrosion-prone reflection detectors. This results in higher sensitivity and precision over a wider measurement range.

## Resistant materials

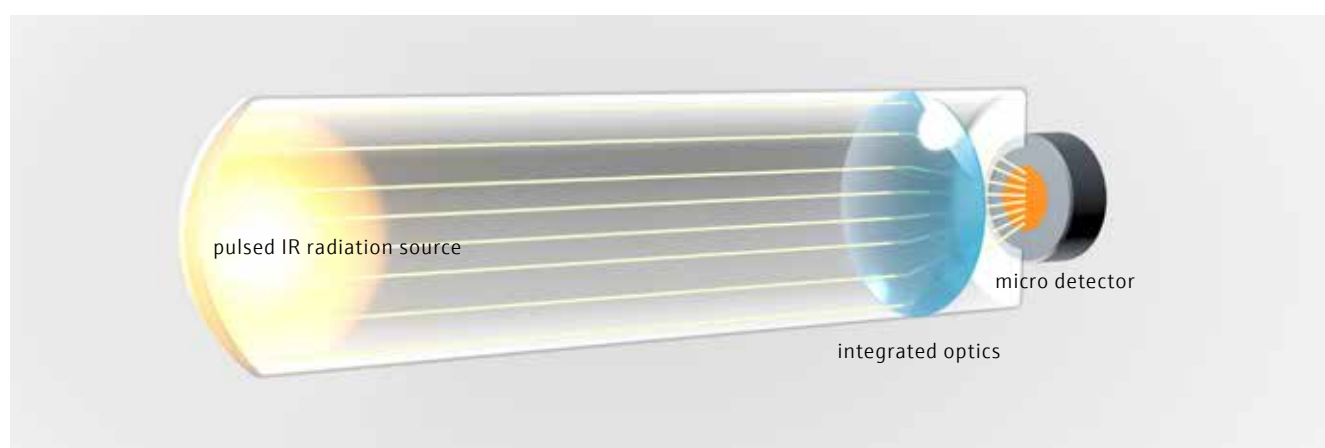
The Focus Radiation NDIR detector is made of completely corrosion-free materials. Furthermore, the radiation source and the detector are encapsulated for optimal protection. This ensures a more stable detector operation, even when working with aggressive samples.

## Latest technology

The Focus Radiation NDIR detector eliminates the use of classical, mechanical movable components which are prone to failure. Instead, the detector is equipped with an electronically pulsed radiation source and an optimized microdetector which guarantee significantly higher stability. As a result, maintenance and operating costs are reduced considerably!

### Focus Radiation NDIR detector – Your benefits

- Highest measurement sensitivity and precision
- No corrosion
- No mechanical movable parts
- 10 years long-term warranty\*
- Large range detector: undiluted measurements from 0–30.000 mg/L TOC



Schematic detector layout

\* according to our warranty conditions: [www.analytik-jena.com](http://www.analytik-jena.com)



# VITA Flow Management System

VITA Flow Management System continues to work where classical TOC analyzers reach their limits.

Gas flow fluctuations that are unavoidable due to evaporation and oxidation processes within the system are detected with precision and considered in the analysis. The measurement curve obtained with the help of VITA is flow-independent, making the TOC system much more precise, sensitive and stable. The VITA Flow Management System not only guarantees highest operating safety but also reliable analysis results. An integrated high-performance gas box ensures stable gas flows by means of electronic control and adjustment of system gas flows several times a second. The test for leaktightness is performed continuously and is fully automated. The results are transmitted to the Self Check System (SCS).

If there are deviations from the preset control values the operator is automatically informed by a warning message. At the same time all active device functions are locked in order to prevent incorrect analyses.

## Improved precision and sensitivity

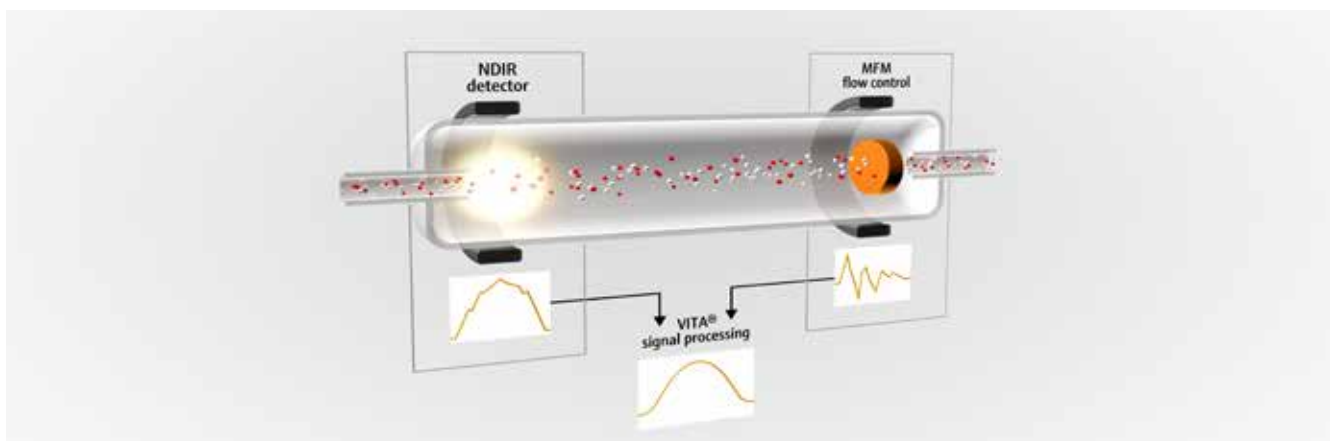
VITA also enables the quick injection of large sample volumes in high-temperature TOC devices. Any unavoidable carrier gas fluctuations are compensated effectively. This significantly improves both the precision of measurement results and sensitivity in the trace range.

## Improved stability

Changed conditions within the analytical system, such as salt deposits, can have a negative effect on the carrier gas flow and thus on the NDIR signal. VITA works effectively against this process and also improves the stability of measurement results after prolonged reactor use, particularly in the case of difficult samples. The long lifetime of the catalyst with consistently reliable results is guaranteed with the VITA Flow Management System.

### VITA Flow Management System – Your benefits

- Quick injection of large sample volumes: Increase of sensitivity
- Compensation of carrier gas fluctuations for maximum precision
- Permanent leak test
- Enables Easy Cal and thus minimum calibration effort with maximum longterm stability



Functional schematic of the VITA Flow Management System



# Easy Cal

Easy, automatic and long-term stable calibration for reliable sample measurements

## Calibration made easy!

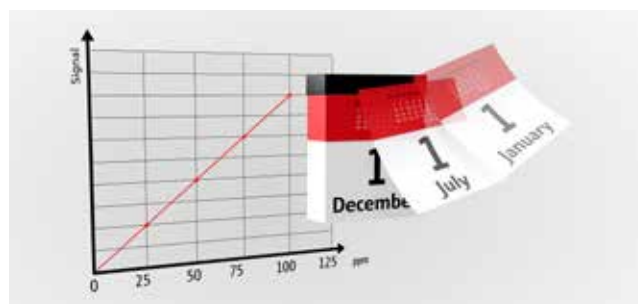
Calibrations with VITA can be made on the basis of a single standard using different injection volumes. This technique is ideally suited for the multipoint calibration of large operating ranges and also in particular for calibration in the trace range. The obtained calibration curves are flow-independent: the calibration remains stable! You only need to provide a suitable standard solution – Easy Cal does the rest.

## Calibration in the trace range

Standards with low concentrations of TOC are less stable. In addition, the TOC blank value of the used water makes it more difficult to prepare low-concentration standard solutions. With Easy Cal this is not a problem – a standard solution with higher concentration is the basis for your calibration. Small injection volumes ensure the necessary sensitivity of the calibration curve. A blank value correction of the used preparation water goes without saying.

## Automatic selection of the calibration curve

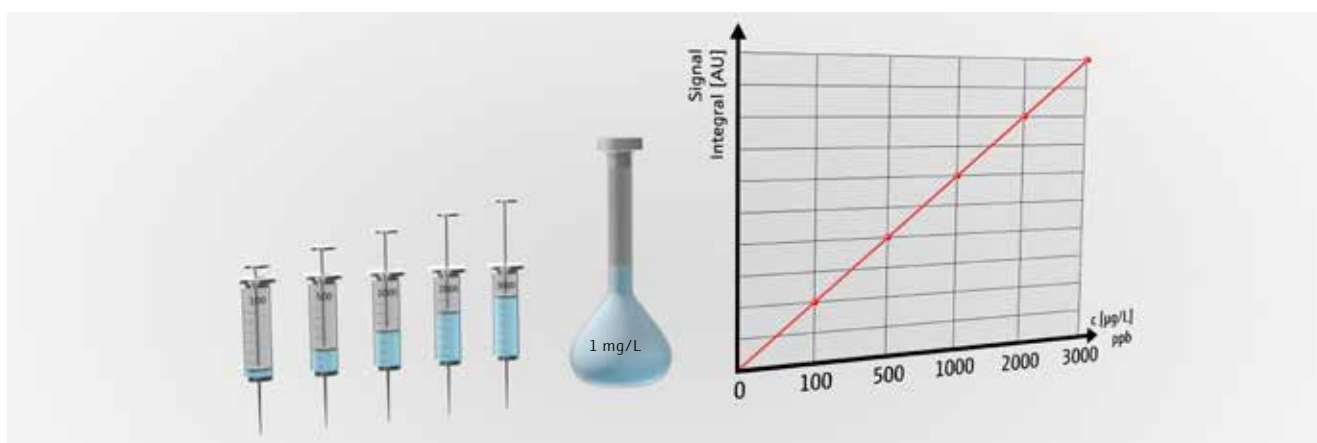
Thanks to Easy Cal, several calibration curves can be linked to a single measurement method. Easy Cal automatically and reliably selects the optimal calibration curve for your sample measurements. It's that easy!



Long-term stability of calibration curve

Parameter	Values
Residual standard deviation	65.13 FE
Method standard deviation	98.32 µg/L
Method variation coefficient	1.79%
Coefficient of determination	0.99906
Correlation coefficient	0.99953
Detection limit	154.8 µg/L
Identification limit	309.6 µg/L
Quantification limit	551.5 µg/L

Easy Cal provides comprehensive method characteristics for method validation



True multipoint calibration with only one standard solution



# Sample Digestion Does Matter

Correct measurement results require complete digestion of the organic and inorganic carbon and nitrogen compounds.



High Power, Long Life UV Reactor



Combustion tube

## Reliable sample digestion

There are two optional efficient digestion methods available for TOC measurement: High-temperature oxidation and UV supported wet chemical digestion.

## High temperature combustion (950 °C)

High combustion temperatures up to 950 °C provide sufficient energy which is necessary for breaking stable C-C multiple bonds as well as C-O or C-N bonds. In combination with the use of effective catalysts, the digestion of the most stable compounds can be achieved quickly and reliably.

## Proven TOC furnace technology: 10 years long-term warranty\*

High-temperature combustion permits the complete oxidation of particulate samples and makes simultaneous  $TN_b$  determination possible. Here is furnace technology that has been proven for decades used and for which we offer a 10 years long-term warranty\*. The combustion tube design also contributes decisively to the economy of operation by minimizing the use of expensive catalysts with simultaneous increase of the tolerance of saline matrices (extension of the maintenance cycles) and optimization of the  $TN_b$  performance.



## High Power, Long Life UV Reactor: 3 years warranty\*

Wet chemical TOC analyzers oxidize the dissolved organic compounds of a water sample through the combination of an oxidizing agent and an UV radiation source.

The multi N/C series uses a High Power, Long Life UV Reactor for this purpose. By using the particularly energy-rich UV radiation with two wavelengths of 254 nm and 185 nm, even the most stable organic compounds are oxidized quickly and completely. The UV reactor used contains an extremely robust and long-lasting UV radiation source, which is why Analytik Jena offers a 3 years warranty\* for this wearing part.



### Your benefits

- 10 years long-term warranty\* for proven furnace technology
- 3 years warranty\* for long-lasting UV lamp in our High Power, Long Life UV Reactor

\* according to our warranty conditions: [www.analytik-jena.com](http://www.analytik-jena.com)



## Precise and Reliable

Auto-Protection and Self Check System work for your perfect measurement results daily.

### Precise and safe measurements with the Self Check System (SCS)!

The fully integrated Self Check System controls all the parameters which are important for device safety and the quality of the analysis. As an intelligent combination of hardware components and software functions, it automatically ensures the trouble-free operation of the entire analytical system. Important parameters, such as gas flows, temperatures, pressures, system tightness, detector status, baseline stability, etc. are constantly checked for you.

### Auto-Protection

Effective measuring gas drying and cleaning as well as its monitoring guarantee the failure-free operation of the high-value system components. The drying of the measuring gas is performed completely without the use of chemical drying agents. Additional aerosol and water traps effectively prevent the penetration of residual humidity into the system. Halogen traps effectively free the measuring gas of corrosive components. An integrated pressure-monitoring guarantees that the system is automatically shutdown in case of failure. A low wear level and efficient operation are also ensured when working with difficult matrices and high salt loads. Auto-Protection makes your multi N/C system safe and robust!

### Your benefits

- Maximum operating safety with minimal operating effort
- Ideally suited for 24-hour operation
- Independent monitoring of maintenance intervals
- No false low readings caused by gas leaks
- No dispersed measured values due to flow fluctuations

System state	
NDIR	OK
C:	2,0
CHD	OK
TN:	1,9
Gas flow	OK
In:	159,8
Out:	160,0
Purge:	0,0
Temperature	OK
Furnace:	801°C
Peltier:	4°C
Sample introduction	
manual	Sampler (146)

System state	
NDIR	OK
C:	2,1
CHD	OK
TN:	1,8
Gas flow	Leaky gas flow
In:	159,8
Out:	131,6
Purge:	0,0
Temperature	OK
Furnace:	800°C
Peltier:	4°C
Sample introduction	
manual	Sampler (146)

Intelligent control of the system tightness thanks to SCS

## Flexible and Powerful

Suitable autosamplers increase your sample throughput. Variable injection techniques ensure correct sample handling and optimal sample dosing.

### High sample throughput in liquid automation

A wide range of autosamplers is available for the automation of your TOC analyzer. You can determine the automation level yourself and thus the sample throughput in your lab. Also users with small amount of samples do not need to work manually: the small, inexpensive autosamplers facilitate work enormously.

For high-throughput labs autosamplers with a high capacity of up to 146 samples are available. The integrated sample homogenization (stirring), the automatic acidification and sample purge features turn your autosampler into an all-rounder for sample preparation and feeding. In addition, time-optimized processes, such as parallel analyzing and purge, increase the sample throughput.



AS Vario up to 146 samples

### Variable injection techniques

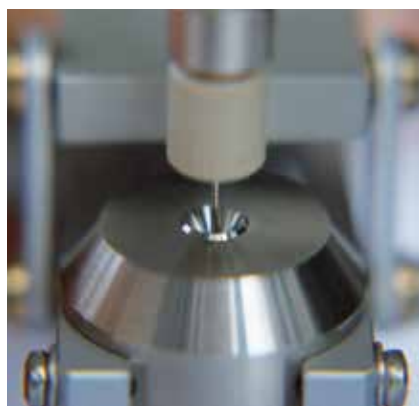
You have the choice – the multi N/C series makes both options available.

#### Direct injection

With the direct injection technique by micro liter syringe the sample reaches the furnace in the most direct way! Particles? No problem! Effective syringe rinse prevents any sample carry-over. It is also ideal when only small sample volumes are available for analysis.

#### Flow injection

Flow injection is the preferred choice when frequently working with variable sample volumes (or looking for lowest detection limits). An intelligent rinsing technique ensures the effective cleaning of the injection system. Highest sample throughput is achieved thanks to the principle of “parallel purging and analyzing” in NPOC mode.



Direct injection

### Fully automated solid TOC

Both, liquid and solid samples can be measured within one analyzer without any physical conversion or downtime. With just a few mouse clicks the multi N/C duo systems provide a most comfortable way to combine fully automated sample measurement for both sample types. For TOC solids measurement up to 48 big ceramic boats, holding up to 3 g of sample, can be transferred automatically into the combustion furnace. Catalyst-free combustion at up to 1300 °C in a ceramic high temperature combustion tube (HTC) provides a robust solution for various TC/TOC solids applications, like soil, sediment, waste, ash, slag, solid fuels or biomass analysis.

These solid options can be combined in the multi N/C duo systems with the specific advantages of multi N/C 2100S or multi N/C 3100 basic units and their individual liquid automation options.



multi N/C duo - automatic solid TOC

## Perfect for All Environmental Applications

Be it nanoparticles or coarse suspended matter – variable injection methods in TOC/TN<sub>b</sub> analysis provide flexibility.



### multi N/C 2100S – the compact power pack

This space-saving TOC/TN<sub>b</sub> analyzer with particular strengths in environmental analysis is also highly popular in the academic field and pharmaceutical vaccine analysis. multi N/C 2100S is equipped with a perfect injection technique for oil-bearing or particle-containing samples. The integrated autosampler and the septum free injection technique turn it into a compact and robust routine analyzer.

#### Characteristics multi N/C 2100S

- Septum-free **direct injection technique**
- Suitable for very small sample volumes
- Optimum particle handling capability and efficient flushing
- Compact system with integrated full automated autosampler



multi N/C 2100S

### multi N/C 3100 – versatility at the highest level

No matter whether ultrapure water or waste water, multi N/C 3100 is suitable for all samples. This is made possible by the combination of catalytic high-temperature combustion and flow injection with intelligent flushing technology for particulate samples. The precise dosing of various volumes is no problem thanks to a high precision dosing unit! In addition, multi N/C 3100 is particularly fast and thus permits high sample throughputs in NPOC mode.

#### Characteristics multi N/C 3100

- **Flow injection** with intelligent flushing technology for particulate samples
- Ceramic injector valve for high robustness
- High detection sensitivity
- High sample throughput thanks to parallel purging and analyzing



multi N/C 3100

# Ideal for Offline Process Monitoring

Greatest matrix tolerance for dissolved salts with best detection sensitivity



## multi N/C UV HS – TOC determination made easy!

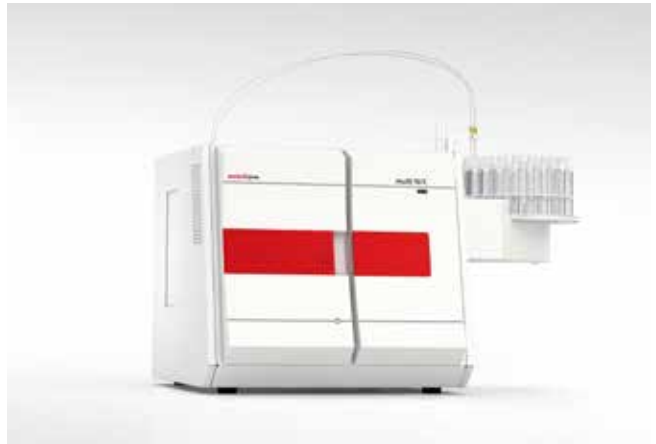
Whether in the energy sector for the analysis of boiler feedwater, in the semiconductor industry with ultrapure water samples containing hydrofluoric acid, during drinking water preparation or in electroplating when monitoring electrolysis baths, the wet chemical UV digestion method convinces in all these applications with high detection capabilities and simultaneous high robustness against aggressive sample matrices and a low maintenance requirement.

The multi N/C UV HS is a system which works both with an oxidation agent (peroxodisulfate) and a highly effective UV radiation source for sample oxidation.

Unlike classical TOC analyzers with an UV reactor, multi N/C UV HS uses two wavelengths instead of just one: 254 nm and 185 nm. The hard radiation obtained in this way guarantees a complete oxidation of even the most stable carbon compounds.

The enormous detection sensitivity is constantly achieved with variable and high precision sample dosing of very high injection volumes (up to 20 mL) by flow injection method. The effective blank value reduction by means of automated purging of the reagents ensures minimal system blank values.

For ultrapure water analyses it can be a decisive advantage to work only with UV radiation without oxidants, because the blank value of the oxidation reagent may distort measurements in the ultrapure water range. This is not a problem with multi N/C UV HS! A suitable method can be selected in the user interface, so that the High Power, Long Life UV reactor delivers the necessary energy for complete oxidation.



multi N/C UV HS

### Characteristics multi N/C UV HS

- Wet chemical oxidation with the High Power Long Life UV Reactor
- Flow injection with high sample throughput by parallel purging and analyzing
- Maximum sensitivity and precision in the ppb area
- TOC determination also in aggressive matrices

# Solid TOC Automation – multi N/C duo Makes it Possible

The determination of TOC in solids is important in the field of environmental monitoring, waste recycling, and agriculture.



In the field of waste recycling and disposal, waste legislation requires the determination of the total organic carbon (TOC) content in the original sample.

The parameter TOC is also of great importance in the field of environmental monitoring and agriculture in matrices like soils, fertilizers, sediments and sludges as well as in building material testing for raw material and finished product control (e.g., limestone, gypsum, cement).

The determination of the solid TOC is often carried out according to EN 13137 or EN 15936 either by the direct or the differential method.

## The Double Furnace Technology

This unique furnace technology allows the combination of water analysis and solids analysis in one and the same furnace by using different combustion tubes (vertical/horizontal).

A catalytic sample digestion at up to 950 °C is used for solids analysis. Double furnace technology is a compact, space-saving alternative for low sample throughput in solids analysis and offers the best detection sensitivity.



Double Furnace Technology - flexible solid TOC solution with integrated T-oven

## Solids analysis by HT 1300 furnace module

With the separate HT 1300 solids module, solid samples can be oxidized catalyst-free in an oxygen stream at up to 1300 °C. The feeding of the sample in ceramic boats is child's play. An open gas lock replaces problematic sample ports that require opening and closing for sample introduction. It is completely maintenance-free, contamination and wear and tear are excluded. The use of resistant high-temperature ceramics (HTC technology) ensures particularly long service lives of the combustion tubes and applications such as the determination of TC in solid fuels e.g. coal or renewable raw materials are enabled. With a large sample weight of up to 3 g, reliable results can be achieved with a single measurement. Inhomogeneous samples are analyzed with ease. Sample preparation and number of repeat measurements are considerably reduced.

A separate **TIC solids module** for acid digestion is available for TIC measurement in solids.



High temperature ceramics (HTC technology) for manual and automated catalyst-free combustion at up to 1300 °C



### multi N/C duo - TC/TOC solids analysis fully automated

The multi N/C 2100S duo and multi N/C 3100 duo systems are available with a high degree of automation for high sample throughput for both liquid and solid samples. The combination of HT 1300 and a fully automatic solid sampler makes it possible for up to 48 sample boats to be automatically transferred into the combustion process. An integrated boat sensor ensures that the automation runs error-free. By setting waiting positions and feed speeds, samples of one and the same run can be analyzed matrix optimized. This allows matrices requiring special temperature program to be processed effortlessly and automatically.

The big advantage of the multi N/C duo systems is especially the robust and catalyst-free combustion technology, the enormous application spectrum for solids analysis and the fast, uncomplicated change between liquid and solids operation, which is made possible by built-in valve technology with just a few mouse clicks.

### Characteristics multi N/C duo systems

- Cost-efficient – up to 48 solid samples in less than 4 h thanks to high grade of automation
- Time saving – switch from solid to liquid mode via software; no hardware modifications required
- Robust ceramic technology - minimal wear of components
- High sample quantities - perfect for less homogenous matrices

### Opening-up further solid parameters






If, apart from TC/TOC, further solid parameters are of interest, the multi EA 4000 offers advanced, automated solutions in solid analysis. With the available TIC automatic module, also the TIC determination and TOC differential method can be automated easily. In addition, the pyrolysis function offers the determination of elemental carbon (EC) and biodegradable organic carbon (BOC) according to the VGB method. Further parameters such as total sulfur (TS) or total chlorine analysis (TCI) are modularly expandable and cover wide application areas for analysis of e.g. ash, slag, combustibles, RDF (refuse derived fuels), construction materials.



multi N/C 2100S duo



multi N/C 3100 duo

multi N/C series:	multi N/C 2100S	multi N/C 3100	multi N/C UV HS	multi N/C 2100S duo	multi N/C 3100 duo
<b>1) Properties</b>					
High temperature combustion 950 °C	x	x	-	x	x
UV/Persulfates (254 nm, 185 nm)	-	-	x	-	-
Flow injection	-	x	x	-	x
Direct injection	x	-	-	x	-
Measuring range [mg/L] TC/TOC/NPOC/TIC	0-30.000	0-30.000	0-10.000	0-30.000	0-30.000
Measuring range [mg/L] TN <sub>b</sub> (ChD)	0-100	0-10.000 <sup>1</sup>	-	0-100	0-10.000 <sup>1</sup>
Measuring range [mg/L] TN <sub>b</sub> (CLD)	0-200	0-20.000 <sup>1</sup>	-	0-200	0-20.000 <sup>1</sup>
HT 1300 solids module	x	x	x	x	x
Double Furnace solids module	x	-	-	-	-
Automated HT 1300 (up to 48 solid samples)	-	-	-	x	x
Measuring range [mg] abs. solid TC/TOC	0 - 500	0 - 500	0 - 500	0 - 500	0 - 500
Self Check System	x	x	x	x	x
VITA/Easy Cal	x	x	x	x	x
<b>2) Applications</b>					
<b>Environmental applications/ water:</b>					
- Drinking water/ ground water	x	x	x	x	x
- Surface water	x	x	x <sup>2</sup>	x	x
- Leachates and extracts	x	x	x <sup>2</sup>	x	x
- Waste water (municipal, industrial)	x	x	-	x	x
- Seawater	x	x	x <sup>3</sup>	x	x
<b>Process applications:</b>					
- Cooling and boiler feedwater	-	x	x	-	x
- Ultrapure water (semiconductor ind.)	-	x	x	-	x
- Electroplating baths <sup>3</sup>	x	x	x	x	x
- Acids and lyes <sup>3</sup>	x	x	x	x	x
Solids TOC in soils, sediments, sludges, filter dusts and much more	x	x	x	x	x

<sup>1</sup> by automatic external dilution with AS vario/ AS vario ER dilution ratios up to 1:100 are possible

<sup>2</sup> only DOC

<sup>3</sup> dilution required

#### Headquarters

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Analytik Jena AG  
Konrad-Zuse-Str. 1  
07745 Jena · Germany

Phone +49 3641 77 70  
Fax +49 3641 77 9279  
info@analytik-jena.com  
www.analytik-jena.com

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pixabay®/ congerdesign  
Subjects to changes in design and scope of delivery as well as further technical development!