

# High Performance TOC Analyzers multi N/C Series

TOC/TN<sub>6</sub> Analysis – multi N/C Series



## multi N/C Series

Working with multi N/C means measuring parameters like TOC, NPOC, POC, TC, TIC and  $TN_b$  quickly, easily, and with no system conversion – and guaranteed for compliance with 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 conventional 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 nearly 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. Its quality and ease of use saves time and operating costs.

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

Multiple liquid automation options, various nitrogen detectors and several solids modules are available. Even an automation option for TOC determination in soil, sediment, waste materials and more can be provided within the same analyzer..

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 a low degree of wear. Additionally few wearing parts, long maintenance intervals and fast replacement guarantee minimum operating costs. Easily accessible wearing parts in the system facilitate maintenance.

### 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,  $TOC = TC - TIC$ . This method makes it possible to 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 acidified automatically and the resulting CO<sub>2</sub> then purged by a carrier gas stream. The residual non purgeable organic carbon (NPOC) is subsequently determined via direct measurement. With 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 results in time savings of up to 50% compared to the TOC differential method. The

automatic TIC control function is especially useful to verify complete TIC elimination during NPOC operation. For most environmental and ultrapure water samples with negligible amounts of light volatile organics, the NPOC results can be set equal to TOC results.

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

**POC determination:** If only the volatile components of a water sample need to be determined, the POC method quickly provides the desired information in a manner that is easy to understand.

Two highly sensitive detectors are available for the **TN<sub>b</sub> determination**. The chemiluminescence detector (CLD) or the solid state chemodetector (ChD) measures all organic and inorganic nitrogen compounds completely and reliably. TN<sub>b</sub> is measured at the same time as the TOC determination from the same injection. No catalyst or combustion tube replacement is required, which saves time and operating costs.

A separate brochure for **pharmaceutical TOC/TN** applications is available as well. Therein we have provided detailed information on multi N/C pharma series.

# 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, the 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 the most efficient detection and a long service life.

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

## Focused energy

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

## Resistant materials

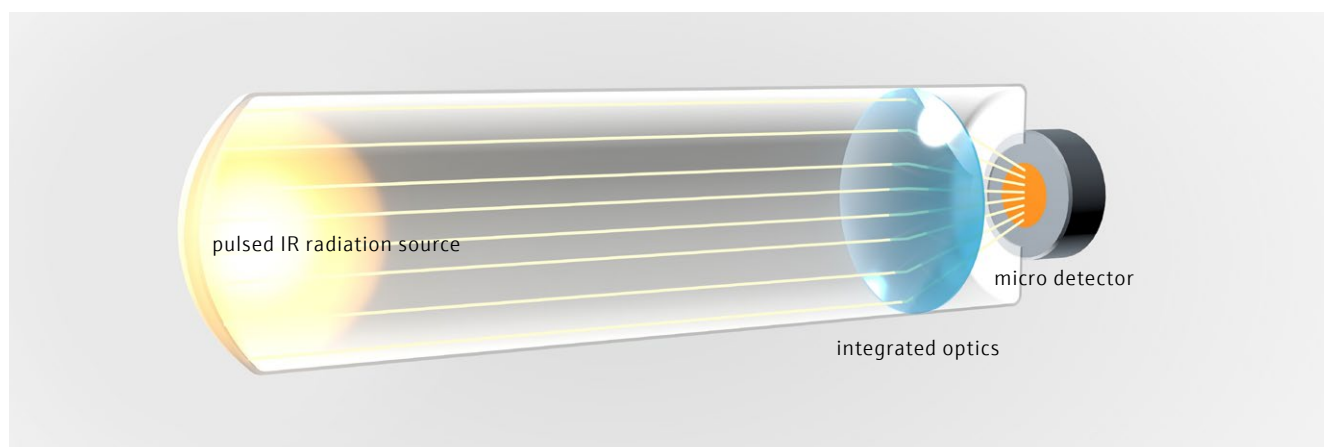
The Focus Radiation NDIR detector is made of completely corrosion-free materials. Furthermore, the radiation source and the detector are encapsulated for optimal protection. This ensures more stable operation of the detector, even when working with aggressive samples.

## Latest technology

The Focus Radiation NDIR detector eliminates the use of conventional, mechanical movable components which are prone to failure. Instead, the detector is equipped with an electronically pulsed radiation source and an optimized micro detector which ensure 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-year 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 conventional 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 independent of flow, which makes the TOC system much more precise, sensitive and stable. The VITA Flow Management System both guarantees the highest operating safety and 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 leak tightness is performed continuously and is fully automated. The results are transmitted to the Self Check System (SCS). In the event that there are deviations from the preset control values the operator is informed automatically via a warning message. All active device functions are locked in order to prevent incorrect analysis results at the same time.

## Improved precision and sensitivity

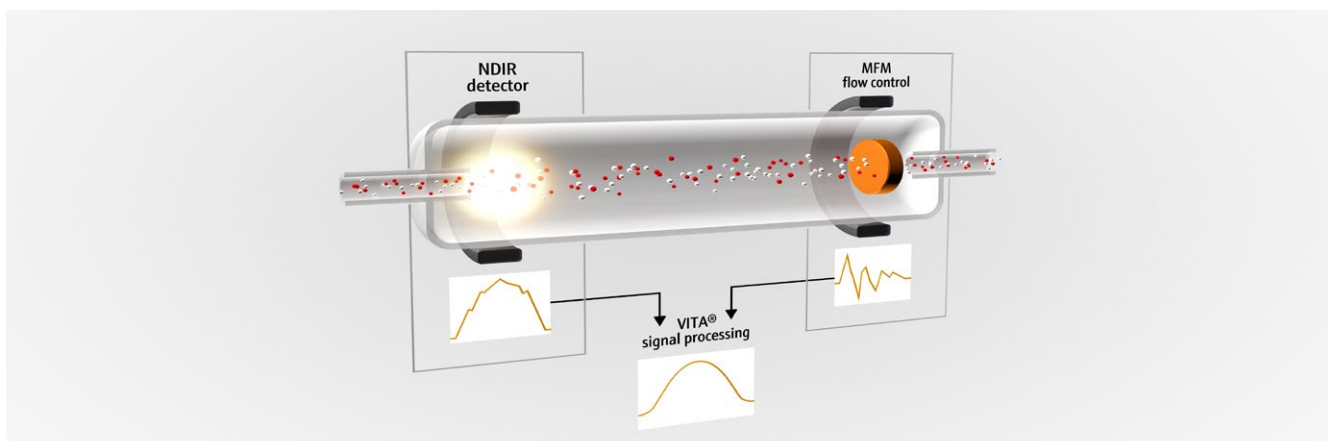
VITA also allows for the fast injection of large sample volumes in high-temperature TOC devices. Any unavoidable carrier gas fluctuations are compensated effectively. This significantly improves both the precision of measurement results and sensitivity in the trace range.

## Improved stability

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

### VITA Flow Management System – Your benefits

- Fast injection of large sample volumes:  
Increased 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 ensure reliable sample measurements.

## Calibration made easy!

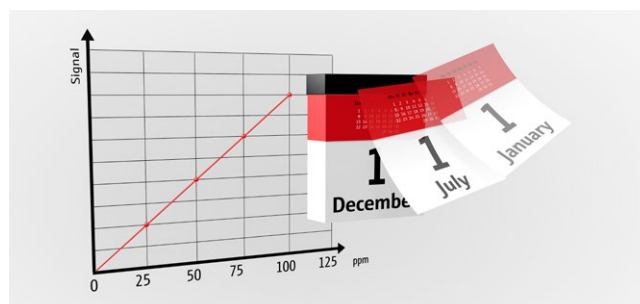
Calibrations with VITA can be made on the basis of a single standard using different injection volumes. This technique is ideally suited for the multipoint calibration of large operating ranges and for calibration in the trace range, in particular. The obtained calibration curves are flow-independent and 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. This is no problem with Easy Cal – a standard solution with higher concentration forms the basis for your calibration. Small injection volumes ensure the necessary sensitivity of the calibration curve. An automatic blank value correction of the used preparation water is of course provided.

## Automatic selection of the calibration curve

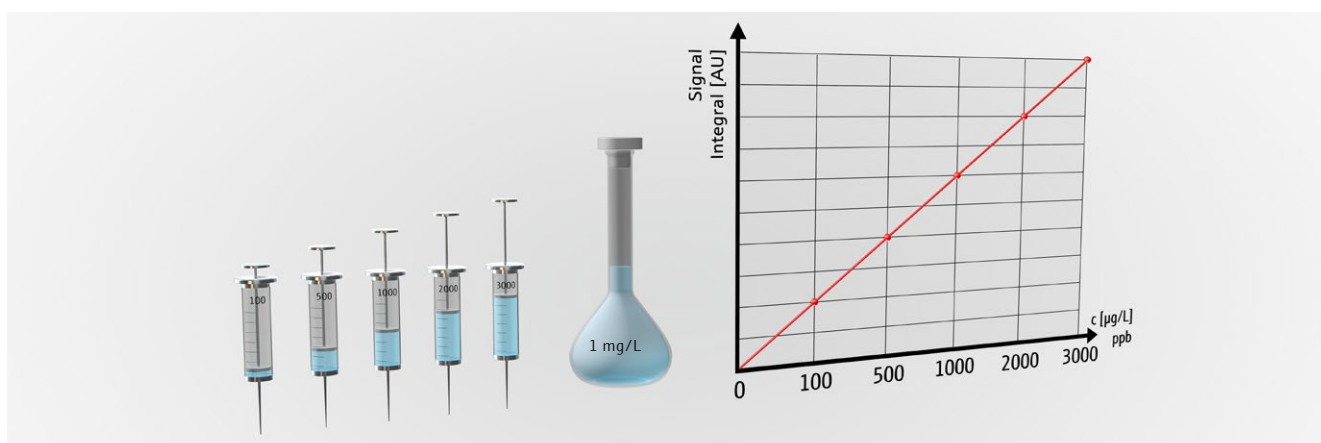
Thanks to Easy Cal, several calibration curves can be linked to a single measurement method. Easy Cal selects the optimal calibration curve for your sample measurements automatically and reliably. It's that easy!



Long-term stability of the calibration curve

Parameter	Values
Residual standard deviation	12,49 FE
Method standard deviation	15,55 µg/L
Method variation coefficient	0,69%
Coefficient of determination	0,99996
Correlation coefficient	0,99998
Detection limit	45,3 µg/L
Identification limit	90,7 µg/L
Quantification limit	196 µg/L

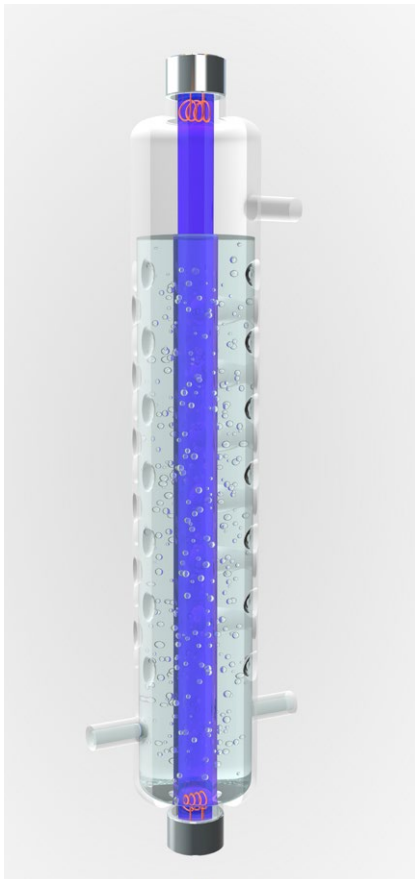
Easy Cal provides comprehensive method characteristics for method validation



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

Two optional efficient digestion methods are 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 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, most stable compounds can be digested quickly and reliably.

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

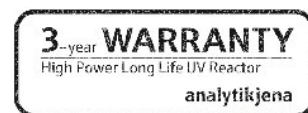
High-temperature combustion permits complete oxidation of particulate samples and makes simultaneous  $TN_b$  determination possible. This is furnace technology that has been proven in use for decades and for which we offer a 10-year long-term warranty\*. The combustion tube design also makes a key contribution to the economy of operation by minimizing the use of expensive catalysts with a 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-year warranty\*

Wet chemical TOC analyzers oxidize the dissolved organic compounds of a water sample by combining 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 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-year warranty\* for this wearing part.



## Your benefits

- 10-year long-term warranty\* for proven furnace technology
- 3-year 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 works for your perfect measurement results every day.

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

The fully integrated Self Check System controls all the parameters that 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 smooth operation of the entire analytical system. Important parameters, such as gas flows, temperatures, pressures, system tightness, detector status, baseline stability, etc. are continuously monitored for you.

### Auto-Protection

Effective measuring gas drying and cleaning as well as its monitoring guarantee the failsafe operation of the high-value system components. The measuring gas is dried without using any chemical drying agents. Additional aerosol and water traps effectively prevent the penetration of residual humidity into the system. Halogen traps free the measuring gas of corrosive components, effectively as well. Integrated pressure monitoring guarantees that the system is shutdown automatically in case of failure.

A low level of wear 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

Autosamplers increase your sample throughput. Variable injection techniques ensure correct sample handling and optimal dosing of samples.

### 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 at your lab. Also users with small numbers of samples do not need to work manually: the small, inexpensive autosamplers facilitate work enormously.

Autosamplers with a high capacity of up to 146 samples are available for high-throughput labs. 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 purging and analyzing increase the sample throughput.



AS Vario up to 146 samples

### Variable injection techniques

The multi N/C series lets you choose either direct or flow injection.

#### Direct injection

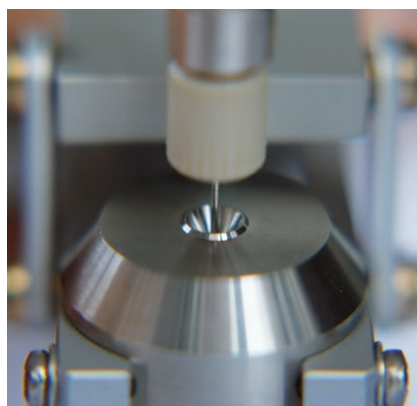
With the direct injection technique via a micro liter syringe, the sample reaches the furnace as directly as possible. Are there any particles? No problem!

An effective syringe rinse prevents sample carry over. This method is also ideal when only small sample volumes are available for analysis.

#### Flow injection

Flow injection is the preferred choice when working with variable sample volumes frequently or looking for minimum detection limits.

An intelligent rinsing technique ensures effective cleaning of the injection system. The 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 very convenient way to combine fully automated sample measurement for both sample types. For TOC solids measurement, up to 48 large ceramic boats, holding up to 3 g of sample, can be transferred into the combustion furnace automatically. 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, such as 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 particular liquid automation options.



multi N/C duo - automatic solid TOC

## Perfect for All Environmental Applications

Whether it is 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

Thanks to the small sample volumes that can be effectively used, this space-saving TOC/TN<sub>b</sub> analyzer supports perfectly environmental analysis and is highly popular in the waste water monitoring, but also in academic field.

multi N/C 2100S is equipped with a perfect direct 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.

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

No matter whether it is 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 rinsing technology for particulate samples.

The precise dosing of various volumes is made possible by a high precision dosing unit. In addition, multi N/C 3100 is particularly fast, provides parallel purge and analyzing and thus permits high sample throughputs in NPOC mode.

#### Characteristics multi N/C 2100S

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

#### Characteristics multi N/C 3100

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



multi N/C 2100S



multi N/C 3100

# Ideal for Offline Process Monitoring

Greatest matrix tolerance for dissolved salts with the best detection sensitivity.



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

Whether it is 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 (peroxydisulfate) and a highly effective UV radiation source for sample oxidation. Unlike conventional 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 manner guarantees complete oxidation of even the most stable carbon compounds.

The enormous detection sensitivity is continuously achieved with variable and high precision sample dosing of very high injection volumes (up to 20 mL) via the 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! The 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.



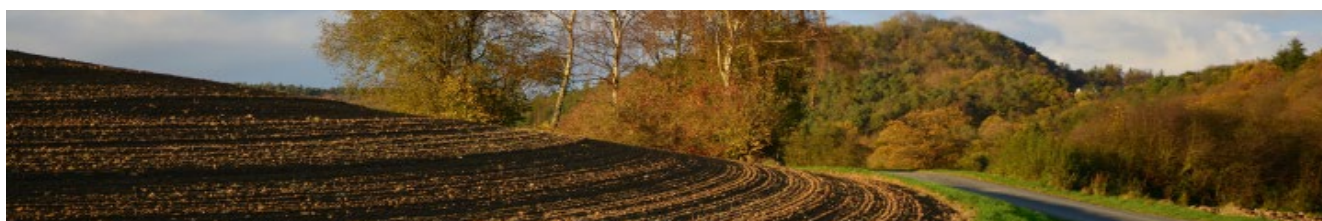
multi N/C UV HS

### Characteristics multi N/C UV HS

- Wet chemical oxidation with the high-power, long-life UV reactor
- Flow injection with high sample throughput via parallel purging and analyzing
- Maximum sensitivity and precision in the ppb area
- TOC determination even in aggressive matrices

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

Determining 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 TOC parameter 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 solid TOC is often determined according to EN 13137 or EN 15936 via either the direct or the differential method.

## The Double Furnace Technology

This unique furnace technology allows combining water analysis and solids analysis in one and the same furnace by using different combustion tubes (vertical/horizontal). Catalytic sample digestion at up to 950 °C is used for the 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 via the 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 1,300 °C. Feeding in the sample in ceramic boats is straightforward. An open gas lock replaces problematic sample ports that require opening and closing for sample introduction. It is completely maintenance-free and 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 allows for applications such as the determination of TC in solid fuels e.g. coal or renewable raw materials. 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. This considerably reduces sample preparation and number of repeat measurements.

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 1,300 °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 to transfer up to 48 sample boats into the combustion process, automatically. An integrated boat sensor ensures that automation runs without any errors. By setting waiting positions and feed speeds, samples of one and the same run can be analyzed optimized for matrices. This allows matrices requiring a special temperature program to be processed effortlessly and automatically.

The main advantage of the multi N/C duo systems is, in particular, the robust and catalyst-free combustion technology, the enormous application spectrum for solids analysis and the fast, uncomplicated switching over 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 under 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

### Adding additional solid parameters






If, apart from TC/TOC, further solid parameters are required, the multi EA 4000 offers advanced, automated solutions in solid analysis. With the available TIC automatic module, TIC determination and the TOC differential method can be automated easily. In addition, the pyrolysis function offers 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) can be expanded modularly and cover wide application areas for analysis of e.g. ash, slag, combustibles, RDF (refuse derived fuels), and construction materials.



multi N/C 2100S duo



multi N/C 3100 duo

	multi N/C 2100S	multi N/C 3100	multi N/C UV HS	multi N/C 2100S duo	multi N/C 3100 duo
<b>multi N/C series:</b> <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 many 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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pixabay®/ congerdesign  
Subjects to changes in design and scope of delivery as well as further technical development!