

# High Performance TOC Analyzers multi N/C<sup>®</sup> Series

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



**analytikjena**  
An Endress+Hauser Company

## multi N/C<sup>®</sup> Series

Working with multi N/C<sup>®</sup> means measuring parameters as 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, the pharmacopoeias and FDA guidelines.



### multi N/C<sup>®</sup> series – Features

- **Focus Radiation NDIR Detector<sup>®</sup>**  
Highest radiation density for highest sensitivity and precision
- **VITA<sup>®</sup> 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



Focus Radiation



Flow Management



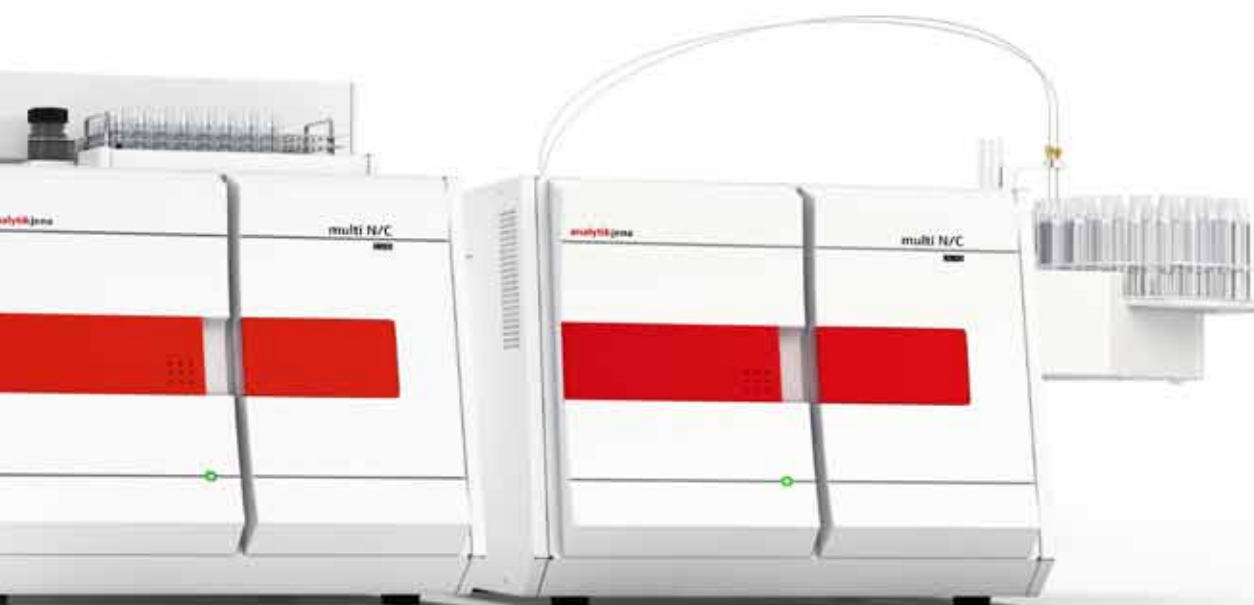
Easy Cal



High Power Long Life

# multi N/C<sup>®</sup> Series

High Performance TOC Analyzers



## **multi N/C<sup>®</sup> 2100S**

Compact and universal for environmental analysis

## **multi N/C<sup>®</sup> 3100**

The all-rounder for almost all TOC applications

## **multi N/C<sup>®</sup> UV HS**

Extremely well proven even in complicated matrices

## **multi N/C<sup>®</sup> pharma HT/pharma UV**

Predestined for pharmaceutical applications

## multi N/C<sup>®</sup> – Unique

The multi N/C<sup>®</sup> series offers the right solution for every application. 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 of the semiconductor and pharmaceutical industries – The modular versatility of the multi N/C<sup>®</sup> series permits individual adaptation to your applications. Multiple automation options, various nitrogen detectors and several solids modules for TOC determination in soil, sediment, waste materials and more are available

multi N/C<sup>®</sup> 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 non-volatile 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. TOC determination then takes place through direct measurement and in the multi N/C<sup>®</sup> models using the flow injection method takes place parallel to the purging of the next sample to save time. Time savings of up to 50 % can be achieved compared to the differential method. Especially useful is the automatic TIC control measurement to check for complete TIC elimination during NPOC operation.

For particularly high sample throughput it is recommended to use our **NPOC plus mode**. Thanks to the clever combination with the difference method time savings up to 50% can be achieved. The verification of the complete TIC elimination in the NPOC mode is ensured by the automatic TIC control function.

**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<sup>®</sup> 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.



# 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 gladly grant all customers a long-term warranty of 10 years for the Focus Radiation NDIR Detector.

## Focused energie

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

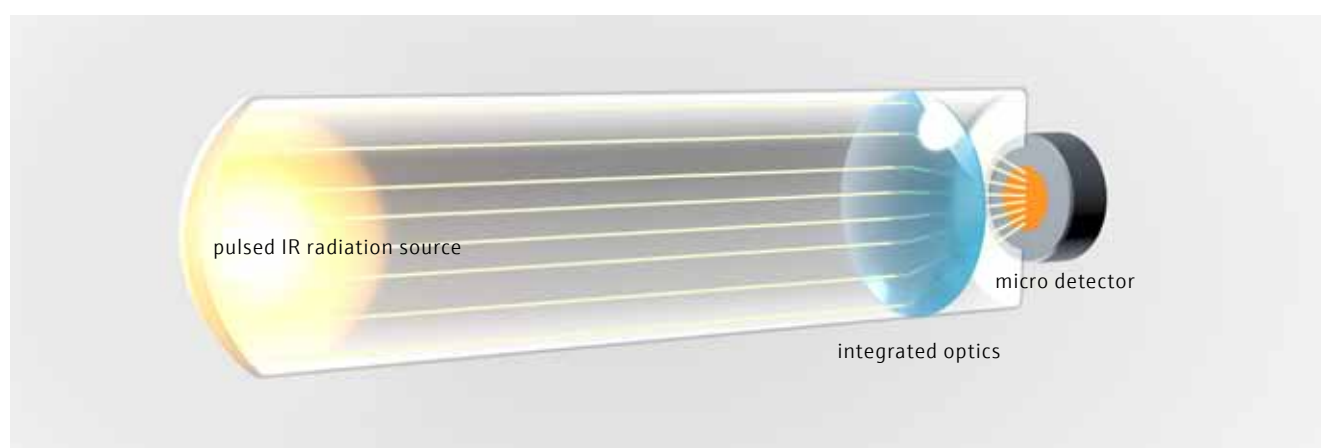
The Focus Radiation NDIR Detector® is made of completely corrosion-free materials. Furthermore, the radiation source and the detector are encapsulated for optimal protection. This ensures a more stable detector operation, even when working with aggressive samples.

## 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 & sensitivity

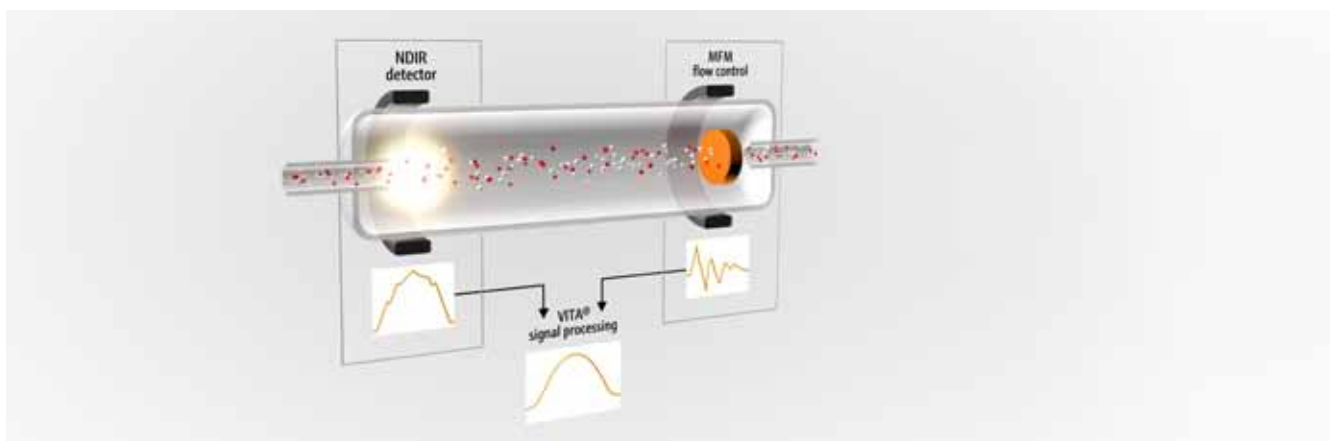
VITA® also enables the quick injection of large sample volumes in high-temperature TOC devices. Any unavoidable carrier gas fluctuations are compensated effectively. This significantly improves both the precision of measurement results and sensitivity in the trace range.

## 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



Funktionsschema des VITA® Flow Management Systems



# Easy Cal

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

## Calibration made easy!

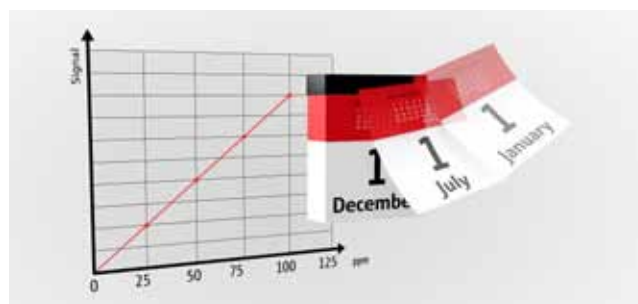
Calibrations with VITA<sup>®</sup> can be made on the basis of a single standard using different injection volumes. This technique is ideally suited for the multipoint calibration of large operating ranges and also in particular for calibration in the trace range. The obtained calibration curves are 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

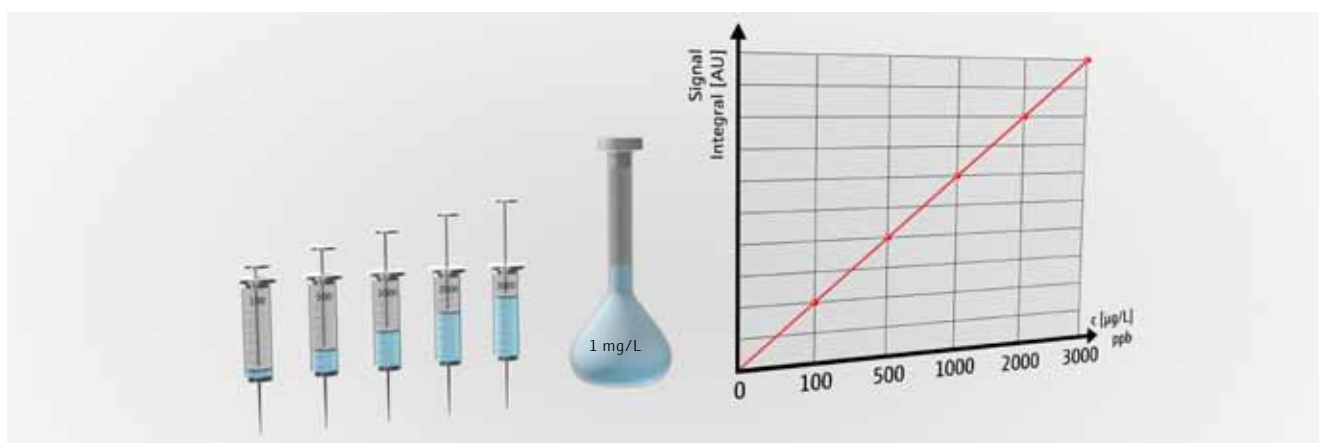
Thanks to Easy Cal, several calibration curves can be linked to a single measurement method: Easy Cal automatically and reliably selects the optimal calibration curve for your sample measurements. It's that easy!



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
Linearity	OK
Variance homogeneity	OK
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

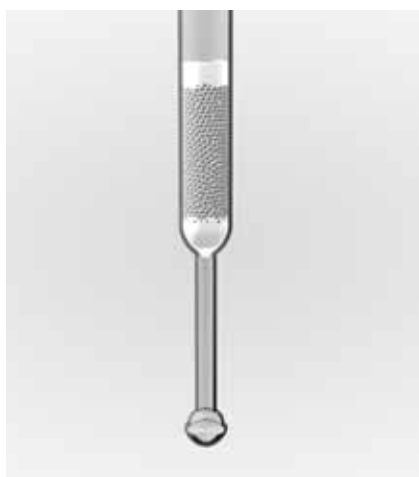


# Sample Digestion Does Matter

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 you 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: Three 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 energyrich UV radiation with two wavelengths of 254 nm and 185 nm, even the most stable organic compounds are oxidized fast and completely. The UV reactor used contains an extremely robust and long-lasting UV radiation source, which is why Analytik Jena offers a three years warranty\* for this wearing part.



### Your benefits

- 10 years long-term warranty\* for proven furnace technology
- Three 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 & Reliable

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

### 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 & Powerful

Suitable autosamplers increase your sample throughput. Clever tools for solids TOC analysis allow for efficient routine work.

### High sample throughput

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

### TOC solids analysis

With the separate solids module HT 1300, solid samples can be digested catalyst-free in pure oxygen gas flow at up to 1300 °C. The introduction of the sample in ceramic boats is child's play. The rapid change between liquid and solid operations is facilitated through a few mouse clicks by the installed valve technology.

By applying the resistant, high-temperature ceramic combustion (HTC-technology), particularly long combustion tube service lives can be achieved. Additional applications like TC determination in coal or renewables are enabled. The maximum sample weight up to 3 g guarantees representative TOC measurement results, even in samples with a low level of homogenization. For TIC measurements in solids a TIC solids module is also available for acid digestion.

### Double Furnace technique

This unique furnace technology enables the combination of TOC analysis in water by a vertical combustion tube and solids TC/TOC determination in a horizontal combustion tube within one and the same furnace. Here a catalytic oxidation process at up to 950 °C is applied for the solids analysis. The Double Furnace technology is above all a compact, space-saving alternative for solid analysis.

For high volumes of solid TOC samples we recommend the fully automated measuring system **multi EA® 4000** with automatic TIC module and FPG 48. The digestion technology is comparable to the HT 1300 and in addition also offers the automation of the TOC differential method.



multi EA® 4000 – 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 ultra-pure 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 analysing



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

## Designed for Pharmaceutical Industry

Pharmaceutical applications require highest sensitivity and precision as well as adaptation to the requirements of the pharmaceutical industry.



### Designed especially for pharmaceutical applications

multi N/C<sup>®</sup> pharma is uniquely suited for ultrapure water analyses, in particular for the analysis of WFI (Water for Injection), AP (purified water) and liquid and solid samples (swabs) from the cleaning validation.

multi N/C<sup>®</sup> pharma is available in two models:  
**multi N/C<sup>®</sup> pharma HT** and **multi N/C<sup>®</sup> pharma UV**.

Depending on the application, two digestion principles are available: catalytic high-temperature combustion up to 950 °C (multi N/C<sup>®</sup> pharma HT) or wet chemical oxidation by the High Power Long Life UV reactor (multi N/C<sup>®</sup> pharma UV). At the same time, the focus is on the precision and correctness of the measurement results in the lower measurement range. This is possible thanks to the VITA<sup>®</sup> Flow Management System and by high sample injection volumes with the help of a high-precision injection syringe.

And also by the use of a volume-specific calibration method which can be used to perform reliable calibration down to the lower ppb range. Minimal system blank values are obtained through the automatic purging of the used chemicals. In addition, a blank value free digestion without reagents is available.

### Characteristics multi N/C<sup>®</sup> pharma

- Wet chemical oxidation with the High Power Long Life UV Reactor
- Catalytic high-temperature combustion up to 950 °C
- Maximum sensitivity and precision in the ppb range
- Effective elimination of blank value influences



multi N/C<sup>®</sup> pharma UV



multi N/C<sup>®</sup> pharma HT

### The Self Check System (SCS) provides valuable services in a pharmaceutical lab

All important device parameters are continuously checked and any deviations are recorded in the audit trail.

### System Suitability Test (SST)

The System Suitability Test (SST), mandatory by the pharmacopoeia regulations, is an integrated function of the multiWin® software. Sucrose, p-benzoquinone and the preparation water for these checking solutions are measured by pressing the button. The user interface offers an integrated SST function which can be executed intuitively by the user and the obtained result is then saved in the audit trail.

### Highest precision and correctness in the ppb range

This is achieved by means of the highly sensitive Focus Radiation NDIR Detector, VITA® and the unique volume-specific calibration method Easy Cal. This method can be used for calibration down to the lower ppb range by injection of different volumes using just a single standard. This means that the trace range, in which it is particularly difficult to prepare stable calibration standards, can be reliably calibrated for the first time.

### FDA 21 CFR part 11

The multiWin® software fully complies with FDA requirements. It is equipped with different levels so that several users can be granted different access rights in the User Management. Individual passwords guarantee that no unauthorized persons can access the system. All important events, such as logon/logoff, measurements, calibrations, as well as the messages generated by the Self Check System (SCS), are recorded in the Audit Trail.

All relevant informations are always protected, for example, also the used method settings and the used calibration which have been used for calculating the respective measurement results. The option of an electronic signature for the generated measured data is implemented.

### IQ, OQ, PQ und SST – a completely reliable package!

multi N/C® pharma provides detailed IQ, OQ and PQ documents that have been especially optimized for the pharmaceutical industry. The device performs a strict mandatory test program during installation. After the device test has been completed, you will receive the software validation certificate, the detailed SST report and much more.






UpdateTime	SSTName	MethName	Result
06.01.2014 08:12:36	SST_140106_0812	IPQC	0,9296229220438
09.12.2013 08:06:30	SST_131208_0806	IPQC	1,02618628420948
25.11.2013 09:59:51	SST_131125_0959	IPQC	1,02204084136844
11.11.2013 10:56:33	SST_131111_1056	IPQC	1,01466618005549
14.10.2013 08:34:37	SST_131014_0834	IPQC	1,00235438594062
11.10.2013 14:20:19	SST_131011_1420	IPQC	1,05888932148202
11.10.2013 11:40:29	SST_131011_1140	IPQC	1,06596626314148

Concentration (water):	40,00µg/l
Concentration (saccharose):	548,0µg/l
Concentration (p-benzoquinone):	855,0µg/l

Clear presentation of the measurement results in the SST report

multiWin® permits the granting of individual access rights

	multi N/C® 2100S	multi N/C® 3100	multi N/C® UV HS	multi N/C® pharma UV	multi N/C® pharma HT
<b>multi N/C® series:</b> <b>1) Properties</b>					
High temperature combustion 950 °C	x	x	-	-	x
UV/Persulfates (254 nm, 185 nm)	-	-	x	x	-
Flow injection	-	x	x	x	x
Direct injection	x	-	-	-	-
Measuring range [mg/L] TC/TOC/NPOC/TIC	0-30.000	0-30.000	0-10.000	0-10.000	0-10.000
Measuring range TN <sub>0</sub> mg/L (ChD)	0-100	0-10.000*	-	-	-
Measuring range TN <sub>0</sub> mg/L (CLD)	0-200 <sup>1</sup>	0-20.000*	-	-	0-200
HT 1300	x	x	x	-	-
Double Furnace/Swab test Modulem	x	-	-	-	x
Self Check System	x <sup>1</sup>	x	x	x	x
VITA®/Easy Cal	x <sup>1</sup>	x	x	x	x
<b>2) Applications</b>					
<b>Environmental applications/water:</b>					
- Drinking water/ground water	x <sup>1</sup>	x	x	-	-
- Surface water	x	x	x <sup>2</sup>	-	-
- Leachates and extracts	x	x	x <sup>2</sup>	-	-
- Waste water (communal, industrial)	x	x	-	-	-
- Seawater	x	x	x <sup>3</sup>	-	-
<b>Process applications:</b>					
- Cooling and boiler feedwater	-	x	x	-	-
- Ultrapure water (semiconductor ind.)	-	x	x	-	-
- Electroplating baths	x	x	x	-	-
- Acids and lyes	x	x	x	-	-
<b>Pharmaceutical applications:</b>					
- WFI	-	x	-	x	x
- Cleaning validation (swab extracts)	-	x	-	x	x
- Direct swab combustion	-	-	-	-	x
- Total protein in vaccines	x	-	-	-	-
Solids TOC	x	x	x	-	-

1 = not multi N/C® 2100

2 = only DOC

3 = diluted

\* by automatic external dilution with AS vario dilution ratios up to 1:100 are possible



#### 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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Subjects to changes in design and scope of delivery as well as further technical development!