

## FLASH 2000 Series Nitrogen and Carbon Analyzer for Soils, Sediments and Filters



### For agricultural and geological materials, environmental control ...

The Thermo Scientific FLASH 2000 Series Nitrogen and Carbon analyzer delivers rapid and precise determinations of Nitrogen and Carbon in geological and agriculture materials such as soils, sediments or filters (the particulate materials obtained by filtration of sea, river, lake or tap water). Accurate determinations of these two elements provide environmental, agronomy and marine biology laboratories with a powerful tool to check on material variations due to the natural mutations or polluting causes.

Unlike traditional techniques – Kjeldahl for Nitrogen and Pringer & Lee/Walkley & Black method for Organic Carbon – operations with the FLASH 2000 analyzer do not involve any toxic or polluting substances. This therefore eliminates the need for safety devices (exhaust fans, fume hoods etc) in the laboratory and expensive procedures to dispose of analytical residues that are mandatory with the traditional techniques.

The FLASH 2000 Series is the direct result of more than 40 years experience in developing this precise and reliable technique, including previous Carlo Erba and Fisons elemental analyzers.

One of the strengths of the FLASH 2000 Series is the dedicated Eager Xperience software: An intelligent tool able to satisfy every analytical request (i.e. evaluate and present the data, personalized analytical reporting and dedicated features for QC labs).

The validity of the FLASH 2000 principle in Nitrogen and Carbon analysis is certified to meet Official Methods and the numerous international round robin tests implemented for every type of soil, rock, and other geological material.

In conclusion, the FLASH 2000 Series Nitrogen and Carbon analyzer is an easy and comprehensive instrument able to become an irreplaceable partner for every geological and environmental agronomy labs.

### *Bursting with Experience*



## Flash Combustion: the *hot heart* of the method

The FLASH 2000 Series is based on the well-known Flash Dynamic Combustion method, which produces complete combustion of the sample within a high temperature reactor, followed by an accurate and precise determination of the elemental gases produced.

The method is rapid, less than 5 minutes for a complete sample characterization, and easily automated with solid or liquid autosamplers.

Suitable for organic or inorganic samples, it takes advantage of the generation (for a few seconds) of a very high temperature into the oxidation reactor (about 1800°C), and allows the complete conversion of all samples, even those containing refractory material, to elemental gases.

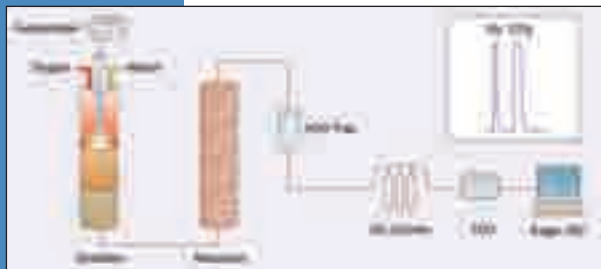
A dedicated chromatography column connected to a highly sensitive thermal conductivity detector ensures a wide detection range from 100 ppm to 100 % for both Carbon and Nitrogen determinations. The GC separation column is an open window on the analytical system; in fact the chromatogram (peak shape, peak separation, peak retention time etc.) demonstrates the real status of the instrument in every condition.

The FLASH 2000 Series is a precise solution to Nitrogen and Carbon determination because it is capable of converting any compound into elemental gases without dilution, gas chamber, gas sampling valve, splitting or purge & trap pathway. Operations that could introduce deviations and errors are therefore completely eliminated. The drastic and hot Flash Combustion avoids any matrix effect.

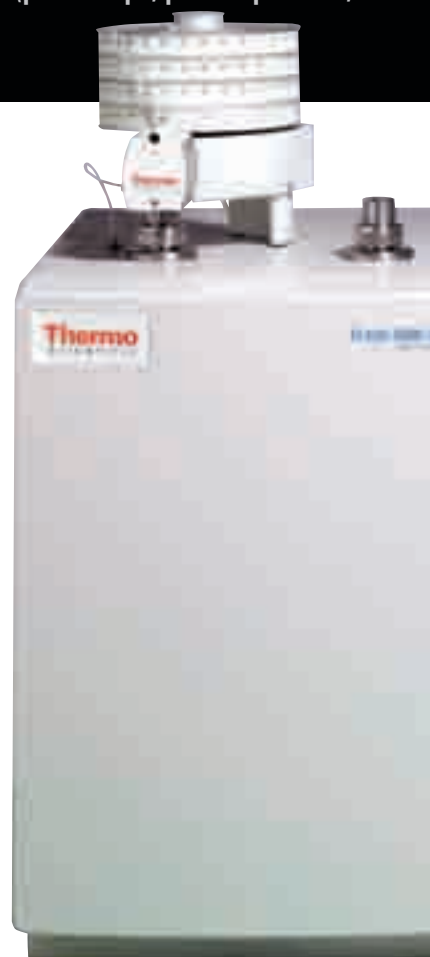
### Simplicity

The simplicity of FLASH 2000 design, coupled to the accuracy provided by the electronic carrier gas controls, result in constant reproducibility for all analytical cycles; reducing the number of calibrations required.

The FLASH 2000 Series analyzers also take advantage of the extremely simple analytical layout: gas splitting is not required and therefore highly quantitative results are easily obtained regardless of the complexity of this determination. Consequently, the FLASH 2000 can be connected with an IRMS (Isotope Ratio Mass Spectrometer) system for the accurate determination of Nitrogen and Carbon Isotope Ratios, which offers a powerful tool in many research areas from environmental to agronomy, to nutritional and marine biology.

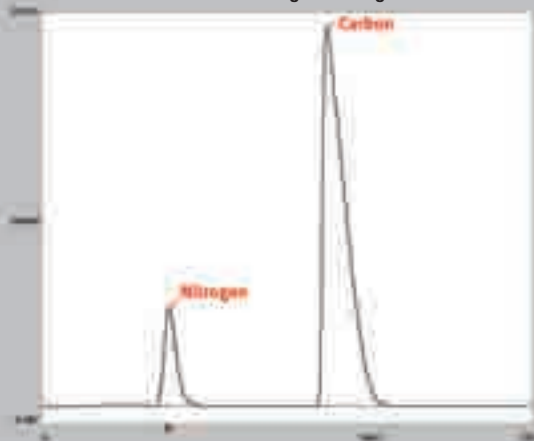


NC Soils



FLASH 2000 with MAS 200R 4 drums

NC Chromatogram using the FLASH 2000 Series



FLASH 2000, MAS 200R  
and AS 3000 Autosamplers



## Modularity

Among the features of the FLASH 2000 instrument is the great modularity of the sample introduction system:

### Universal Autosampler

The Thermo Scientific MAS 200R is typically configured with a 31-sample tray, but can accept a further 3 drums.

In this way the MAS 200R sample capacity reaches 124 samples and it becomes a useful tool for the lab which must analyze several samples every day.

### Liquid Autosamplers

Thermo Fisher Scientific provides two liquid autosamplers suitable for all configurations of the FLASH 2000 Series: the AI 3000 and AS 3000.



The AI 3000 has an 8-sample tray while the AS 3000 boasts a 105 position tray. Both liquid autosamplers are robust, precise, easy to install and easy to use.

### Change of application?

The modular design of the FLASH 2000 NC Soils analyzer means that laboratories can change the configuration to any other Thermo Scientific Organic Elemental Analyzer, according to their needs.

## Accurate Total Carbon determination

Total Organic Carbon is one of the most important routine parameters in soil characterization. Besides Total Carbon, the FLASH 2000 can also be used to accurately measure only the Organic Carbon content in the sample.

This analytical process starts with the elimination of all inorganic carbons in the form of Carbon Dioxide by the effect of acidification of the sample in the special container. The liquid phase produced containing all the soluble organic compounds is then dried, and the special container is then closed and loaded into the autosampler carousel, ready to be analyzed.

The results obtained are very accurate since redox interferences, matrix effects, incomplete combustion and loss of acid soluble Carbon during carbonate dissolution are eliminated.

In addition to soils other material such as marine sediments, composts, industrial wastes, concrete and a wide range of various sample types can be analyzed using this method, approved by several official institutes.

For obtaining the TOC determination a special kit including heater, sample holder plate, syringe, special containers etc, is available.

## Precise Sulfur determination

Together with Nitrogen and Carbon determination, the analysis of soils, sediments and fertilizers often requires precise Sulfur determination. Sulfur is an essential element critical to the plant's life cycle, hence its accurate determination offers a valuable parameter to the ecologist in understanding soil fertility factors.

The FLASH 2000 Series is capable of providing a single element Sulfur determination within four minutes or simultaneously with Nitrogen and Carbon in less than ten minutes.

No modifications to the FLASH 2000 hardware are needed for the Sulfur or NCS upgrading.

Sulfur determination can be performed not only in soils but also on other geological or vegetables materials, such as algae, lichens, leaves, roots, flowers and others.

For obtaining trace Sulfur determinations it is possible to couple a specific sulfur detector denominated **FPD (Flame Photometric Detector)** to the FLASH 2000. With this special system it is possible to reach 5 - 10 ppm of Sulfur; opening a new pathway for the classical OEA analysis.

## Eager Xperience software – More than a little help

The positively unique features offered by the dedicated FLASH 2000 Series software, Eager Xperience, ensure rock bottom costs for Nitrogen and Carbon analysis. Unique capabilities such as the Automatic Oxygen Dosing System, significantly reduces the amount of Oxygen required for the combustion process and the complete continuous instrument control, even incorporating automatic monitoring of the catalysts, greatly extend the instrument uptime.

Compatible with the current Windows® system, Eager Xperience is a highly flexible software platform that allows users to access all the available features or set the customized and simplified user-interface, incorporating a pre-set method.

Other features, designed to ensure ease of use and operator convenience, include special instrument functions – *Auto-Ready, Auto-Off, Auto-Standby and Auto-Start functions, Automatic Leak Test* and customized analytical reporting.

## Maintenance Status under control

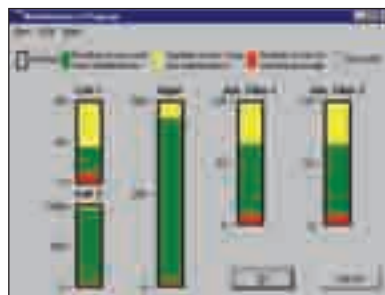
Eager Xperience permits the user to program the instrument maintenance schedule and monitor the remaining life span of the catalysts and the adsorption traps at-a-glance.

This scheduled maintenance program is entered into a log-book and then used by the Eager Xperience to continuously monitor the level of consumption of catalyst and adsorption material and then to pre-warn the user when routine maintenance needs to be performed.

Within the maintenance window a color change from green to yellow is a simple indication of catalyst usage, while the appearance of a red color informs the operator that it is time to change the catalyst or filter.

The warning message continues to alert the user until maintenance is carried out.

The Maintenance Status is an indispensable software function for better organization of daily (and nightly) lab activity.



**Eager Xperience Maintenance Status**

# Product Specifications

## FLASH 2000 Series NC Soils , Sediments and Filters results

An NC Soils reference material, suitable for every geological material determination, has been used for the data set below.

The Soil Reference Material (quality certified by an authorized lab) is included in the FLASH 2000 NC Soils analyzer standard outfit.

### Total Nitrogen and Carbon in Soils and Sediments

	no. of analysis	N %	RSD %	C %	RSD %
Soil A	12	0.274	0.180	3.79	0.033
Soil B	12	0.185	0.647	3.20	0.105
Soil C	12	0.134	0.895	2.58	0.874
Soil D	12	0.156	0.906	1.89	0.782
Sediment A	10	2.08	0.543	13.75	0.452
Sediment B	10	2.09	0.953	13.60	0.286
Sediment C	10	0.149	0.024	2.05	1.180
Sediment D	10	0.078	0.087	0.501	1.584
Sediment E	10	0.113	0.958	1.07	0.388
Sediment F	10	0.051	0.943	1.352	1.020
Sediment G	10	0.083	0.871	2.481	1.327
Sediment H	10	0.109	0.736	1.845	0.993

**Standard: Aspartic Acid (N %: 10.52; C %: 36.09)**

**Standard weight: 4 - 5 mg**

**Sample weight: 50 - 200 mg**

### Total N and C in water suspended particulate (Filters)

	no. of analysis	N (mg/L)	RSD %	C (mg/L)	RSD %
Filter A	8	0.164	0.771	0.948	0.850
Filter B	8	0.069	0.650	0.329	0.762
Filter C	8	0.131	0.877	0.794	0.641
Filter D	8	0.072	0.972	0.347	0.753

### Total Carbon (TC) and Total Organic Carbon (TOC) in Soils

	FLASH 2000		Walkley & Black method*
	TC %	TOC %	
Soil A	7.35	1.54	1.56
Soil B	4.22	2.14	2.10
Soil C	4.82	3.18	3.25
Soil D	2.22	1.02	0.97
Soil E	4.73	1.43	1.41

\* : wet oxidation / back titration

The FLASH 2000 data (TC and TOC) are based on 5 determinations

## NCS determination in Soils

	no. of an.	N %	RSD %	C %	RSD %	S %	RSD %
Soil A	5	0.391	1.806	5.970	0.913	0.087	1.864
Soil B	5	0.298	1.793	6.465	0.555	0.114	1.722
Soil C	5	0.184	0.077	1.821	1.601	0.029	2.021
Soil D	5	0.174	1.135	5.391	0.376	0.016	2.521

**Standard: BBOT (N %: 6.51; C %: 72.53; S %: 7.44)**

**BBOT: 2,5 (5-ter-butyl-benzoxazol-2-y) thiophene**

**Standard weight: 1 - 2 mg**

**Sample weight: 10 - 20 mg**

### Sulfur determination in Plants by FPD detector

	S %	Average S %	RSD %
Potato	0.2515 0.2531 0.2529	0.2525	0.3453
Rape seed Grains	0.2821 0.2799 0.2932	0.2851	2.5008

**Standard: Thermo Scientific Soil Reference Material (S %: 0.0320)**

**Standard weight: 0.1 - 0.5 mg**

### Sulfur determination in Soils by FPD detector

	no. of analysis	S %	RSD %
Soil A	5	0.031	1.801
Soil B	5	0.036	0.956
Soil C	5	0.042	0.667
Soil D	5	0.021	1.671
Irrigated Soil	10	0.0320	1.933
Montana Soil*	10	0.0439	3.375

\* : NIST standard Reference Material no. 2711, theoretical S %: 0.0420

**Standard: Thermo Scientific Soil Reference Material (S %: 0.0320)**

**Standard weight: 0.1 - 0.5 mg**

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