SKALAR

your partner in chemistry automation

Formacs^{series}
Total Organic Carbon &
Total Nitrogen Analyzers

Skalar's Formacs^HT^ TOC / TN Analyzer

The Formacs^HT^ TOC/TN analyzers provide fast, reliable analysis of Total Organic Carbon (TOC) and Total Nitrogen (TN) in liquid samples using high temperature catalytic combustion. The units are designed to measure and handle the concentration of nitrogen and / or carbon fractions from various sample matrices.
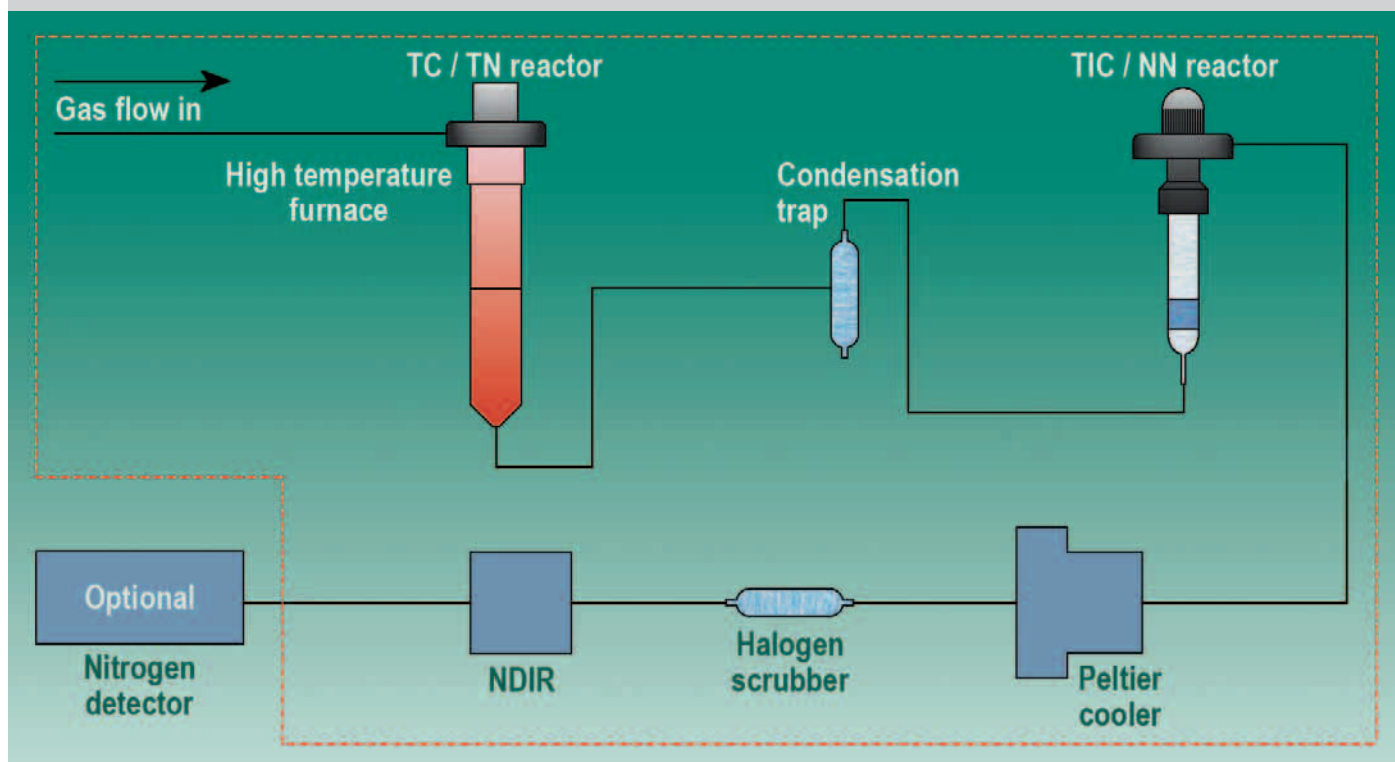
The instrument is supplied customized for the sample type and optimized from a range of different catalysts and operation temperatures allowing the analysis of all carbon and nitrogen fractions present in the sample. The fractions can be measured sequentially or simultaneously with automated sample pretreatments such as acidification and purging.

A variety of options and accessories are available, including the Primacs^MCS^ add-on module for carbon determination in solid materials, the ND20 Total Nitrogen detector and the possibility of measuring nitrates and nitrites to provide a true Kjeldahl alternative.
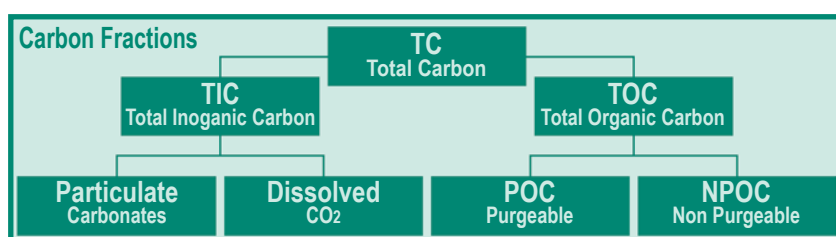
The Formacs^HT^ analyzer meets the latest requirements for any laboratory from low level up to extended high concentration ranges. Applicable for:

- Drinking water
- Waste water
- Surface water
- Sea water
- High saline waters
- Process control
- Pharmaceutical industry
- Soil extracts
- Others

Principle of operation

Gas flow in

TC / TN reactor

High temperature furnace

Condensation trap

TIC / NN reactor

Optional Nitrogen detector

NDIR

Halogen scrubber

Peltier cooler

The Formacs^{HT} Analyzer measures Total Organic Carbon (TOC) by analyzing the Total Carbon (TC) and the Total Inorganic Carbon (TIC). Total Carbon (TC) is obtained by injection of the sample into a high temperature combustion furnace. TC is converted to carbon dioxide at temperatures up to 950°C by catalytic oxidation. The carbon dioxide formed is subsequently dispersed into the carrier gas and the CO_2 concentration is measured by a non-dispersive infrared detector (NDIR). Total Inorganic Carbon (TIC) is determined by injecting the sample into a reactor containing acid, converting inorganic carbon to carbon dioxide. The NDIR measures the carbon dioxide concentration formed during acidification. The TOC is calculated by automatically subtracting the TIC from the TC.

Carbon Fractions

	TC Total Carbon	
TIC Total Inoganic Carbon		TOC Total Organic Carbon
Particulate Carbonates	Dissolved CO_2	POC Purgeable · NPOC Non Purgeable

In addition, Non Purgeable Organic Carbon (NPOC) can be measured by automatic acidification and purging of the sample. Total Inorganic Carbon (TIC) and the Purgeable Organic Carbon (POC) are removed. NPOC remains in the sample and can be measured directly by injecting the sample into the high temperature combustion furnace. The NPOC equals the TOC if the POC concentration is insignificant (TOC = NPOC + POC).

The Formacs^{HT} analyzer can be operated as stand-alone analyzer. A random access auto sampler is available for complete automation. The auto sampler allows homogenization and acidification & purging of the following sample while analyzing the current one, which saves valuable analysis time. The NPOC sample pretreatment is fully controlled by the software and auto sampler, this pretreatment can be set in a preferred mode by the operator.

Features

- Stand-alone TOC operation or with auto-sampler
- Homogenization by automated stirring (rod or magnetic)
- Robust rotary septumless injection ports
- Integrated Peltier cooler for optimum moisture removal
- Large variety of vial sizes including septum-closed vials
- Allows a true system blank analysis
- Method according to EPA 415.1, Standard Methods 5310B, DIN 38409 H3, ASTM D-5173, USP <643>, EU 2.2.44, ISO 8245, EN 1484, USEPA 9060A

TN & TKN analysis

The ND20 detector can be added to the Formacs^{HT} Analyzer for Total Nitrogen (TN) analysis. A wide concentration range of TN can be measured with high accuracy in a short analysis time using chemiluminescence detection (CLD).

The sample is injected into the high temperature furnace where it is catalytically combusted at 850°C. Oxidative pyrolysis causes the chemically bound nitrogen to be converted to nitric oxide (NO). In the ND20 detector, nitric oxide (NO) reacts to form metastable nitrogen dioxide. The photons emitted from the rapid decay of the metastable nitrogen dioxide are detected by a photomultiplier tube.

The Formacs^{HT} analyzer also provides a unique cost-effective and safer alternative for Total Kjeldahl Nitrogen (TKN) analysis, by an integrated NN-reactor for the analysis of NO_3 + NO_2 (NN).

The TKN value is determined in two steps, i.e. the analysis of Total Nitrogen (TN) and the analysis of NO_3 + NO_2 via chemical reduction, where NO_3 and NO_2 are reduced to nitric oxide (NO) and detected via CLD detection. The TKN value is obtained automatically by subtraction: TKN = TN – NN.

This unique alternative method of TKN analysis results in a very fast analysis time (5 min.), and eliminates the use of hazardous digestion acids. The Formacs^{HT} TOC/TN analyzer combines the automation of TOC, TN and TKN all in one system.

Nitrogen Detector

NO_2 and NO_3 Reactor

Features

- Simultaneous TOC and TN measurements
- CLD detector for analysis of TN and NO_2 + NO_3
- Excellent alternative for Total Kjeldahl Analysis
- Low detection limits
- Fast analyses using no hazardous reagents
- No sample preparation required
- Wide dynamic range
- Low maintenance unit
- Method according to EN 12260, ISO 11905-2, ASTM D5176-91, DIN 38409 H27

Primacs^{MCS} TOC module for solid samples

The Primacs^{MCS} add-on module is designed for analyzing solid materials and operates in combination with the Skalar Formacs^{series} liquid sample TOC analyzers, offering an economical solution for laboratories handling a large variety of sample matrices.

The unit consists of two integrated reactors for both Total Carbon (TC) and Total Inorganic Carbon (TIC) analysis without any sample preparation. The TC is determined by catalytic oxidation of the sample at 1100°C, which converts the carbon to CO_2. TIC is determined by acidification of the sample in a separate reactor, which converts inorganic carbon to CO_2. The Primacs^{MCS} uses the multi-range NDIR detector of the Formacs^{series} for the detection of CO_2.

The Primacs^{MCS} analyses TC, TIC and TOC. The software calculates the TOC concentration of the samples by subtraction - (TC - TIC = TOC).

Features

- Automatic balance interfacing
- Sample weights up to 3 grams
- Range of 1 mg to 40 mg absolute carbon
- Unique vertical sample introduction system
- Reusable quartz sample crucibles
- Economical concept
- Requires minimal bench space
- Integrated TC and TIC reactors
- No sample pretreatment required
- Method according ISO 10649, ISO 13137, EN 13639 , EPA 415.1, ASTM D-2579 US EPA 9060A

TOC & TN Software

The Formacs^{series} comes with a user-friendly multitasking data acquisition and instrument control software package. Different access levels are available to prevent unauthorized operation. In the sample table the analysis sequence can be defined allowing the selection of injection volume, type of analysis (TC, TIC, TOC, NPOC, TN and NN), stirring, and acidification & purging. Samples and standards can be set individually as they may vary, or can be entered as a group-batch method.

During the run the real-time peak information and results are displayed in multiple view screens. When Carbon and Nitrogen are analyzed simultaneously, the real-time graphics either provides visualization for both analyses or individually.
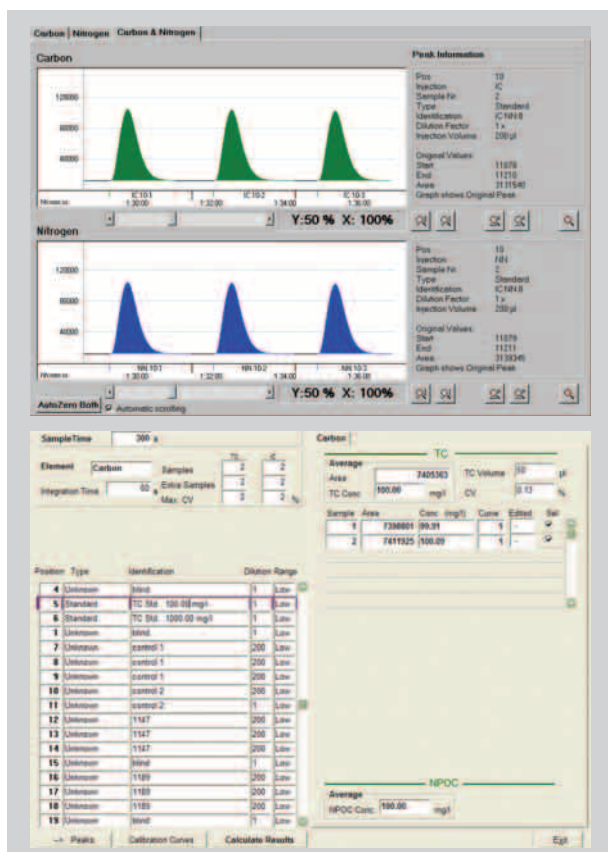
Results are automatically calculated during the analysis. An unlimited number of calibration curves can be stored for calculation. The software automatically selects the best-fitting curve. When priority samples need to be analyzed the sample-table can be expanded and edited during analysis.

Analysis results can be exported to LIMS or Excel, including the statistical data of the analysis such as the calibration curve, CV values and average concentrations. Export and print layouts can be custom-made.

Software Features

- Full data protection
- Real-time diagnostics
- Real-time editing function
- Integrated alarm settings and alarm actions
- Automatic blank correction
- Automatic start-up and shut-down procedure
- Zooming and re-scaling possible on graphics screens
- Possible to include/exclude areas and do a recalculation
- 21CFR part 11 compliant

Other Skalar TOC & TN Analyzers

The Formacs^{LT} Analyzer

This TOC Analyzer is particularly suitable for low level analysis and TOC analysis in complex sample matrices. The method is based on a combination of UV - persulfate oxidation and NDIR detection. Applications include drinking water, ground water, sea water, surface water, boiler feed water and pharmaceutical water.

The Primacs^{SLC} Analyzer

This analyzer provides Carbon analysis on solid materials. Based on a dual furnace design, the system is capable of performing fast, reliable and separate determinations of TC and TIC without sample pretreatment. The TOC is automatically calculated (TOC = TC - TIC). Applications include fertilizer, soil, plant, sludges, sediments and solid waste.

The Primacs^{ATC} Analyzer

This analyzer with integrated auto-sampler has been designed for the analysis of Total Carbon and Total Organic Carbon in liquid and solid samples. Typical applications include soil, plant and fertilizer samples - waste incinerators - sludges and sediments - cement industry - mining industry.

The Primacs^{SN} Analyzer

This Protein-Nitrogen Analyzer is based on the DUMAS methodology with an analysis time of less than 5 minutes. The auto-sampler is equipped with a unique vertical sample introduction, which reduces maintenance significantly. Typical applications are animal feed, soil, plant, and food materials.

The Primacs^{SNC} Analyzer

This analyzer provides both Carbon and Nitrogen analysis in soil, plant, animal feed, food samples, sediments and sludge samples. The determination of Total Carbon and Total Nitrogen is combined in one system using high temperature catalytic combustion.

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