Skalar

your partner in chemistry automation

Formacs HT-i
Carbon & Nitrogen Analyzers

Formacs^{HT-i}
TOC / TN Analyzer

The Formacs^{HT-i} provides fast, reliable analysis of Total Organic Carbon (TOC) and Total Nitrogen (TN) in liquid samples by direct sample injection into a high-temperature catalytic combustion oven.

The units are specially designed for particulate- laden samples (suspensions), for example waste water and sewage samples, but can handle the concentration of nitrogen and / or carbon fractions from various other sample matrices.

The instrument is supplied customized for the customers sample type and optimized based on 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 ND25 Total Nitrogen detector and the possibility of measuring nitrates and nitrites to provide a true Kjeldahl alternative.

The Formacs^{HT-i} analyzer meets the latest requirements for any laboratory from low levels up to extended high concentration ranges.
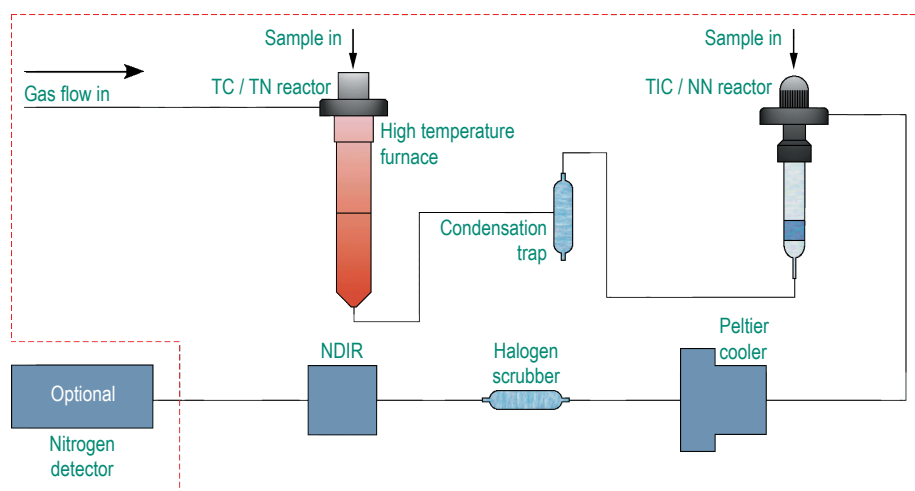
Application fields:
- Drinking water
- Waste water
- Surface water
- Sea water
- High saline waters
- Process control
- Mining samples
- Soil extracts
- Others

FEATURES
- Simultaneous TOC and TN analysis
- Unique easy access septum less direct injection system, especially designed for particulate laden samples (suspensions)
- Integrated 80 position random-access autosampler
- Selectable contamination free top and magnetic stirring
- Open and/or closed sample vials, 8 ml vials
- Handles particle sizes up to 450 μm or 800 μm with optional large bore needle
- Detector, automatic range selector for a wide dynamic working range
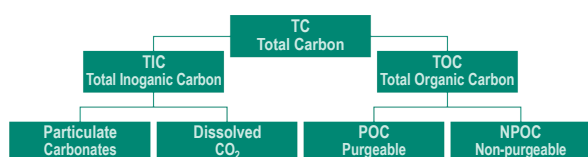- Integrated Peltier cooler for optimum moisture removal

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Principle of operation

Gas flow in

Sample in
TC / TN reactor
High temperature furnace

Sample in
TIC / NN reactor

Condensation trap

Peltier cooler

Optional
Nitrogen detector

NDIR

Halogen scrubber

The Formacs^HT-i is a stand-alone TOC /TN analyzer with integrated random access autosampler.

The Formacs^HT-i analyzer measures TOC by analyzing TC and TIC. TC in the sample is obtained by catalytic oxidation at a temperature fixed between 680°C & 950°C, which converts the TC present, (organic and inorganic), into Carbon Dioxide (CO_2).

Carbon Fractions

TC Total Carbon	
TIC Total Inoganic Carbon	TOC Total Organic Carbon
Particulate Carbonates / Dissolved CO_2	POC Purgeable / NPOC Non-purgeable

The TC sample is introduced by direct sample injection through a unique septum-less injection port which prevents any contamination of the sample and is especially useful when analyzing low levels of carbon suspensions. The CO_2 formed is subsequently dispersed into the carrier gas and passed through a peltier cooler to remove water. It is then measured using a non-dispersive infrared detector (NDIR). TIC is determined by acidification of the sample after direct injection into the TIC reactor, which converts the inorganic carbon to carbon dioxide. The NDIR measures the quantity of carbon dioxide formed during acidification. TOC is calculated by subtracting the TIC valve from the TC valve.

In addition, non purgeable organic carbon (NPOC) can be measured by automatic acidification and purging of the sample. TIC and 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 negligible (TOC = NPOC + POC).

Simple and reliable design septum less injection port

Carrier gas inlet

Sample injection

TC septum less direct injection port

TN & TKN analysis

The ND25 detector can be added to the Formacs^{HT-i} 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. Oxidative pyrolysis causes the chemically bound nitrogen to be converted to nitric oxide (NO). In the ND25 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-i} analyzer also provides a unique, cost-effective and safer alternative for Total Kjeldahl Nitrogen (TKN) analysis, via 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 NO3 + 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-i} TOC/TN analyzer combines the automation of TOC, TN and TKN all in one system.

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 measuring range
- Low maintenance unit
- Method according to EN 12260, ISO 11905-2, ASTM D5176-91, DIN 38409 H27

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Primacs^{MCS} TOC module for solid samples

The Primacs^{MCS} can be added to the Formacs^{HT-i} for solid sample analysis.

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

The unit consists of two integrated reactors for both TC and 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
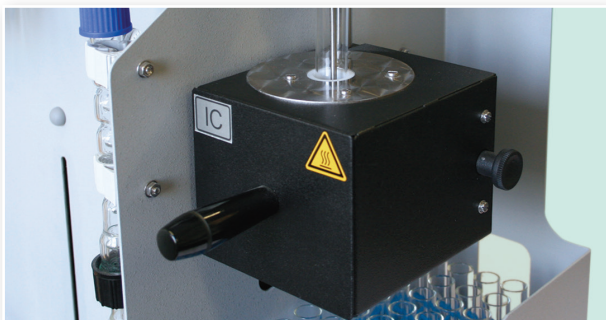
Data Acquisition & Instrument Control

The analyzer is controlled by Skalar's flexible HTAccess™ V5 data acquisition software.

HTAccess™ V5 is a user-friendly software package, which operates in a Windows 10 or Windows 11 environment. Accurate data processing, reporting, automated quality control features and enhanced analytical tools such as analysis methods with optimized smart settings for a specific analysis. Automatic dynamic smart dilutions are included in this software package.

Once the analyzer has been configured to the laboratory preferences and the analysis methods have been validated, the operator simply creates a new analysis table, imports the sample ID's and selects for each sample the validated analysis method. A method contains the optimized settings such as oven temperature, injection volume, sample time etc. for a specific analysis. The advantage is that each individual sample can be run with optimized conditions.

During the run, the analysis progress can be followed in the analysis window. Each peak is automatically marked and identified in the graphical display of the run with realtime editing functions. The dual-channel software displays the peaks and results of carbon and nitrogen analysis simultaneously. In case multiple calibration curves are stored, the software automatically selects the best-fit curve for every individual sample. Samples can be added or deleted during an analysis run and the running sequence can be changed in case of priority samples.

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 customized by the user.

SOFTWARE FEATURES
- Specific optimized validated analysis methods per individual sample
- User-defined alarm levels for safe and unattended operation
- User-defined access levels to prevent unauthorized actions, like modifying validated analysis methods
- Automatic preparation of working standards
- Extended dilution functions with dynamic dilution factor
- Real-time graphs of analysis integration data for calibration
- Dual or single screen views of carbon and nitrogen
- Possibility of opening multiple analysis runs
- Availability of peak editing mode, during or after analysis, for optimizing analysis data before reporting
- Possibility of using quality control samples and creating QC Charts
- Possibility of exporting results during analysis
- Windows 10 & 11 compatible
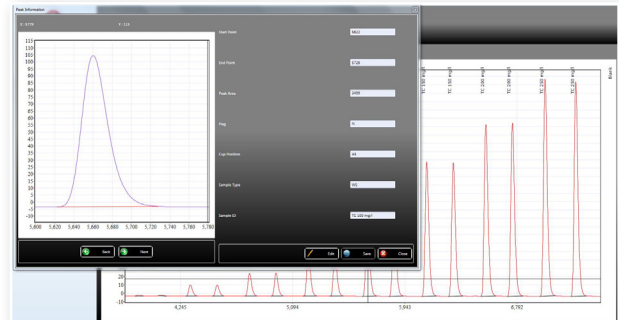
Peak Information Window

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Other Skalar TOC & TN Analyzers

Skalar offers a variety of TOC and TN analyzers that are available for liquid or solid samples, all based on international standard regulations.

Liquid Samples

Formacs^{HT} TOC Analyzer

The Formacs^{HT} TOC analyzer provides a fast and reliable analysis of Total Organic Carbon (TOC) in liquid samples using high temperature catalytic combustion. The unit is designed to measure TC, IC, TOC, NPOC, POC and DOC in water samples. The instrument is customized for the sample type and optimized from a range of different catalysts. Optionally the FormacsHT can be extended for TN and NO_3 + NO_2 analysis.

Solid Samples

Primacs$^{SNC-100}$ TOC - TN / Protein Analyzer

The Primacs$^{SNC-100}$ is a flexible solid sample analyzer with an integrated 100-position autosampler for determination of Total Nitrogen (TN) / Protein, Total Carbon (TC), Total Elemental Carbon (TEC), Total Inorganic Carbon (TIC) and Total Organic Carbon (TOC). The analyzer provides fast, accurate and low level analysis for these parameters in applications such as soil & plant, sludges & sediments, animal feed & grain, food, malt, fertilizer etc.

To check which analyzer is the best solution to automate your application(s) visit our website **www.skalar.com** or contact us directly via E-mail or phone.

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