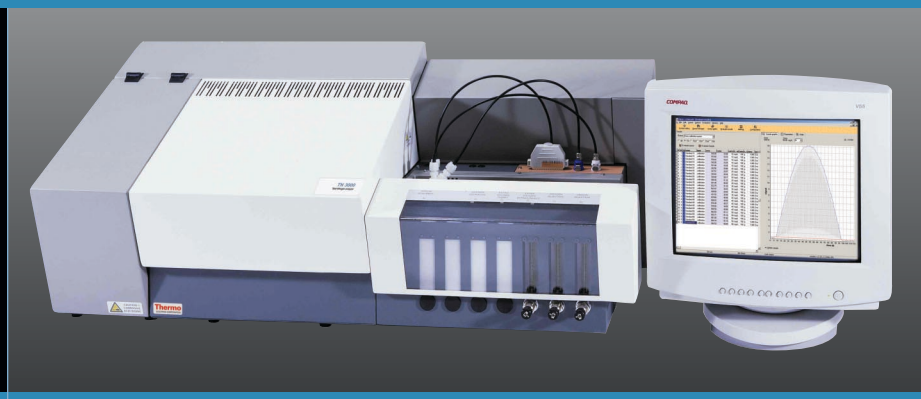
Total Nitrogen Analyzer
TN 3000



Flexible, Reliable and Accurate Nitrogen Analysis for well-balanced Industrial Processes

Analyze • Detect • Measure • Control™

Thermo
ELECTRON CORPORATION

Total Nitrogen Analyzer TN 3000

Flexible, Reliable and Accurate

Nitrogen analysis: the key to success in industrial analysis

In a growing number of industrial activities, much attention is being focused on the total nitrogen content. Levels of nitrogenous compounds are crucial for well-balanced industrial processes.

Compounds that contain nitrogen play an important part in the manufacture of chemicals, petrochemicals, food and beverages. Knowledge of nitrogenous compounds is also essential to meet increasingly stringent pollution legislation. In the production of plastics, for example, nitrogenous compounds are often used as additives. Measuring the amount of total nitrogen in resin batch samples, makes it possible to establish the amount of additives present.

In refineries nitrogen has a double role. First of all, refineries are under enormous pressure to reduce emissions of environmentally harmful compounds like nitrogen oxides (NOx) and sulfur dioxide (SO_2). The industry spends billions of dollars on cleaning up production. Measuring nitrogen in fumes and other waste is becoming increasingly important. Secondly, refineries have moved into producing more light compounds from crude oil fractions. These compounds sell for higher prices and have higher margins.

Catalysts play a major role in the new processes and nitrogen is detrimental to the effectiveness of these catalysts. To ensure efficient production, trace analysis of nitrogen has to be done on a very regular basis.

TN 3000

Thermo Electron Corporation introduces the Total Nitrogen Analyzer, model TN 3000, as a trace level analyzer that gets you the necessary data quickly, reliable and accurately. The TN 3000 is matrix independent and complies fully with the international industrial and environmental standards.

The TN 3000 provides the following benefits:

1. **Versatility.** The TN 3000 analyses water, liquid, solid and gas samples from very low levels (20 ppb) to very high concentrations (5000 ppm).
2. **Flexibility.** The TN 3000 is easily adaptable to new types of analyses (from nitrogen to sulfur and/or chlorine).
3. **Productivity.** The TN 3000 works around the clock, equipped with a liquids or solids autosampler.
4. **Reliability.** The TN 3000 ensures complete combustion even with large samples.
5. **Superiority.** The TN 3000 is superior to wet chemistry and competitive instrumental methods. It has the lowest detection limit on the market.

Principle of operation

Samples are combusted in a quartz tube at high temperature in a carrier/oxygen atmosphere. The nitrogen oxide formed is led through a polymer-based scrubber into a reaction chamber where ozone is added. Here the dehydrogenation of the gas stream takes place, which is transferred under vacuum to the photomultiplier tube (PMT). Detection of light emitted during the relaxation of excited nitrogen dioxide (NO_2^*) takes place in accordance with the following reaction scheme:

$R\text{-}N + O_2$	→	$NO_2 + CO_2 + H_2O$	
$NO + O_3$	→	$NO_2^* + O_2$	(1)
NO_2^*	→	$NO_2^* + h\,v$	(2)

Applications:

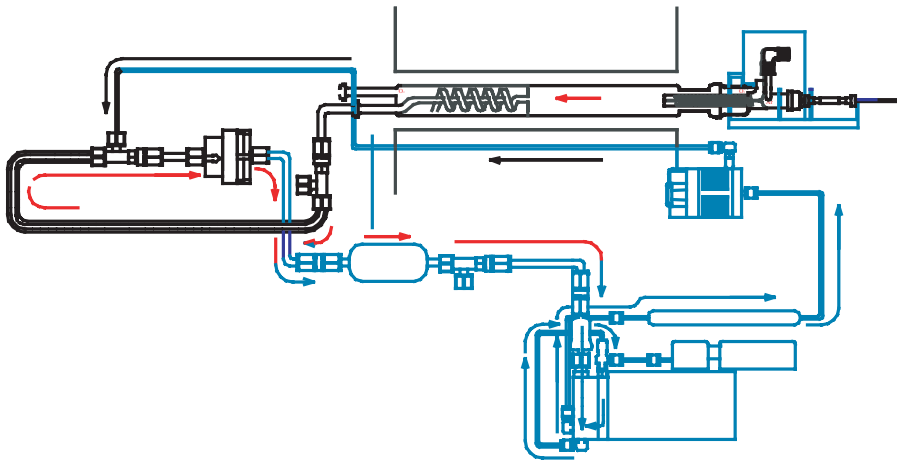
CHEMICALS	REFINERY PRODUCTS	LPG AND GASES	OTHERS
Acetic Acid	Crude Oil	Butane	Drinking water
Polypropylene	Kerosene	Propane	Waste water
Polyethylene	Fuel Oil	Butadiene	Process water
Aromatics	Gasoline	LPG	Milk powder
Polycarbonate	Diesel Fuel	LNG	Vegetable additives
Resins	Catalyst	Ethylene	Beverages
Olefins	Naphtha	Propylene	Proteins
Parrafines	Lubricants	CO2	Soil

Markets:

- Chemical & Petrochemical
- Refineries
- Commercial Petrotesting labs
- Research & Development Centers
- Environmental QC labs
- Food & Beverages
- Government
- Plastic Industry

International Methods:

The TN 3000 model complies with the following international standards for Total Nitrogen analysis: ASTM D4629, ASTM D5762, ASTM 6069 and UOP 971



Sample Introduction Modules

Liquids module

The Thermo universal liquids module is suitable for fast injection of a wide range of light hydrocarbons. The unique design of catalyst free syringe type introduction module can achieve an operating temperature of 600 °C. This module is provided with fast gas connectors and can handle large volume of samples (max. 250 µl). Injection rate, sample volume and temperatures can be set by the ThEuS software, which ensures an optimum total nitrogen analysis.

Solids module

For analysis of heavy hydrocarbons and solid samples, the Thermo boat introduction module is the key. The automatic boat driven concept controlled by ThEuS software, provides the optimum solution for many applications. The high sample load capacity and integrated septum stopper minimizes weighing errors and eliminates problems caused by non-homogeneous samples. The module is supported with fast gas connectors for carrier gas and oxygen as well.

Water-sample introduction module

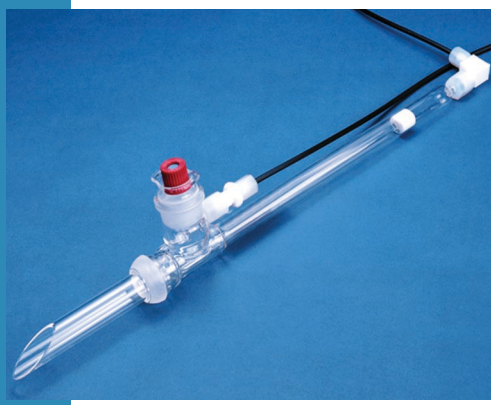
For introduction of water samples into the TN 3000, Thermo offers a special water module. This module is developed to optimize the transfer of the sample into NO regardless of the origin of the nitrogen. This ensures that the organic nitrogen, ammonia nitrogen and nitrate nitrogen are measured in the same yield. This also complies with existing DIN and EPA regulations.

Gas & LPG module

The EGM 1700 module from Thermo Electron enables the introduction of gas and LPG samples into the TN 3000 Total Nitrogen Analyzer. The autosampler is provided with a vaporizer and exchangeable sample loop, and easy connection to the liquids module.

Key advantages of the EGM 1700 are:

- Adjustable multiple injection
- Easy switching between loops
- Optimal conversion from liquid to gaseous phase by controlling vaporizer temperature
- High reproducibility and low detection limit



Solid Module

Autosamplers

ELS 3000 model

The Thermo ELS 3000 autosampler is designed for fully automated introduction of light hydrocarbon samples. The sampler has 74 positions for 2 ml screw capped sample vials and can inject a maximum of 250 µl.

Key advantages of the ELS 3000 autosampler are:

- Designed for a 24 hours operationing environment
- All operations fully controlled by Windows™ ThEuS software
- Easy connection to universal syringe type liquids or boat introduction modules
- Wash solvent and waste containers included

ESA 2000 model

For the automatic introduction of solids and highly viscous liquid samples into the TN 3000, the ESA 2000 autosampler is the best choice. The sampler is provided with a 47 position sample tray suitable for quartz sample cups, which will be picked up from the sample tray and transferred automatically to the quartz boat of the solids module.

The main advantages of the ESA 2000 are:

- Optimal conditioning of samples by using purge flow and a protective lid on the sample carousel
- Works around the clock
- Fully supported by ThEuS software

ESA 2000 Model

Extra power: Sulfur (UV) and Chlorine options

TS-UV module

The Total Nitrogen analyzer, model TN 3000 can be extended in a couple of minutes into a fully-fledged TN/TS-UV analyzer. The sulfur module has a short start-up time and is able to perform a large number of simultaneous nitrogen & sulfur analyses supported by ThEuS software.

The pulsed UV-fluorescence module is connected to the TN 3000 as an add-on package and operates in a serial sequence. No other parts of the basic TN 3000 model like the combustion tube or sample introduction module need to be modified or exchanged. Both sulfur and nitrogen detectors measure SO_2 and NO_2 specifically in-line .

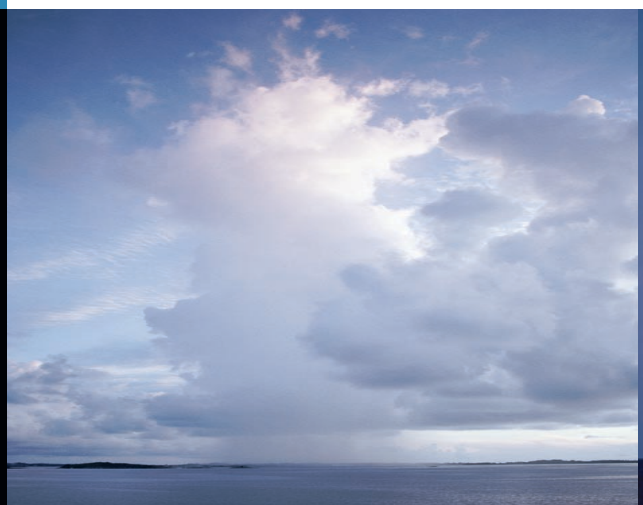
Key advantages of the TN 3000 with TS UV module are:

- Increases quality control performance and reduction of operational costs
- Fully meets ASTM D5453 and D 6667 approved sulfur methodology
- Performance down to 20 ppb for typical applications
- Extended life-time of UV-lamp due to auto gain control technology
- No loss of sensitivity because of serial measurement (TS-UV + TN)

Chlorine Module

For analysis of total chlorine in hydrocarbons the Thermo TN 3000 system can be extended with a chlorine option based on microcoulometric titration of hydro-genchlorides (Cl-) with silver-ions (Ag+).

The robust chlorine titration cell fitted within a peltier cooled compartment does have a very short start-up time and is able to perform at least 60 analyses, without any maintenance. The module is supported with a cable set, to be connected to the coulometer on board and fully complies with several ASTM standards like D4929, D 5194 and D5808. Sensitivity, short analysis time and excellent analytical performance down to 50 ppb are key features of this chlorine option.



What is in it for you?

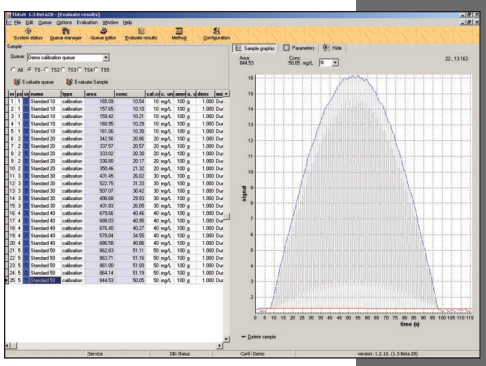
FEATURES	ADVANTAGES	BENEFITS
Modular design	Switches easily and rapidly between nitrogen, sulfur and chlorine analyses	No need for three separate instruments, reducing both bench space and investment costs
Robust dual-temperature furnace	Guarantees at least 5 years life-time and prevents overheating	Maximum flexibility with respect to your applications and reduce operational costs
Turbo quartz tube	Optimum combustion, no soot formation	Easy maintenance, less downtime
Auto samplers for liquids and solids	Higher throughput, 24-hour operation	Lower cost per analysis
Simultaneous sulfur and nitrogen analysis	One injection getting 2 results	Lower investment and operational costs
Windows™-based ThEuS software	Intuitive user interface and fully multi-tasking operation	No need for extensive training, less error-prone
Robust and sensitive detectors	Less maintenance and broad dynamic working range	Achieves excellent results with small sample-sizes
Meets ASTM, DIN, CEN, ISO and IP standards	Broad acceptance of results	Works with all customers, applicable in interlaboratory studies

ThEuS Analytical Software

The advanced user interface of the Thermo Software (ThEuS) design makes operation of the TN 3000 both intuitive and straight forward. ThEuS assists the user in achieving routine TN analysis in an efficient, fast and reliable way. Clear, user-friendly icons, allow simple instrument operation at a glance. The fully multi-tasking operation makes it possible to modify sample queues, evaluate data and calibration lines independently, while operating the analyzer. Results are presented in customized print-reports or exported in a variety of data formats.

Key features of ThEuS are:

FEATURES	BENEFITS
One software solution for all trace Elemental analyzers	Reduces complexity and improves productivity
Real time measurement curves	Maximal analysis control, easy to compare samples at a glimpse
Multi-Elemental analysis	Optimal analysis control and time saving procedure
Selectable user and service levels	Security and data integrity
Customized application and analysis methods	Full control of the analysis/system, flexible method structure
Fully multi-tasking	Efficiency, user friendly and time saving



The technologies you need.
The brand you trust.
The service you deserve.

Thermo Electron Corporation

Your solid partner for:

- Elemental analysis
- Customer specific applications
- Advanced service support

For analyzing elements at trace levels Thermo has built a solid reputation with a wide range of elemental analyzers. Various applications for total sulfur, total nitrogen, total chlorine, organic halogens and total organic carbon in liquids, solids and gasses can be performed. Our instruments help you to achieve environmental regulatory, process control, quality control, quality improvement and increasing profitability.

Laboratory Solutions Backed by Worldwide Service and Support

State-of-the-art instruments are only the beginning with Thermo Electron. Comprehensive service and support programs are offered on our products worldwide by a network of factory trained and highly qualified scientists and engineers. Our experts help you choose the right instruments for your lab, then keep the instruments performing to specification.

Contact us today for more information on how our specialized sales and service engineers can help you meet your laboratory needs.

In addition to these offices, Thermo Electron Corporation maintains a network of representative organizations throughout the world.

Australia
+61 2 9898 1244 • analyze.au@thermo.com
Austria
+43 1 333 50340 • analyze.at@thermo.com
Belgium
+32 2 482 30 30 • analyze.be@thermo.com
Canada
+1 800 532 4752 • analyze.ca@thermo.com
China
+86 10 5850 3588 • analyze.cn@thermo.com
France
+33 1 60 92 48 00 • analyze.fr@thermo.com
Germany
+49 6103 4080 • analyze.de@thermo.com
Italy
+39 02 950 591 • analyze.it@thermo.com
Japan
+81 45 453 9100 • analyze.jp@thermo.com
Netherlands
+31 162 460 200 • info@ankersmid.com
Nordic
+46 8 556 468 00 • analyze.se@thermo.com
South Africa
+27 11 570 1840 • analyze.sa@thermo.com
Spain
+34 91 657 4930 • analyze.es@thermo.com
Switzerland
+41 61 48784 00 • analyze.ch@thermo.com
UK
+44 1442 233555 • analyze.uk@thermo.com
USA
+1 800 532 4752 • analyze.us@thermo.com

www.thermo.com

BR42008_E 01/04

Thermo
ELECTRON CORPORATION