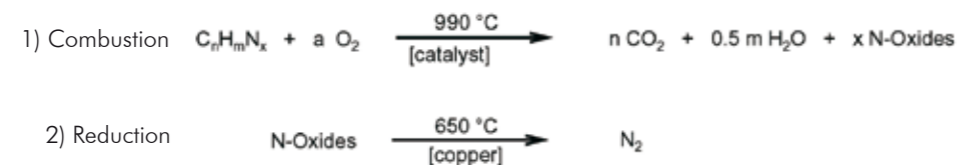




## Dumatherm - Principle

### Principle of Analysis

Solid or liquid samples are combusted at high temperatures in the presence of catalysts into oxides. With the help of copper, the resulting nitrogen oxides (NO<sub>x</sub>) are reduced to elemental nitrogen while the by-products water and carbon dioxide are separated completely. The remaining nitrogen is analyzed using a thermal conductivity detector.

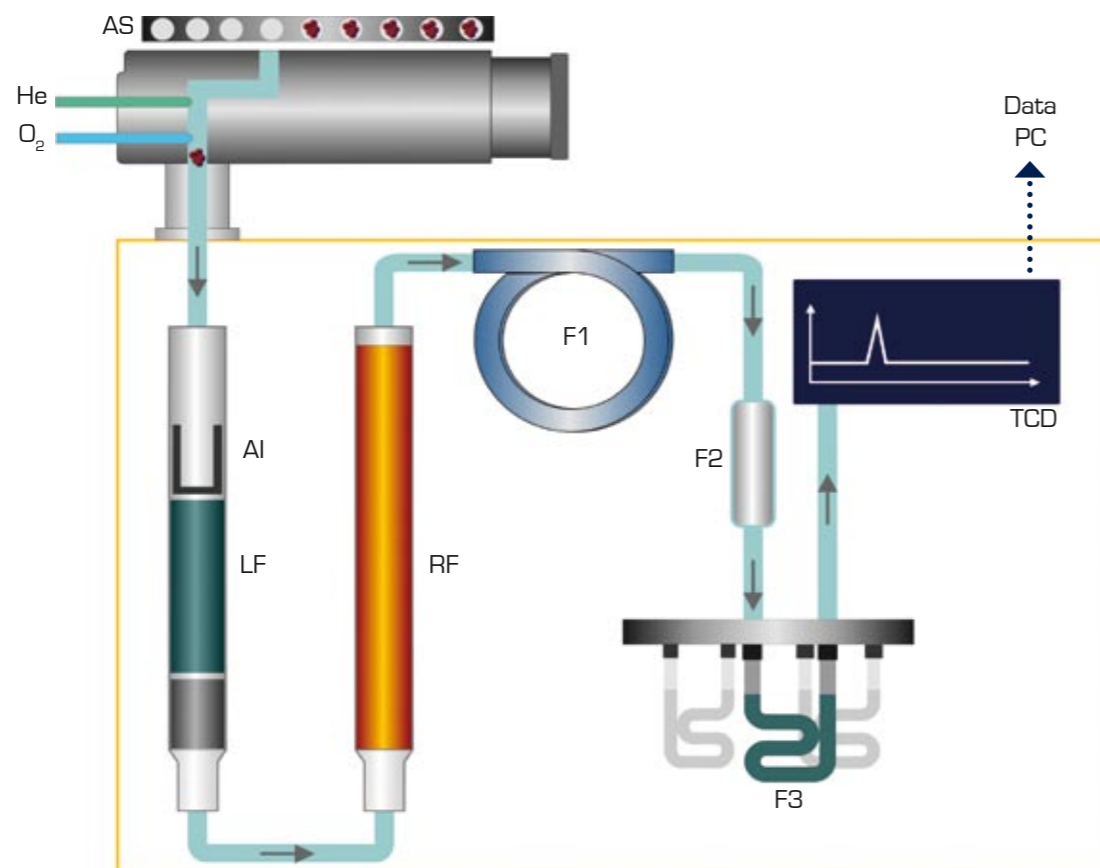


### Sample Preparation and Weighing of Sample

A smaller sample size means saving costs per analysis since the basic throughput of consumables is reduced thanks to the stoichiometric combustion. The homogenized sample is weighed in tin foil, packed air-tight and then put into an empty sample chamber in the auto sampler. Communication between the balance and the PC via the data interface reduces the work load for the weighing data sample input.

### Analysis Procedure

The samples drop from the auto sampler (AS) into a purge chamber, which is constantly purged with helium. The combustion is initiated by switching the gas flow to oxygen and the transport into the 1000 °C, upright combustion furnace (LF). Ashes of the samples are collected in a special ash insert (AI), which can be easily removed and exchanged – even when the unit has reached operating temperature. Of all the resulting combustion products (CO<sub>2</sub>, H<sub>2</sub>O and N-oxides), the nitrogen oxides reduced in the reduction furnace (RF) to elemental nitrogen (N<sub>2</sub>). The majority of the water is separated using an intelligent Nafion® tube membrane system (F1), which works using a semi permeable wall in the counter flow. Any remaining water is caught in an absorption trap (F2), where the separation of CO<sub>2</sub> is also done in self-regenerating adsorption traps (F3). Elemental nitrogen remains, which is measured in a thermal conductivity detector (TCD) without any reference gas flow. Data management (input/output) is done via PC.



AS Autosampler, AI Ash insert, LF Combustion furnace, RF Reduction furnace, F1 Membrane system (Nafion®), F2 Absorption trap, F3 Self regenerating adsorption trap, TCD Thermal conductivity detector

## Dumatherm Manager

### Modern Controlling Software

Dumatherm is entirely controlled and operated using the controlling software Dumatherm Manager. This software issues error warnings and should any serious problem occur, the analysis is aborted. This reduces the time the operator has to actually be present thus saving labour costs. Furthermore, the software is also capable of an efficient diagnosis and documentation function, which facilitates the handling of all parameters of the instrument and analysis.

- Installation of your own program library
- Assignment of administrator rights
- Traceability of all analysis data e.g. date, results, user, program data, errors, etc.
- Print out of results of single- and serial samples
- Data base with results with filter and sorting functions
- Direct data transfer from balance to PC
- Data transfer from LIMS-systems is possible
- Individual calibration is possible
- Software update service and many more features



### Analysis and Results

All parameters of the analysis are set and controlled by the PC. The software will calculate the analysis parameters, which are needed by the various sample types e.g. the dosing of gas, combustion times etc. and these parameters will then be stored in the analysis programs. By entering the oxygen factor, the amount of combustion gas needed can be controlled by the user. Thus, only the exact amount of oxygen which is really needed for an analysis will be added. For the general types of samples, these combustion categories are already preset.

### Detector and Calibration

The innovative thermal conductivity detector is calibrated with the help of standard substances with known nitrogen content, e.g. EDTA. Without the need for a reference gas flow, the detector offers the possibility to provide an individual calibration for various nitrogen contents. Very diverse sample materials can be measured using the optimum calibration for any content range. A standard-adaptation of the calibrations which have been stable for weeks is NOT necessary in the daily routine.

### Data Interpretation

All analysis data and the measuring results obtained, are stored in a course data base (history) and can be copied from this table into excel data files for interpretation. For a series of samples or a single sample, a detailed print out of the analysis parameter and the results, including an error calculation can be obtained. The course databases can be stored so that a data library can be set up. This ensures safe handling of the sensitive analysis data.

## Versatility

### Applications

Dumatherm observes international and national norms and analysis standards and thus, meets the requested analysis qualities. Dumatherm can be used for nearly all analytical areas. Application notes for various determinations are available on request.

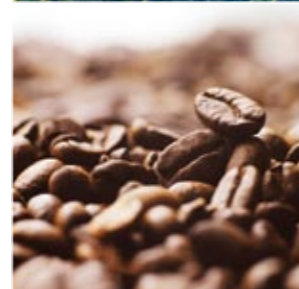
#### Protein determination in:

- Grain and grain products e.g. AOAC 979.09, 920.87
- Eggs and egg products e.g. § 35,05.00,15
- Milk and milk products e.g. DIN EN ISO 14891, § 35,01.00,10
- Meat and meat products, e.g. AOAC 992.15 or AOAC 928.08
- Raw material for breweries, e.g. AOAC 920.53,950.09
- Animal feed e.g. AOAC 990.03
- Starch
- Malt, wort, beer, e.g. AOAC 997.09
- Wheat products, oil seeds DIN EN ISO 16634
- and many more



#### Nitrogen determination in:

- Soil (fertilizers) e.g. DIN 11512-20, DIN 19684-part 4 or AOAC 973.48
- Water e.g. DEV, H11, H28
- Soil improvement and culture media, substrates, fertilizers e.g. AOAC 993.13
- Urine
- Pulp
- Paper
- Petroleum
- Tobacco
- Coffee
- Plastics
- Explosives
- and many more



#### Accessories and Consumables

For the daily operation with Dumatherm you need the following accessories and consumables:

Order No.	Description
7711	HT oxidation catalyst
7714	LT oxidation catalyst
7710	Copper reduced wires
7718	Tin foil cups (conditioned)
7717	Pressed tin capsules (9 x 10 mm)
7725	Ash finger insert
7719	Transparent quartz tube 26 x 450 mm
7712	Quartz wool
7726	Prepacked combustion reactor filled with HT + LT catalyst



## Technical Data

Dumatherm DT	
Sample size	0,5 mg - 1 g, depending on the type of sample
Sample capacity	Auto sampler with 40, 80 or 120 positions
Duration of analysis	2 - 4 min, depending on the sample type and sample size
Recovery rate	> 99,5 %
Detection limit	0,01 mg N
Standard deviation	< 0,5 %
Operation	via PC using the control software Dumatherm Manager
	- Sample input
	- Direct data transfer from balance
	- Data transfer from LIMS-systems is possible
	- Individual analysis methods can be programmed
	- Statistics and diagnostic functions
	- Single- and serial print out of the results
	- Extensive possibilities of documentation
	- Individual calibration possible
Temperature range	Combustion furnace 400 - 1100 °C
	Reduction furnace 400 - 1100 °C
	Desorption furnace 50 - 350 °C
Required gases and quality	Helium, quality grade 5.0 (99,999 %)
	Oxygen, quality grade 5.0 (99,999 %)
	Compressed air or nitrogen, quality grade 4.6 (99,996 %, oil- and water free)
Inlet pressure helium	3 - 6 bar
Inlet pressure oxygen	3 - 6 bar
Inlet pressure compr. air / nitrogen	4 bar
Ambient temperature	15 °C < t < 35 °C
Nominal voltage	230 VAC, 50/60 Hz
Dimensions (W x D x H)	800 x 370 x 500 mm (625 mm with auto sampler)
Weight	65 kg
Current	max. 6 Amp
Order No.	7700
Type	DT
Digital balance	Optional (recommended Sartorius CP 64), precision 0,1 mg

#### Shipment

The Dumatherm basic system includes controlling software Dumatherm Manager and all consumables as well as accessories for about 1.000 measurements. Personal computer and printer are not included in the shipment.

#### Requirements for PC

- Operating system Microsoft Windows XP, Vista
- Microsoft Excel
- COM-Port or USB-Port for connection Dumatherm to PC
- COM-Port for connection balance to PC

#### Installation Requirements in the Laboratory

The system needs connections for the above mentioned gases for operation including pressure reducing device.