



vario MICRO cube



More than 100 years ago, in the centre of Germany, near Frankfurt, the high technology industrial company Heraeus developed and manufactured the world's first elemental analyser for organic substances.

From that foundation, a continuous progression of technology in elemental analysis products lead to the establishment of Elementar. Still at the same location today, Elementar is the world's leading producer of instruments for the analysis of C, H, N, S and O.

Elementar has coupled the latest developments in micro electronics and mechanics with the vast experience in elemental analysis. Newly developed separation and detection methods have been utilised.

Even the form and colour of the new instrument line offer improved clarity of the basic concept and special demands of elemental analysis.

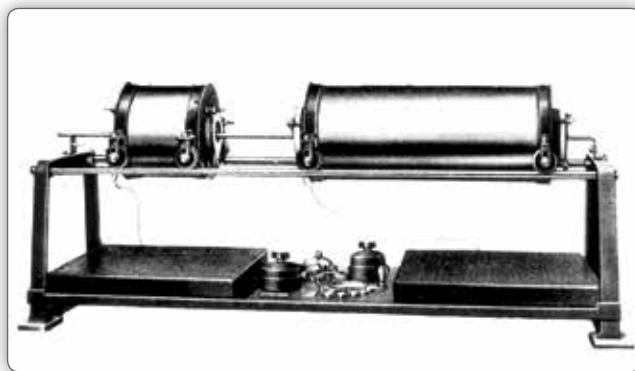
The roots of success

Given Elementar's century long expertise, it is not surprising that our newest development is particularly special.

- Wide variety of elements measured from nearly all types of samples.
- Highest precision and accuracy of the analytical results.
- Unsurpassed reliability and long time stability.
- High ease of use with a very innovative design.
- Lowest operation costs and set up requirements.

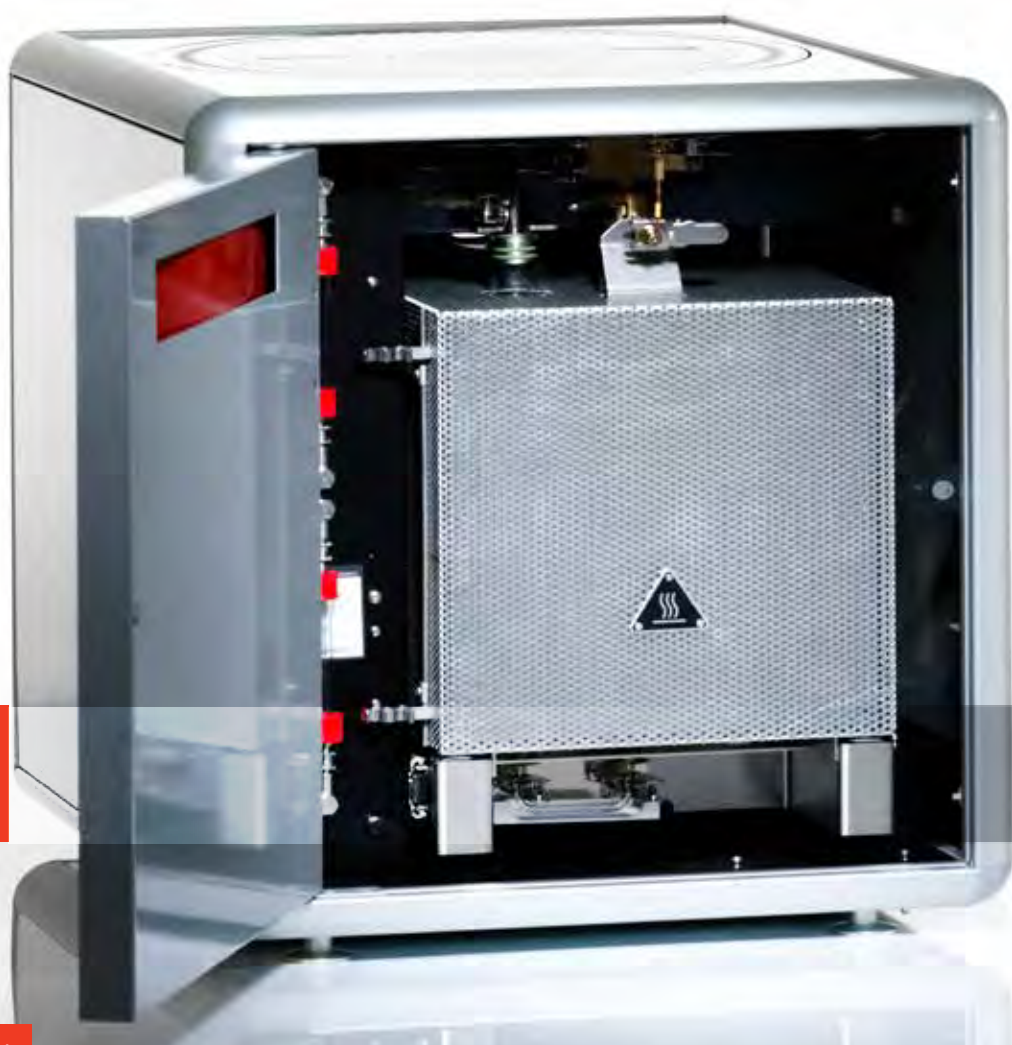
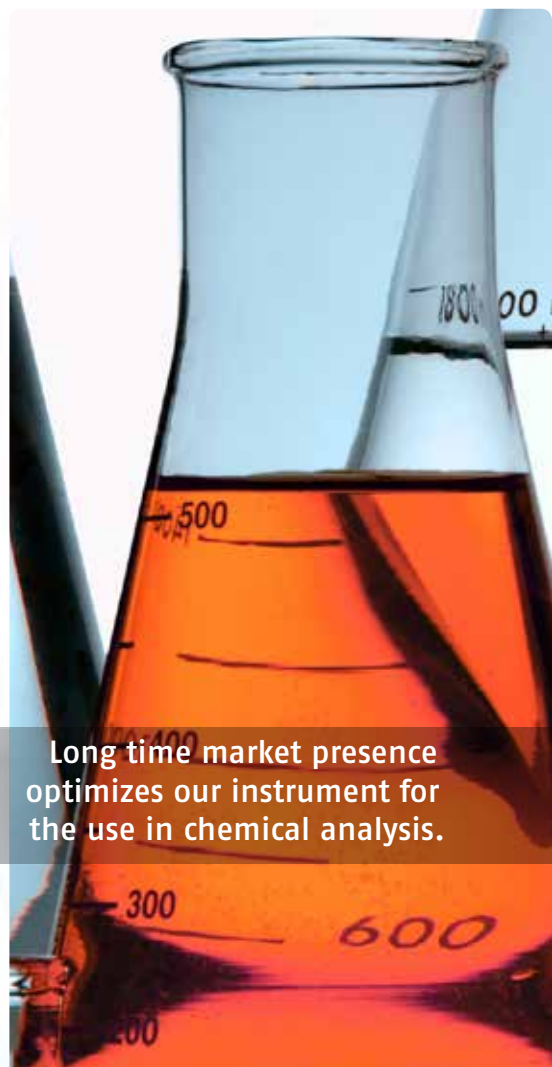
Colour and shape of the instrument line reflect the clarity of the basic concept and the special ambition in its design.

Sophisticated chemical analytical technique combined with engineering knowhow add up to a new benchmark in elemental analysis: vario MICRO cube.



Heraeus Micro Analyser 1930

The instrument concept – simply sophisticated



Long time market presence
optimizes our instrument for
the use in chemical analysis.

The measuring principle is impressively simple as shown in the functional diagram

The samples are weighed in tin or silver vessels and loaded in the integrated carousel for 120 samples. In a fully automatic process, the transfer of the sample through the ball valve into the combustion tube is performed.

Each sample is individually flushed with inert gas (Heraeus patent) to remove atmospheric nitrogen, resulting in a zero blank sampling process.

The catalytic combustion is carried out at a permanent temperature of up to 1200 °C. Unique is the furnace warranty of 10 years!

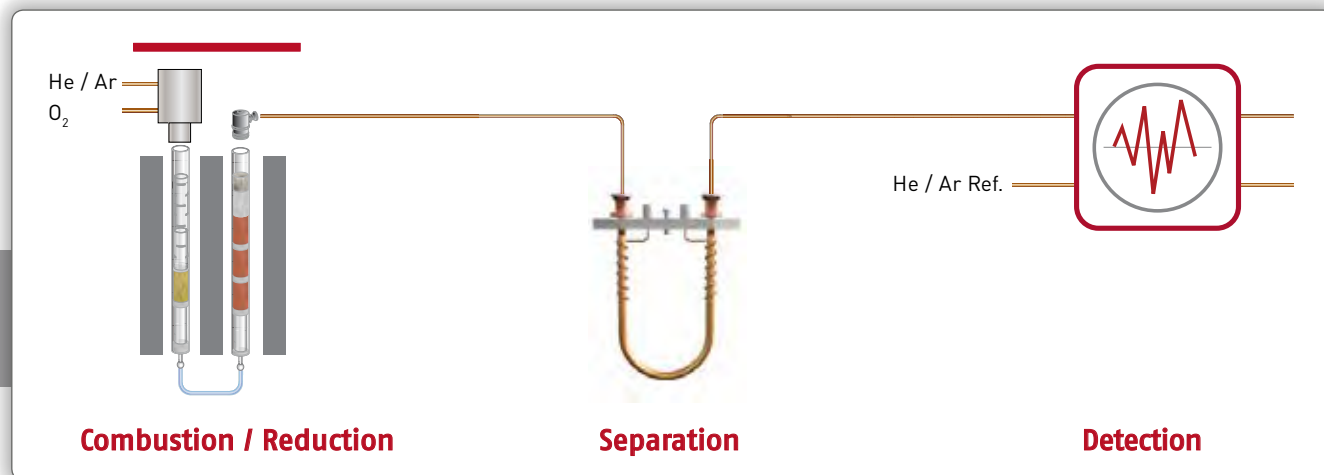
Subsequently, the reduction of the combustion gases on hot copper is carried out in a second furnace. The formed analysis gases, N_2 , CO_2 , H_2O and SO_2 remain in the He carrier gas stream.

The gas mixture is separated in its components on a column by the newly developed temperature programmed desorption (TPD) and is subsequently fed into a thermal conductivity detector (TCD).

The TCD is based on thermistor technology, is impervious to damage from oxygen intrusion, and stands out for particularly high stability and measuring dynamics.

Right before the detector an electronic gas flow controller ensures absolutely stable pressure and flow conditions. This results in a stable instrument calibration over months or even years.

A connected PC computes the element concentration from the detector signal, and the sample weight on the basis of stored calibration curves.



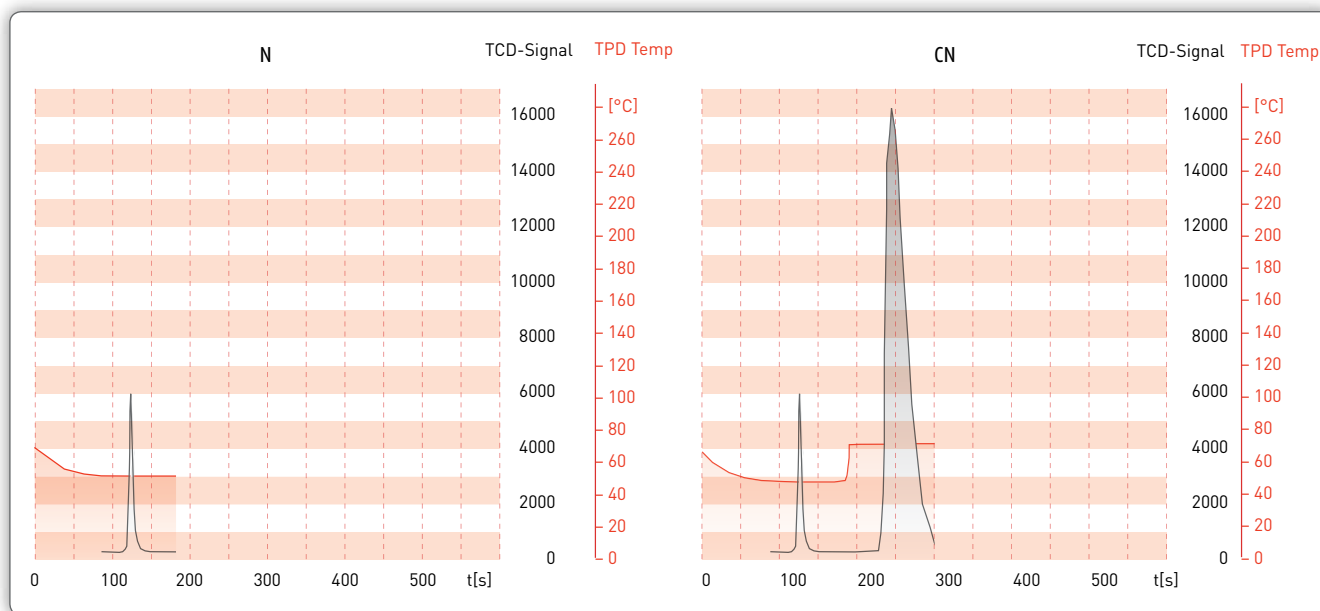
simplified functional diagram

For the first time, the principle of thermal programmed desorption (TPD) is applied in an elemental analyser.

The CHNS elemental analysis is based on the high temperature combustion and subsequent analysis of the combustion gases. The quantitative separation of the analyte gases N_2 , CO_2 , H_2O and SO_2 in the He carrier gas prior to the detection is crucial for the performance of the complete instrument. Thereby Elementar breaks new ground with the vario MICRO cube. All four analyte gases are separated on one column, by the use of 4 stepped temperatures (patent pending).

At near room temperature, N_2 flows unimpeded through the column while CO_2 , H_2O and SO_2 are adsorbed. After the detection of the N_2 peak, the column temperature is quickly increased to approx. 60°C , which releases the CO_2 . After detection of the CO_2 , the column is stepped to over 100°C for release and detection of the H_2O . Finally, the SO_2 is desorbed at a column temperature of over 200°C .

TPD for High Concentration Dynamics



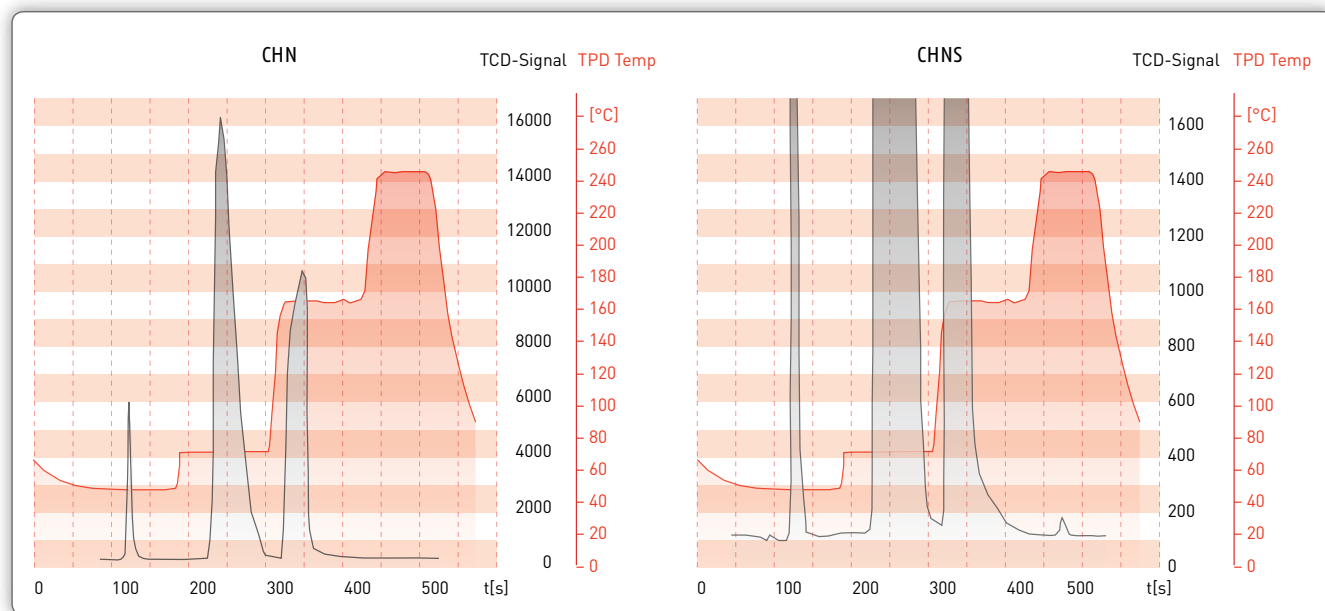
Peak graphics wheat flour (5 mg)

Each heating step takes place only after the completion of the subsequent peak detection on the TCD. A complete baseline resolution is achieved even for large amounts of organic material (up to 7 mg carbon content), as well as for large relative concentration differences (e.g. low nitrogen with high concentration of carbon). Analysis time is also optimised using this process.

This results in a performance comparable to the great separation ability of the „purge and trap“ gas separation. With just one column, the TPD system corresponds in simplicity to gas chromatographic separations, but without the significant compromises of separation ability and drift problems.

While TPD separation allows for the simultaneous determination of the elements C, H, N and S, it is also possible to configure for the determination of only one, two or three elements (i.e. CHN, CNS, CN, N or S). In these cases, the dynamic range of the analyser can be extended (e.g. > 10 mg carbon in CN mode), and time per analysis is reduced (~3 min for N).

The perfect gas separation



Peak graphics wheat flour (5 mg)

In our time an analytical instrument can only be as good as its micro electronics and software.



The cube instruments of Elemental set new standards as the first elemental analysers in which all instrument functions are digitally controlled and monitored. This results in completely new possibilities for automatic operation and optimisation as well as remote control and diagnosis over the internet.

The system is designed for intuitive operation, but content sensitive help is just a click away. User friendliness is designed into the software at all levels. Instrument operators do not need special skills to take advantage of the instruments powerful capabilities.

Digitalisation in the user's interest

The basis for this is the use of the latest micro processors and electronic sensors for all gas flows and pressures.

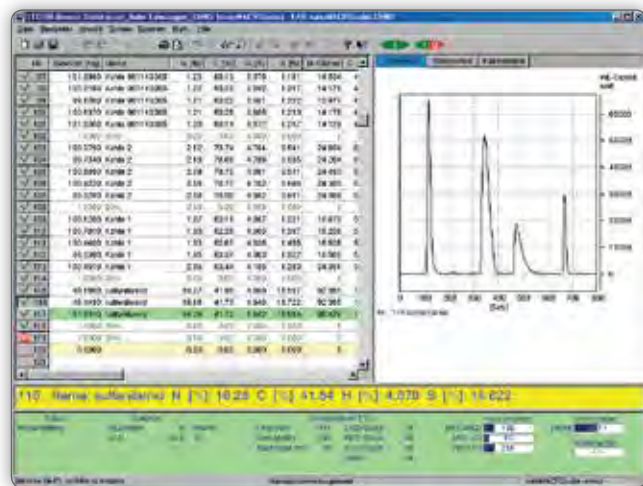
The vario MICRO cube's firmware (internal software of the analyser) is stored on flash memories, which can be easily updated via PC or the internet. The critically important fast signal communication between components in the analyser (such as the detector signal) is handled by the fail-safe CAN bus technology.

Self-explanatory user navigation and content-sensitive help screens make printed manuals almost obsolete. Graphical leak checking with pictorial guides for each step are a new favourite feature of users.

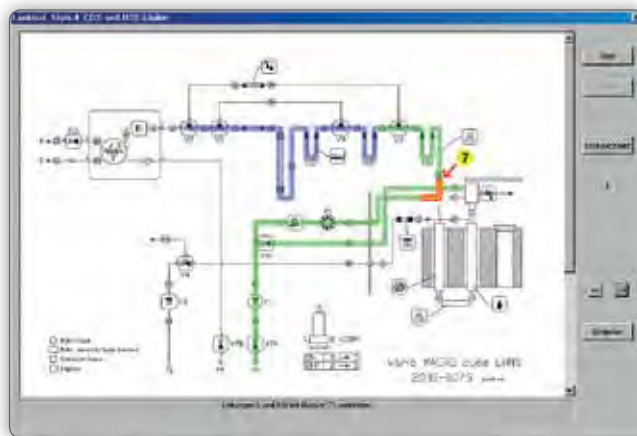
The software is designed in accordance with the strict requirements of 21 CFR Part 11 data safety.

A commercial PC or laptop serves as the user interface for control and evaluation. Our software runs under the Windows® operating system and offers state of the art features and capabilities:

- almost unlimited storage capacity of analytical data, including graphics and statistics
- automatic optimisation of operating conditions
- monitoring of maintenance intervals
- integration into existing networks
- data transfer into LIMS
- data transfer to calculation programmes like Excel®



Main window instrument software



Leak test

		Carbon *	Hydrogen *	Nitrogen *	Sulphur *
Sulfanilic Acid					
Measurements	6	41.54 ± 0.03	4.01 ± 0.01	8.14 ± 0.019	18.51 ± 0.006
Weight	1 mg				
N-F-dibenzolsulfonimide					
Measurements	6	45.65 ± 0.07	3.20 ± 0.01	4.46 ± 0.01	20.20 ± 0.2
Weight	1 mg				
Benzylcysteine HCl					
Measurements	6	52.97 ± 0.063	6.85 ± 0.010	6.82 ± 0.023	15.52 ± 0.022
Weight	1 mg				
Spruce Needles					
Measurements	6	49.13 ± 0.05	6.41 ± 0.04	1.84 ± 0.01	0.10 ± 0.01
Weight	1 mg				
Soil					
Measurements	5	0.216 ± 0.004	0.457 ± 0.003	0.007 ± 0.001	0.0052 ± 0.0005
Weight	50 mg				
Coal					
Measurements	6	75.49 ± 0.09	4.90 ± 0.01	1.93 ± 0.02	0.51 ± 0.03
Weight	7 mg				
Mineral Oil					
Measurements	6	87.62 ± 0.06	9.46 ± 0.02	0.21 ± 0.01	1.27 ± 0.04
Weight	6 mg				
Teflon					
Measurements	5	24.51 ± 0.12	-	-	-
Weight	1 mg				
Glass Fibre Filter					
Measurements	6	0.166 ± 0.008	-	0.026 ± 0.002	0.114 ± 0.007
Weight	400 ml				
PVC					
Measurements	6	40.40 ± 0.05	5.13 ± 0.04	-	Chlorine *
Weight	2 mg				44.36 ± 0.89

* Element contents in [%] incl. standard deviation in [%]

One instrument – a world of applications

The vario MICRO cube is the ideal instrument for the universal elemental analysis of CHNS, as well as optional O and Cl.

The applications cover all organic and the majority of inorganic samples of solid or liquid material. Its special strength lies in the sample weight in the lower milligram range regarding detection limit, concentration dynamics and the possibility to also analyse difficult samples e.g. those with a high fluorine or chlorine content.

A key characteristic is the ability to analyse organic samples up to a weight of 10 mg in the CHNS mode, as well as 1 gram of soil samples.

This is possible due to the quantitative combustion at a continuous furnace temperature of up to 1200 °C. Another key to the complete combustion of even samples with large gas generation is the oxygen „jet injection“ via a ceramic lance directly at the place of combustion. Combustion gases which could otherwise insulate further combustion are blown away by the high velocity oxygen jet.

The standard equipment already offers the possibility to work in CHNS, CHN, CNS, CN, N or S mode.

Element concentrations of well below 100 ppm to 100% are detectable with the standard detector (TCD). For even lower detection limits, special detectors can be employed. As one example an IR photometer allows the detection of sulphur down to 2 ppm.

The basis for the special detection strength is the high amplifying dynamic of the detector signals, the short gas pathways, and the high stability of the gas flow by means of a digital mass flow controller directly before the detector.

Therefore, the entire range of applications from organic chemistry, pharmaceuticals, petrochemical and other industrial products, to fossil fuels, environmental samples or bio material can be handled.

For particularly inhomogeneous samples which are difficult to grind or homogenise, large samples weights are required. In these cases alternative instruments of the vario family such as the vario MACRO cube or vario MAX cube are available.



In addition to the standard CHNS determination, easy add-on options provide the broadest application range for the elemental analysis:

Upgrade kits for oxygen determination

using high temperature pyrolysis. Conversion to CO in the presence of carbon, and measurement of CO with standard TCD, or for special requirements with IR detection.

Capsule press

for absolutely gas tight sealing of liquids in capsules. Also applicable for the analysis of air sensitive samples under inert gas.

Accessories for special applications

like reaction tubes with a diameter of 14.5 mm for a particularly small dead volume (e.g. for very small sample weights), special means for large sample amounts, accessories and consumables for high fluorine contents.

Adding value systematically

Sulphur measurement with IR photometer

for the improvement of the detection limit for sulphur to approx. 2 ppm simultaneously to CHN determination. Recommended also for samples with a high fluorine content.

Accessory for chlorine analysis

with absolutely new sensor detection of HCl in the combustion gas. This results in a large concentration dynamic range (patent pending).

Helium or Argon as carrier gas

Our answer to the worldwide shortage of helium is the alternative use of budget-priced and easily available argon as carrier gas. Fast and unproblematic change – and the analytical results correspond without any doubt to high requirements. The selection of the different carrier gas modes is done via the software during operation.

Software for quality assurance

e.g. the safety of electronic data (21 CFR Part 11), analytical quality assurance (AQS) and instrument validation (IQ, OQ) are available.

Analysis method:

High temperature combustion or pyrolysis of the sample and conversion of the elements into gaseous products.

Separation of the analysis gases by temperature programmed desorption (TPD) and detection at a TCD (IR optional).

Operating modes:

CHNS, CHN, CNS, CN, N, S as standard with TCD,
S with IR detection optional,
O with TCD or IR detection optional,
Cl with EC sensor optional.

Digestion temperatures:

adjustable up to 1200 °C
(by combustion of the tin vessels a temperature of approx. 1800 °C is temporarily reached).

Safety standards:

CE-label, EN 61010-1, EMV low voltage directives 73/23/EEC

Calibration:

Multi point calibration, regression linear to the 4th order,
different calibrations applicable in one run, stable over months.

* depending on sample kind, analysis mode and options

Specification vario MICRO cube

Sample weight*:	< 1 – 20 mg plant material, up to 1 g soil sample
Analysis time*:	self-optimising, depending on element content and sample weight
Autosampler:	120 positions in a magazine as standard reloadable any time during operation direct injection of liquid or gaseous samples optional incl. automatic liquid sampler
Gases:	He / Ar
Instrument control:	Operation and control via PC under Windows®; All instrument functions are digitally controllable, the comprehensive operation software includes e.g. automatic leak test, extensive error diagnosis, monitoring of the maintenance cycles, sleep-/wake up function, statistical evaluation and almost unlimited memory capacity for analysis data incl. graphics. Integration in data networks like LIMS and the possibility of remote control and diagnosis via the internet. In full compliance with 21 CFR Part 11 (option).
Electrical connections:	100/110/200/230 V, 50/60 Hz, 1.8 kW
Dimensions:	42 × 55 × 55 cm (W × D × H)
Weight:	approx. 65 kg

* depending on sample kind, analysis mode and options



Elementar
Analysensysteme GmbH

Donaustraße 7
63452 Hanau (Germany)

Phone: +49 6181 9100-0
Fax: +49 6181 9100-10
Mail: info@elementar.de



Agrarian
Analysis



Chemical
Analysis



Fuel
Analysis



Water and
Environmental
Analysis



Consumables
Service



Isotope
Analysis

