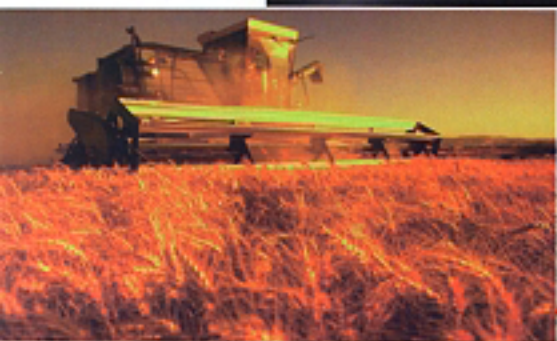
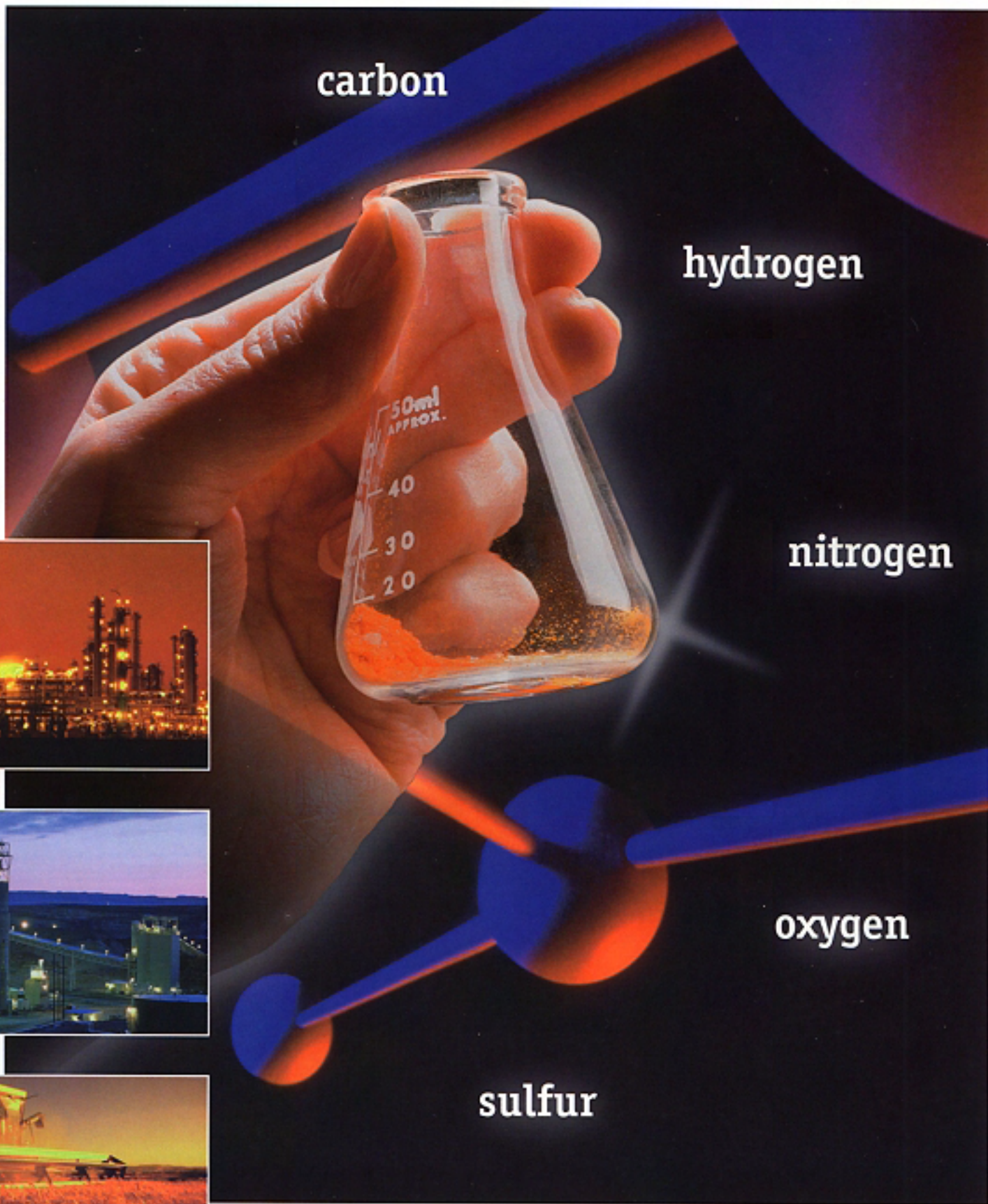


# Model CE-440 Rapid Analysis Elemental Analyzer





## The CE-440: Ideal For Any Lab, Any Sample, Any Time.

Whether you are analyzing organic compounds, pharmaceuticals, fuels or oils, petrochemicals, refractories or polymers, determining the Carbon, Hydrogen, Nitrogen, Oxygen, and Sulfur content is one of your lab's most basic and essential needs. So is the need for dependable results and maximum throughput. This is why you want the CE-440 Elemental Analyzer.

The CE-440 uses a thermal conductivity detection method for measuring carbon, hydrogen, and nitrogen after combustion and reduction. This method gives rapid and highly accurate measurements over a very wide range of elemental compositions, with most measurements completed in less than 5 minutes. Combine that with the CE-440's 64-sample carousel and you will achieve peak throughput. The CE-440's advanced Windows®-based software, with data storage, statistical analysis, flexible report generation and continuous diagnostic and automatic maintenance alerts, controls and monitors all instrument functions. This simplifies operation for consistent operator-to-operator results, no matter what sample types you analyze. Plus, due to its low gas and reagent consumption, the CE-440 offers the lowest cost per sample in the industry.

For the CHN/O/S analyzer offering the best performance and price, we invite you to examine the CE-440 for yourself.

### CE-440 Benefits

- Rapid analysis for high productivity – analysis time of less than 5 minutes
- Unique combustion technique makes possible the analysis of any sample type, from volatiles to refractories
- Stable thermal conductivity detectors provide linear response with superior precision and accuracy
- Windows®-based software with data storage for statistical analysis and flexible report generation
- Horizontal sample injection removes interfering residue between each sample run
- Continuous diagnostics and automatic maintenance alerts
- Low reagent consumption – industry's lowest cost per sample

## Measure These Advantages:

**Accuracy and Precision** The CE-440 provides analytical data of unsurpassed accuracy and precision. The complete control of combustion parameters combined with continuous measurement of the steady state combustion process ensures a level of accuracy and precision that cannot be matched.

**Versatility** With its unique combination of both static and dynamic combustion, the CE-440 can analyze the widest range of sample types of any CHN/O/S instrument. Our unique horizontal furnace allows for automatic removal of the residue from each sample after analysis, avoiding residue accumulation, memory effects and gas flow problems, which can occur with vertical furnace systems.

**Reliability** The CE-440 is a fully automated CHN/O/S elemental analyzer. The Windows-based software has been designed to reduce operator error through extensive automation, customer help, and diagnostic facilities. Using the technique of continuous measurement of the steady state combustion process, the CE-440 is inherently more reliable than gas chromatographic systems which are dependent on flow rate, column temperature, and dead-volume management.

Continuous diagnostics and automatic maintenance alerts make operation almost fool-proof. By monitoring signals, voltages, and sample throughput, the instrument provides continuous status reports on consumable reagents as well as diagnostic alerts should a problem occur. Most parts are user-replaceable, further reducing service costs and downtime.

## Ideal For Volatiles To Refractories And Everything In Between.

With its wide linear range, combined static/dynamic combustion and unique horizontal furnace design allowing for the removal of sample residue between runs, the CE-440 is capable of analyzing the widest range of sample types—quickly, easily and reliably. Typical applications include:

**Organics and Pharmaceuticals** The CE-440 can analyze virtually any class of organics, including organometallics, heterocyclic nitrogen derivatives, steroids, polynuclear aromatics and organophosphorous.

**Environmental** Determine the presence of fuels, oils, and their by-products in the environment, or study the composition of material retained by membranes used in oceanographic research, water filtration and air monitoring.

**Polymers** The CE-440 provides a fast, direct method for determining elemental composition of polymers, copolymers, and blends. Even samples with high levels of halogens, like PVC or Teflon,<sup>®</sup> can be analyzed rapidly and accurately.

**Refractories** Nitrides, graphite fibers, and ceramics can be analyzed—even carbides with melting points over 2000°C.

**Volatile/Air Sensitive Samples** Volatile and air sensitive materials are easily analyzed with the aid of our capsule sealing device.

**Other Application Areas:** Plastics, petrochemicals, agriculture, food, and pyrotechnical compounds.

Data From Ten Consecutive Runs,  
Analyzing A Pharmaceutical Sample

Sample Run	%C	%H	%N
1	65.43	6.72	8.45
2	65.47	6.73	8.45
3	65.47	6.72	8.48
4	65.45	6.70	8.44
5	65.44	6.72	8.47
6	65.50	6.72	8.52
7	65.52	6.70	8.52
8	65.48	6.70	8.49
9	65.45	6.70	8.48
10	65.49	6.71	8.48
Mean Values.....	65.47	6.71	8.48
Theoretical Values.....	65.44	6.71	8.45
Deviation from Theory.....	0.03	0.00	0.03



(a)



(b)



(c)

## Sample Handling

For most samples, the CE-440 requires no special preparation. The sample is placed into a capsule, which is then weighed (fig. a.) If you only run a few samples at a time, our Single Sample Automation will let you manually introduce a sample for analysis. Once completed you have the ability to re-weigh for ash if needed.

For higher sample loads, our automatic sample changer allows you to run up to 64 samples without operator intervention (fig. b.) Our unique double drop feature allows for the analysis of samples up to 500 mg in size.

For liquid samples our Capsule Sealer ensures sample integrity by closing the capsules with a cold weld (fig. c.) Analyzing volatiles such as gasoline becomes routine.

Our Refractory Materials Kit (not shown) contains fluxes and special sleeves for the combustion of difficult samples requiring extreme conditions for extracting carbon and nitrogen.

## SPECIFICATIONS

**Accuracy:** With standard organic compounds, +/- 0.15% absolute plus +/- 0.15% relative

**Sample Size:** Typically 1-5 mg; up to 500 mg for samples with low carbon content

**Analysis Time:** Less than 5 minutes for CHN

**Controller:** IBM-compatible PC with Windows/Windows 95

**Automation:** 64 sample carousel or single sample with ability to re-weigh for ash

**Range:** 100 ppm to 100%

**Detector:** Thermal conductivity

**System Sensitivity:** +/- 1 microvolt

**Analytical Sensitivity:** Less than 1 microgram

**Power:** 110/220 V, 60/50 Hz, 10 amp, single phase

**Weight:** 125 lbs. / 57 kg.

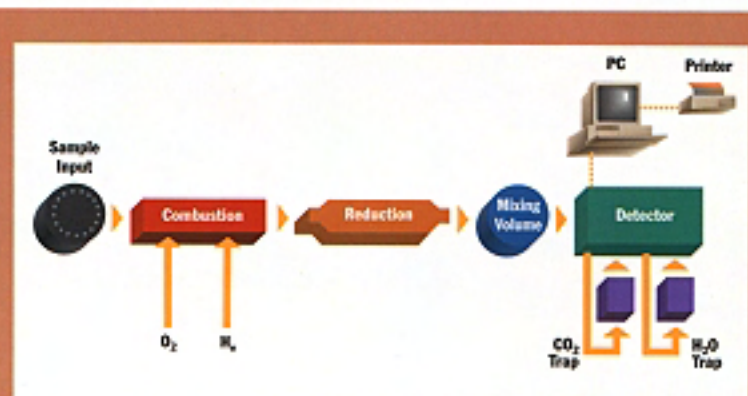
**Dimensions:** 32" wide x 28" deep x 13" high (81 x 71 x 33 cm)

**Bottled Gases Required:** Helium 99.99%, Oxygen 99.99%

## About Our Company.

Exeter Analytical, Inc. is a company with a rich heritage of specializing in the manufacture of elemental analyzers for a wide range of research, industrial and academic applications. Our customers include some of the largest companies in the fields of pharmaceuticals, petrochemicals and agriculture.

Our CHN/O/S application laboratory stands ready to assist you in getting the best results on your samples. Our experienced and knowledgeable applications chemists and engineering staff are always available to provide in-depth support and consultation on any CE-440 application.



## Model CE 440 Principles of Operation

The samples to be analyzed are weighed in consumable tin or aluminum capsules. The capsule is injected into a high temperature furnace and combusted in pure oxygen under static conditions. At the end of the combustion period, a dynamic burst of oxygen is added to ensure total combustion of all inorganic and organic substances. If tin capsules are used for the sample container, an initial exothermic reaction occurs raising the temperature of combustion to over 1800°C.

The resulting combustion products pass through specialized reagents to produce carbon dioxide (CO<sub>2</sub>), water (H<sub>2</sub>O) and nitrogen (N<sub>2</sub>) and oxides of nitrogen. These reagents also remove other interferences including halogens, sulfur, and phosphorous. The gases are then passed over copper to scrub excess oxygen and reduce oxides of nitrogen to elemental nitrogen. After scrubbing, the gases enter a mixing volume chamber to ensure a homogeneous mixture at constant temperature and pressure.

The mixture then passes through

a series of high-precision thermal conductivity detectors, each containing a pair of thermal conductivity cells. Between the first two cells is a water trap. The differential signal between the cells is proportional to the water concentration, which is a function of the amount of hydrogen in the original sample. Between the next two cells is a carbon dioxide trap for measuring carbon. Finally, nitrogen is measured against a helium reference.

Sulfur is measured separately, as sulfur dioxide, by replacing the combustion and reduction reagents. Oxygen is also measured separately by pyrolysis in the presence of platinumized carbon. The oxygen is finally measured as carbon dioxide. Both analyses are easily carried out and require a simple change of reagent tubes. In this way the analysis of either sulfur or oxygen is not compromised by trying to determine several elements at the same time. Parameters and reagents are optimized for the element undergoing analysis.

# EAI

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