NEXQC+ QuantEZ

Elemental analysis by X-ray fluorescence

Low cost EDXRF elemental analyzers

Energy dispersive X-ray fluorescence spectroscopy

Rigaku
Applied Rigaku Technologies, Inc.

NEX QC⁺ for cost-effective performance in a compact package

Energy dispersive X-ray fluorescence (EDXRF) is a routinely used analytical technique for the qualitative and quantitative determination of major and minor atomic elements in a wide variety of sample types. The heart of its versatility stems from the ability to provide rapid, non-destructive, multi-element analyses — from low parts-per-million (ppm) levels to high weight percent (wt%) concentrations — for elements from sodium ($_{11}$Na) through uranium ($_{92}$U). The versatile Rigaku NEX QC⁺ QuantEZ™ EDXRF spectrometer delivers routine elemental measurements across a diverse range of matrices — from homogeneous liquids of any viscosity to solids, thin films, alloys, slurries, powders and pastes.

## Elemental analysis in the field, plant or laboratory

Especially designed and engineered for heavy industrial use, whether on the plant floor or in remote field environments, the superior analytical power, flexibility and ease-of-use of the NEX QC⁺ QuantEZ adds to its broad appeal for an ever expanding range of applications, including exploration, research, bulk RoHS inspection, and education, as well as industrial and production monitoring applications. Whether the need is basic quality control (QC) or its more sophisticated variants — such as analytical quality control (AQC), quality assurance (QA) or statistical process control like Six Sigma — the NEX QC⁺ QuantEZ is the reliable choice for routine elemental analysis.

Elemental analysis for industry, academia and government

## Powerful Windows® based QuantEZ software

QuantEZ analytical software was specifically designed for the Rigaku NEX QC⁺ QuantEZ benchtop EDXRF analyzer. Running under the Microsoft® Windows® operating system, on either a laptop or benchtop personal computer (PC), the software offers all the functions required for calibration and routine operation. Rigaku has developed software that is not only user-friendly, but sophisticated and powerful enough for the most complex analysis. Based on the famous Rigaku easy-to-use flow bar interface, QuantEZ software walks the user through steps required to set up either an empirical or fundamental parameters application.
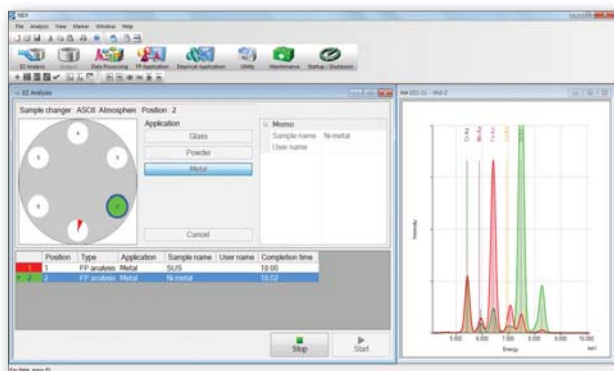
EZ Analysis interface, available in a variety of languages, is used for routine measurements. A live spectral display is shown in the right window.
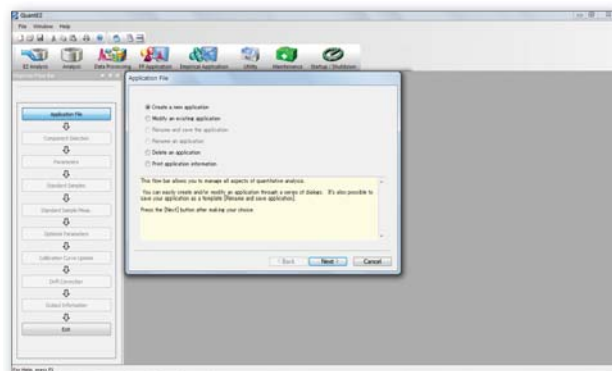
Rigaku's famous flow bar interface, shown in the left side window, for the empirical calibration module.
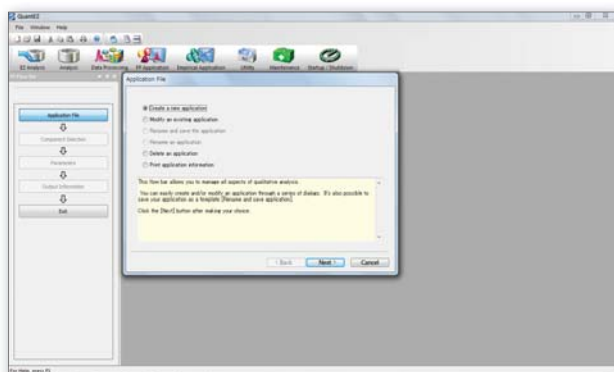
Flow bar interface, shown in the left side window, for the optional fundamental parameters module.
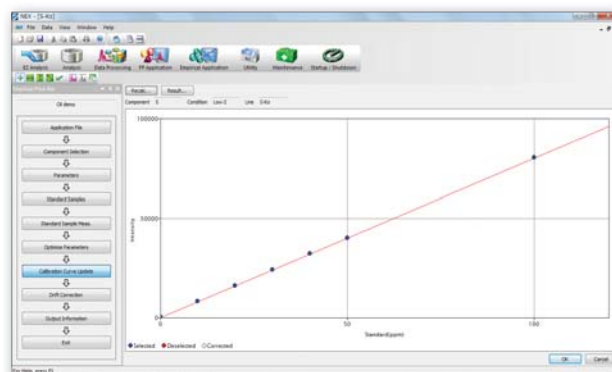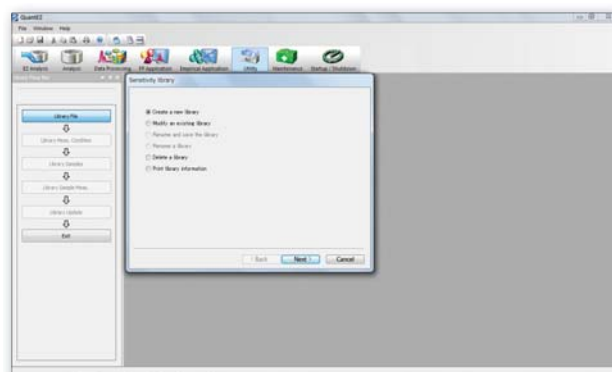

Illustration of an empirical calibration curve as one of the flow bar steps to set up an application.

Easy to use component selection screen within the optional fundamental parameters module.

Flow bar interface, shown in the left side window, to set up a matching library within the optional fundamental parameters module.

# NEX QC+ QuantEZ for exceptional spectral resolution and throughput

For demanding applications, or for situations where analysis time or sample throughput is critical, Rigaku offers the NEX QC+ QuantEZ spectrometer. Employing the next generation silicon detector technology, the enhanced instrument affords significant improvements in elemental peak resolution and counting statistics, resulting in superior calibrations and precision for the most challenging measurements.

Silicon drift detector technology

A silicon drift detector (SDD) affords extremely high count rate capability with excellent spectral resolution. This enables NEX QC+ QuantEZ to deliver the highest precision analytical results in the shortest possible measurement times. The unique engineering feature of SDD is the transversal field generated by a series of ring electrodes that forces charge carriers to "drift" to a small collection electrode. Current generation SDD detectors, with the field effect transistor (FET) moved out of the radiation path, represent the state of the art in conventional EDXRF detector technology.
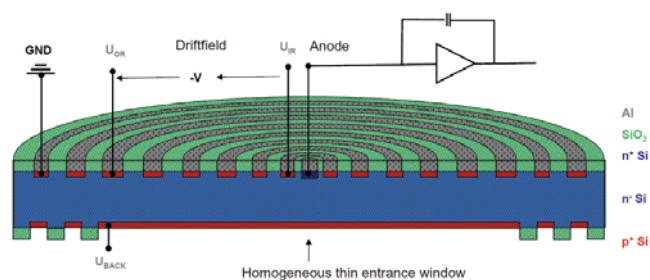

Simplified diagram of an SDD detector illustrating the concentric ring construction that allows for very high X-ray count rates
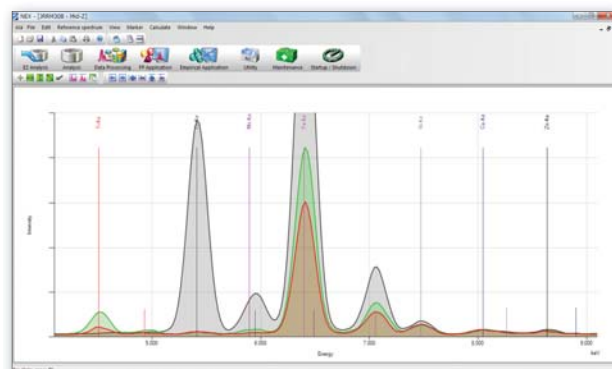
QuantEZ software, coupled with the high-resolution SDD detector, provides easy to use qualitative evaluation of spectra. Shown are overlapped spectra with element line markers.

How it works

In X-ray fluorescence (XRF), an electron can be ejected from its atomic orbital by the absorption of X-rays (photons) from an X-ray tube. When an inner orbital electron is ejected (middle image), a higher energy electron transfers to fill the vacancy. During this transition, a *characteristic* photon may be emitted (right image) that is of a unique energy for each type of atom. The number of *characteristic* photons per unit time (counts per second or cps) is proportional to the amount of that element in a sample. Thus, qualitative and quantitative elemental analysis is achieved by determining the energy of X-ray peaks in a sample spectrum and measuring their associated count rates.
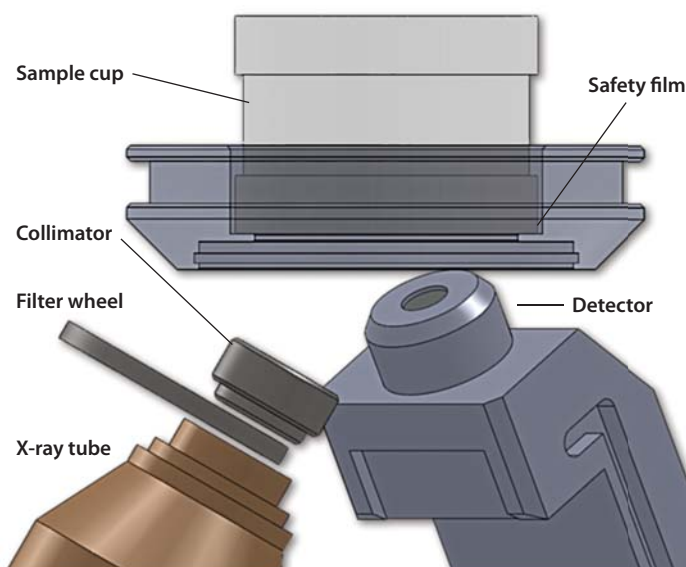

X-ray fluorescence schematic
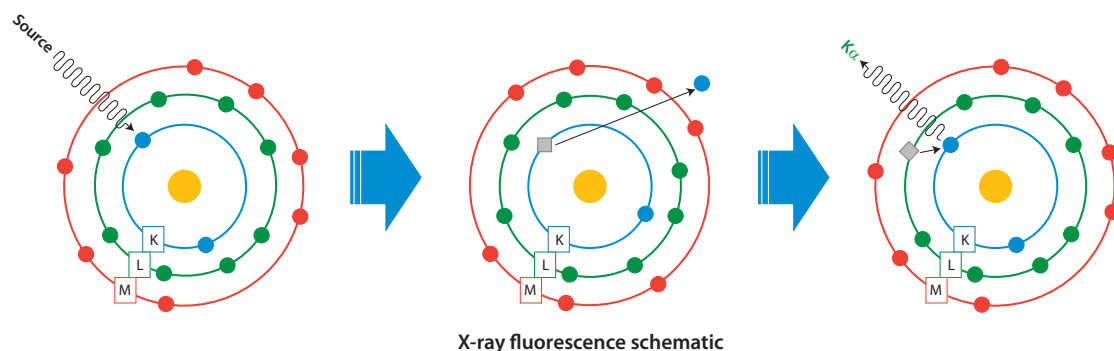
EZ Analysis interface

Rigaku QuantEZ software was developed to be both extraordinarily powerful and extremely easy to use. Ideal for non-technical operators, routine analyses are performed through a simplified customizable EZ Analysis interface. Software operation simply involves selecting the sample position on the computer screen and entering a sample name. Next, the application method (i.e., calibration) is selected. Selecting the "start" button with the mouse pointer initiates the analysis. The depth and breadth of features, as well as the sophistication of the interface, are the result of decades of XRF software development at Rigaku.
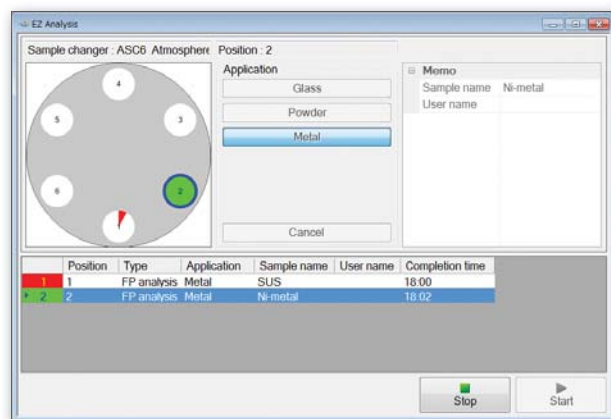
State-of-the art X-ray optics

The NEX QC$^+$ QuantEZ employs a 50 kV X-ray tube and Peltier cooled semiconductor detector technology to deliver exceptional short-term repeatability and long-term reproducibility with excellent elemental peak resolution. The high voltage, along with multiple automated X-ray tube filters, provides multi-element analysis capability for unmatched performance with low limits of detection (LOD). Optics are protected by a safety film that requires no tools to change.

Sample cup
Safety film
Collimator
Filter wheel
Detector
X-ray tube

Potassium | Calcium | Scandium | Titanium | Vanadium | Chromium | Manganese

K 19 | Ca 20 | Sc 21 | Ti 22 | V 23 | Cr 24 | Mn 2

c Weight = 39.10 | Atomic Weight = 40.08 | Atomic Weight = 44.96 | Atomic Weight = 47.87 | Atomic Weight = 50.94 | Atomic Weight = 52.00 | Atomic Weight = 54.94

Nondestructively analyze from sodium through uranium

X-ray tube conservation

By operating only during data collection, X-ray tube wear and tear is minimized.

No tools safety film

No tools are required to change the safety film protecting the optical kernel.

Digital data output

Data export and LIMS compatibility are supported using either RS-232C or TCP/IP.

Silicon drift detector (SDD)

A silicon drift detector (SDD) affords extremely high count rate capability with excellent spectral resolution.

Windows® based software

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RFP-SQX fundamental parameters option

Capable of standardless semi-quantitative analysis. Dramatically reduces the number of standards needed to implement a high quality calibration; especially useful when standards are difficult to obtain or for complex matrices where many elements vary independently.

EZ Analysis interface for routine operation

Ideal for non-technical operators, routine analyses are performed through a simplified customizable EZ Analysis interface.

Single position or autosampler

Standard single-position configuration can be supplemented with an optional autosampler.

Removable sample trays

Interchangeable optional autosampler trays may be pre-loaded, and swapped in and out, to increase efficiency or where throughput is important. Supports 32 mm and 40 mm cups.
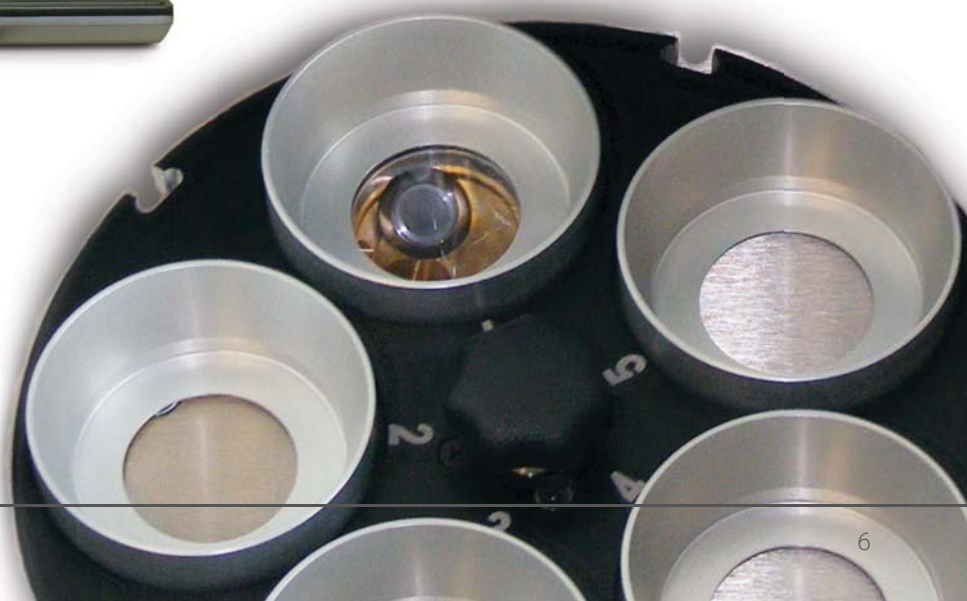
Applications span global industries

Catalysts

EDXRF analysis of heterogeneous and homogeneous catalysts can be used to determine heavy metal content or stoichiometry and/or to quantify poisoning agents. Determination of the value of precious metals content in recycled automotive catalysts is a cost effective application for the NEX QC$^+$ QuantEZ.

Cement

The Rigaku NEX QC$^+$ QuantEZ elemental analyzer is a reliable and rugged low-cost system for quality control measurements at cement plants, making it the ideal tool throughout the production process and as backups to WDXRF systems. They are applicable to clinker and raw meal, and may be used to measure gypsum (SO_3) in finished cement.

Coatings

Paper and plastic may be coated with a thin layer of silicone as a release coating in the manufacture of tape or other adhesives or as a barrier coating for protection against air in the packaging of food and other materials. Metallic coatings, either electroplated or sputtered onto some substrate material, may also be quantified with the NEX QC$^+$ QuantEZ.

Cosmetics

Since many additives in cosmetics are minerals or inorganic compounds, EDXRF is ideal. Applications include Ti and Zn oxides as UV blockers as well as Fe, Ti and Zn oxides and metallic dyes as pigments. Rigaku's NEX QC$^+$ QuantEZ elemental analyzer can also screen cosmetics for toxic metals and inspect incoming raw materials.

Education

An understanding of the basis of atomic spectroscopy is one of the key tenets underpinning the core sciences of physics and chemistry. Low cost EDXRF is an ideal way to give students instrumentation time in the lab to support their classroom instruction. Unlike AA or ICP, no routine maintenance or consumables are required.

Geology

In studying Earth, geologists routinely analyze the composition of rock and mineral samples. Rapid elemental analyses can be accomplished with NEX QC$^+$ QuantEZ elemental analyzer without sample digestion. Common industrial geological applications include analysis of limestone, kaolin clay and silica sand.

Metals and alloys

Elemental analysis is typically used as a basis for classifying alloys, controlling their production, or verifying their designation. In addition to routine QC applications like iron in aluminum alloys, the NEX QC$^+$ QuantEZ instrument may also be used for analyzing slags, feeds and tailings in the smelting process.

Mining and refining

Foundries, smelters and mills are characterized by having continuous production, demanding control of both the process and the quality of incoming and outgoing materials. NEX QC+ QuantEZ elemental analyzer may be used to analyze ores, feeds, slags and tails. Low cost EDXRF also makes an ideal backup analyzer.

Paint and pigments

Many paints and pigments contain metal dyes, opacifiers and other inorganic stabilizers that can be analyzed by EDXRF. One specific application is titanium dioxide and lead chromate in white and yellow road paint respectively. NEX QC+ QuantEZ is the ideal low cost solution for industrial quality control, as well as for forensic identification of paint chips.

Petroleum

From the quantification of heavy elements in crude oil to sulfur in fuels to a variety of elements in lubricating oils, EDXRF is a well established technique for the petroleum and petrochemical industries. For sulfur in crude oil, bunker fuel and ULSD, NEX QC+ QuantEZ is specific to ASTM D4294, ISO 20847 and 8754, IP 496 and 336, JIS K 2541-4, as well as ISO 13032.

Plastics

Plastics, polymers, and rubber are combined with different additives to afford specific properties. Commonly analyzed as beads, pressed or molded into plaques, typical applications include Br and Sb as fire retardants; stabilizers and lubricants such as P, Ca, Ba, and Zn, as well as Mg, Al, Si, Fe in fiberglass and S in polyurethane.

RoHS

RoHS provides that plastics for consumer goods — as well as new electrical and electronic equipment put on the market for the first time from July 1, 2006 — should not contain certain heavy metal toxins, including: Pb, Cd, Hg, and hexavalent chromium (Cr). NEX QC+ QuantEZ can help compliance by providing rapid elemental analysis of bulk materials.

Wood

Processes undertaken to prevent wood rot fall under the definition of wood preservation or timber treatment. The NEX QC+ QuantEZ can help control a number of different chemical preservatives and processes used to extend the life of wood and engineered wood products, including: CCA, IPBC, PENTA, copper (CA-B, CA-C), and ACZA.

Wovens and non-wovens

Fabrics of all kind are either created with inorganic chemical additives or treated with compounds to modify the behavior of the material. The NEX QC+ QuantEZ elemental analyzer is ideal for quantifying compounds such as fire retardants, UV stabilizers, anti-microbial treatments and electromagnetic shielding.

Options

RPF-SQX reduces the need for standards

QuantEZ software is optionally available with new qualitative and quantitative analytical software, RPF-SQX, that features Rigaku Profile Fitting (RPF) technology. The software allows semi-quantitative analysis of almost all sample types without standards — and rigorous quantitative analysis with standards.

RPF-SQX greatly reduces the number of required standards, for a given level of calibration fit, as compared to conventional EDXRF analytical software. As standards are expensive, and can be difficult to obtain for many applications, the utility of RPF-SQX can significantly lower the cost of ownership and reduce workload requirements for routine operation.

Black dot: Raw data
Gray: Result of fitting
Purple: Barium
Green: Titanium
Red: Chromium
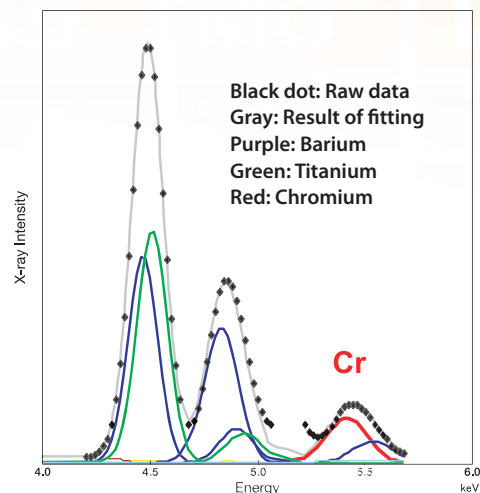
For RoHS polymer standard BCR680, coexisting elements Ti and Ba overlap with Cr; RPF-SQX deconvolutes the overlap so that Cr can be analyzed

Sample spinner

Coarse grained, inhomogeneous and rough finished samples should be rotated during analysis to provide an averaged presentation and to suppress diffraction peaks. Thus, a single position 32 mm sample spinner is offered as an option. Extremely robust in design, the spinner is almost completely silent while rotating at its nominal speed of 30 rpm. It may be used in autosampler-equipped models by replacing the automatic sample tray as needed.

Helium purge

Light element performance is dramatically improved by use of a helium (He) environment during analysis. Helium flow rate is 0.2 liters per minute (SLM).

Hellium

He 2

Atomic Weight = 4.00

Autosampler

In addition to the standard single-position (32 mm) sample holder (bottom left image) and large object adapter (bottom right image), two automatic sample changers are offered as options. A six-position changer (bottom center image) accommodates 32 mm samples, while the five-position variation accepts 40 mm samples. Both autosampler trays take the respective industry standard XRF sample cups. Extra trays may be used to preload trays for easy batch analysis.
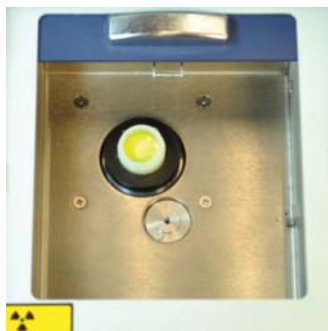
Specifications

Excitation

50 kV X-ray tube
4 W max power
6 tube filter positions with shutter

Detection

High performance silicon drift detector (SDD)
Peltier thermo-electric cooling
Optimum balance of spectral resolution and count rate

Sample chamber

Large 190 x 165 x 60 mm sample chamber
Single-position 32 mm sample aperture
Single-position 40 mm sample aperture
Bulk sample aperture
6-position 32 mm automatic sample changer
5-position 40 mm automatic sample changer
Single-position 32 mm sample spinner
Analysis in air or helium

Software

Windows based QuantEZ software
Qualitative and quantitative analysis
Application templates
EZ Analysis interface multi-language support
User selectable shaping times
Simple flow bar wizard to create new methods
Intensity or concentration based alpha corrections
Data export / LIMS compatibility by RS-232C or TCP/IP

Environmental conditions

Ambient temperatures 10 – 35°C (50 – 95°F)
Relative humidity <85% non condensing
Vibration undetectable by human
Free from corrosive gas, dust, and particles

Computer

| |
|---|
| External PC: desktop or laptop |
| Microsoft Windows operating system |
| Keyboard and mouse (if desktop type) |
| USB and ethernet connections |

Backed by Rigaku

Since its inception in 1951, Rigaku has been at the forefront of analytical and industrial instrumentation technology. Today, with hundreds of major innovations to our credit, the Rigaku Group of Companies are world leaders in the field of analytical X-ray instrumentation. Rigaku employs over 1,400 people worldwide in operations based in Japan, the U.S., Europe, South America and China.

Options

6-position 32 mm automatic sample changer
5-position 40 mm automatic sample changer
Single-position 32 mm sample spinner
Helium purge
RPF-SQX fundamental parameters w/ matching libraries function

Spectrometer data

Single phase AC	100/240 V, 1.4 A (50/60 Hz)
Dimensions:	331 (W) x 432 (D) x 232 (H) mm (13 x 17 x 14.8 in)
Weight:	16 kg (35 lbs.)
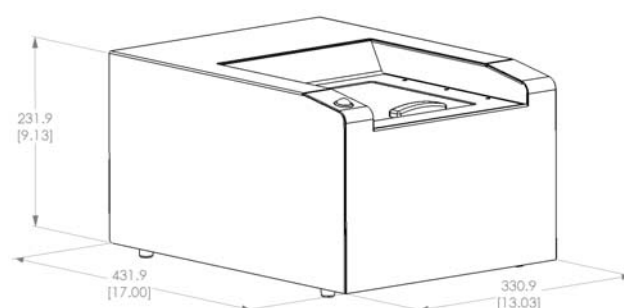
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