NEXDE

Elemental analysis by X-ray fluorescence

High performance, direct excitation EDXRF elemental analyzer

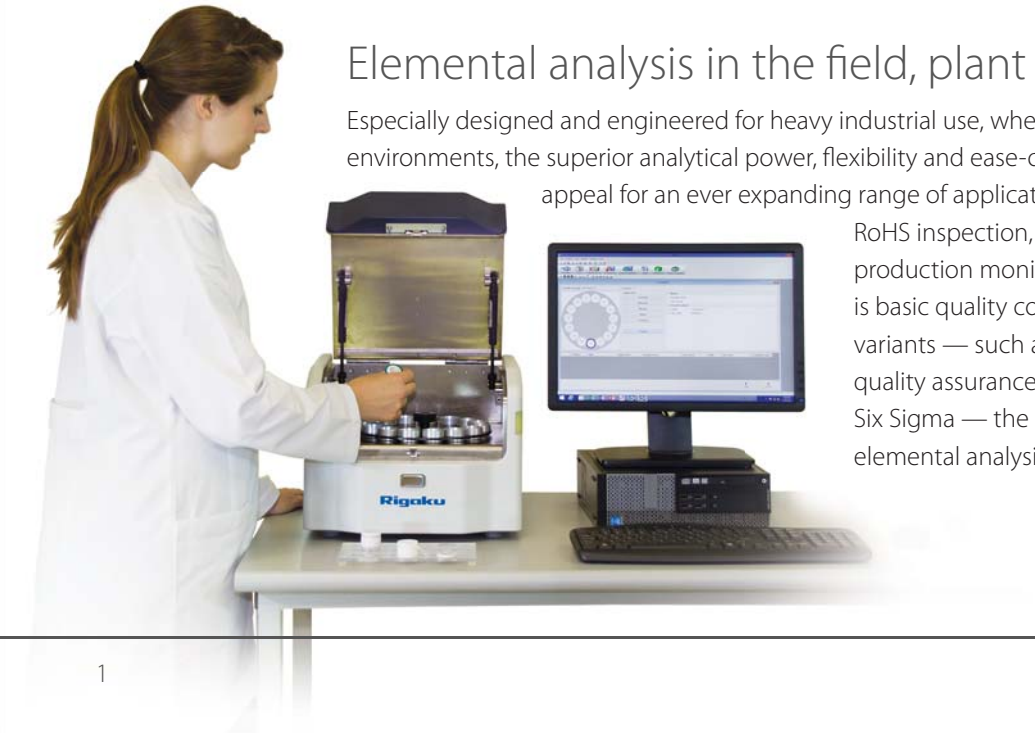
Energy dispersive X-ray fluorescence spectroscopy

Rigaku

Applied Rigaku Technologies, Inc.

NEX DE 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 DE 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

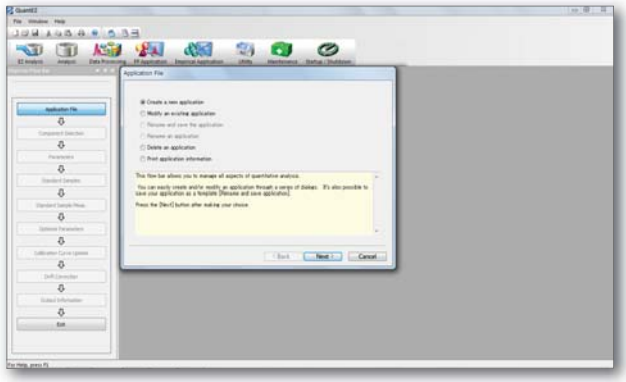
Especially designed and engineered for heavy industrial use, whether on the plant floor or in remote field environments, the superior analytical power, flexibility and ease-of-use of the NEX DE adds to its broad appeal for an ever expanding range of applications, including exploration, research, bulk 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 DE is the reliable choice for routine elemental analysis.

Elemental analysis for industry, academia and government

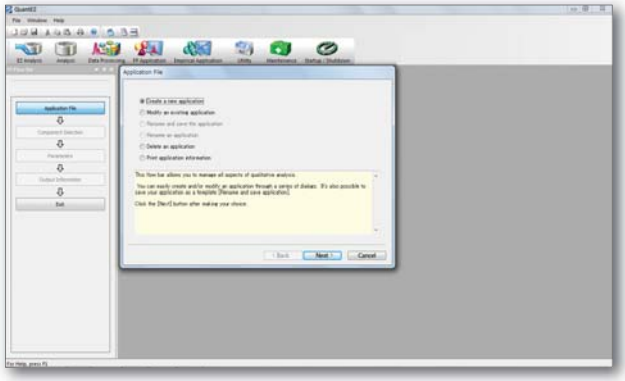
Powerful Windows® based QuantEZ™ software

QuantEZ analytical software was specifically designed for the Rigaku family of benchtop EDXRF analyzers. 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.

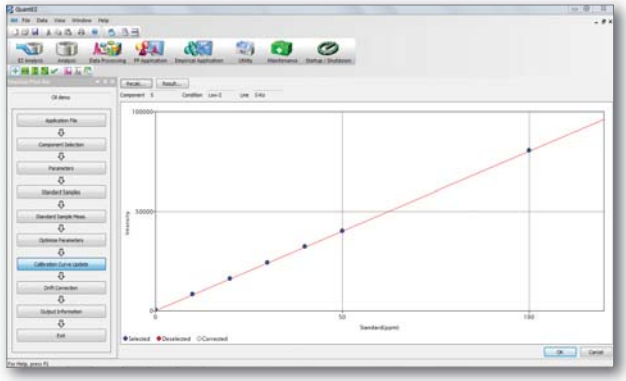
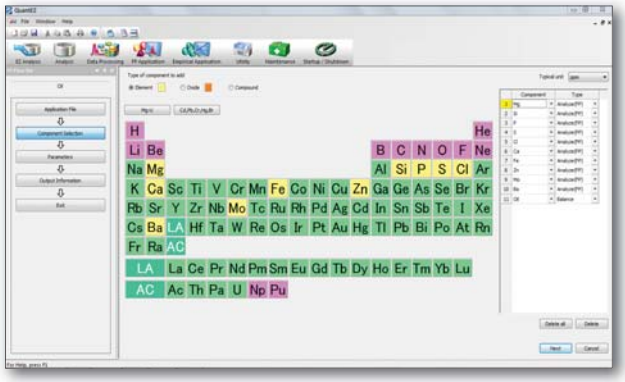
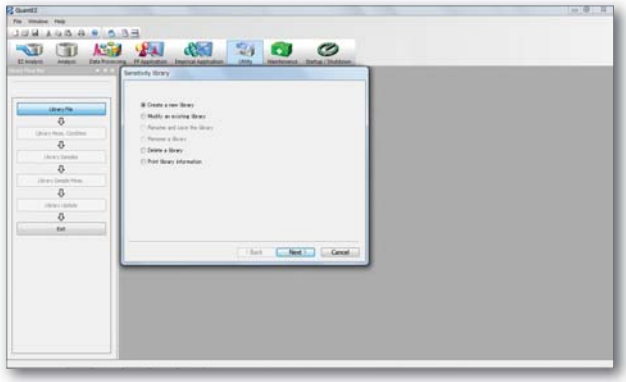


Illustration of an empirical calibration curve as one of the flow bar steps to set up an application.



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



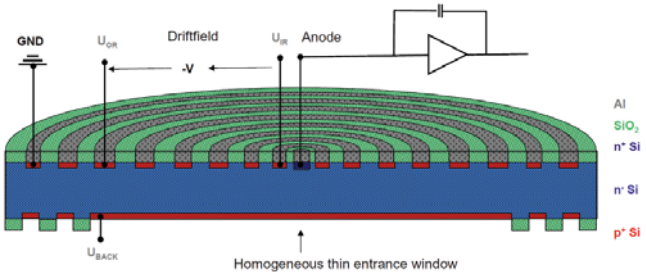
Flow bar interface, shown in the left side window, to set up a matching library within the optional fundamental parameters module.

NEXDE for exceptional spectral resolution and throughput

For demanding applications, or for situations where analysis time or sample throughput is critical, Rigaku offers the NEX DE spectrometer. Employing the next generation silicon drift 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.

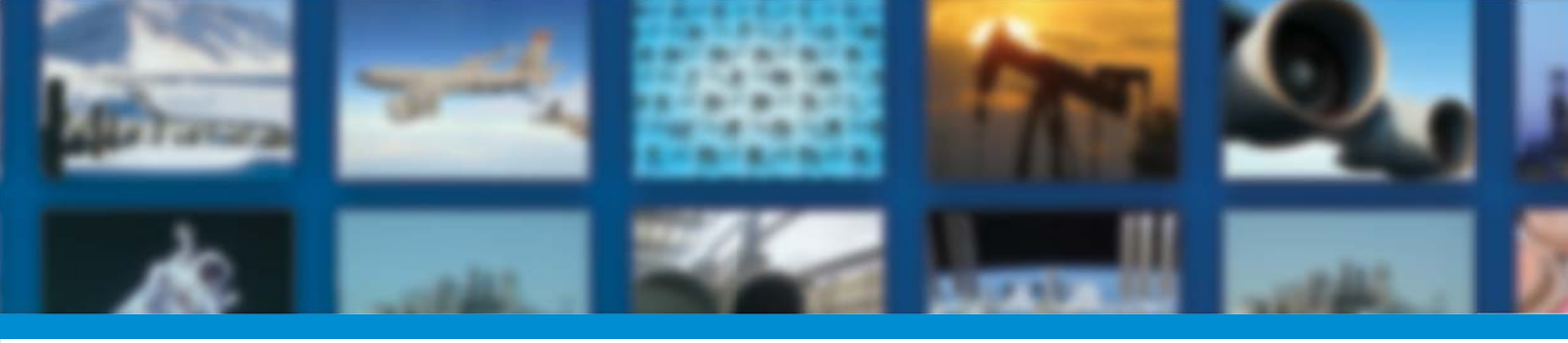
Silicon drift detector technology

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



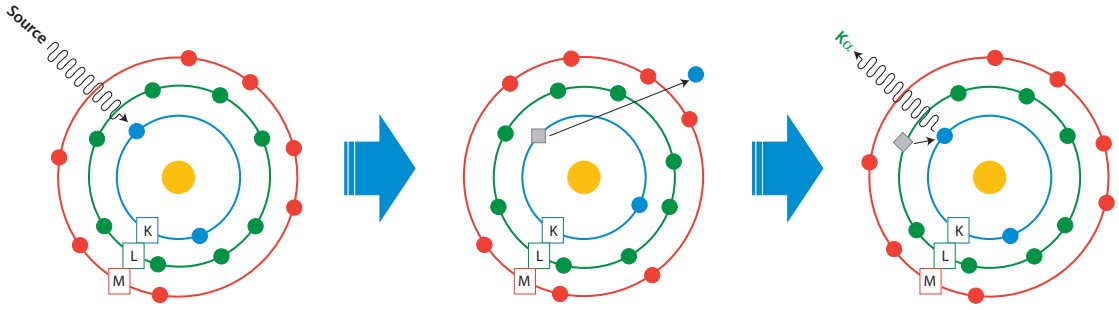
Simplified diagram of an SDD detector illustrating the concentric ring construction that allows for very high X-ray count rates

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

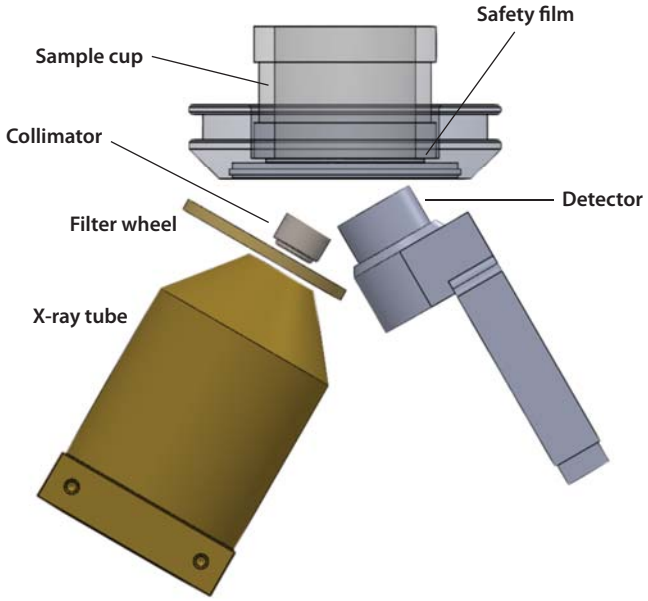
In X-ray fluorescence (XRF), an electron can be ejected from its atomic orbital by the absorption of X-rays (photons) from an X-ray tube. When an inner orbital electron is ejected (middle image), a higher energy electron transfers to fill the vacancy. During this transition, a *characteristic* photon 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 DE employs a 60 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.

Nondestructively analyze from sodium through uranium

NEXDE

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.

60 kV, 12 W X-ray tube

Close-coupled Ag-anode end-window X-ray tube. High emission current at low voltages for superior light element performance.

Silicon drift detector (SDD)

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

Windows® based software

QuantEZ software was developed to be both extraordinarily powerful and extremely easy to use. 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.

RPF-SQX fundamental parameters (FP) 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.

RPF-SQX matching libraries

When using FP, matching libraries can be created to match your sample type. By integrating a few standards of a similar matrix to unknown sample types, and creating a semi-quantitative library for each, far greater accuracy can be realized for the unknowns (shown on screen to the left).

EZ Analysis interface for routine operation

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

Large sample chamber

Accommodates large samples, up to 30 cm diameter and 10 cm tall, as well as a variety of single position and autosampler options.

Vacuum option

Available vacuum system comes with high capacity pump and vacuum sensor, delivering superior light element sensitivity for non-volatile samples and short pump-down times.

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, 40 and 50 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 DE.

Cement

The Rigaku NEX DE 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 DE.

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 DE 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 DE 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 DE 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 DE 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 DE 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 DE 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 DE 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 DE 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.

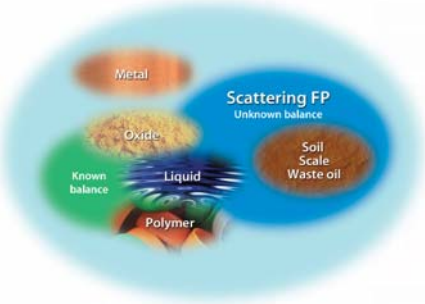
Wovens and non-wovens

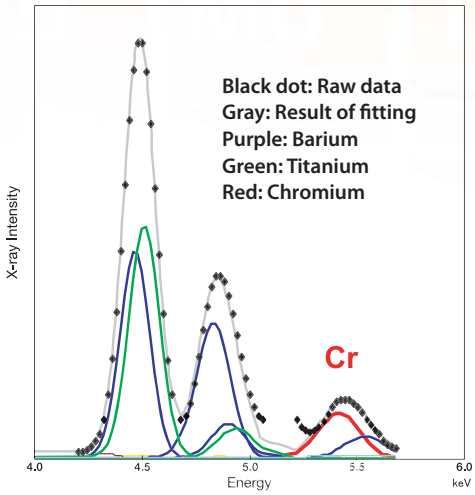
Fabrics of all kind are either created with inorganic chemical additives or treated with compounds to modify the behavior of the material. The NEX DE elemental analyzer is ideal for quantifying compounds such as fire retardants, UV stabilizers, anti-microbial treatments and electromagnetic shielding.

Options

RPF-SQX reduces the need for standards

NEX DE is powered by 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. Featuring Rigaku's famous Scatter FP method, the software can automatically estimate the concentration of unobserved low atomic number elements (H to F) and provide appropriate corrections.





For RoHS polymer standard BCR680, coexisting elements Ti and Ba overlap with Cr; RPF-SQX deconvolutes the overlap so that Cr can be analyzed

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.

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.

Optional sample spinner

Vacuum atmosphere

For non-volatile samples, a vacuum atmosphere maximizes light element sensitivity. The optional single sample vacuum system is easily attached, inside the measurement chamber, without the use of tools. Included is a high pumping speed, compact, and quiet rotary vacuum pump that is capable of obtaining a <50 Pa pressure in the sample vacuum system.

Optional vacuum system

Helium purge

Light element performance is dramatically improved by use of a helium (He) environment during analysis.

Large object configuration

Specifications

Excitation
X-ray tube with Ag anode (with X-ray enable key switch)
60 kV max voltage, 1 mA max current
12 W max power
7 position primary filter wheel
10 mm collimation

Detection
High performance, fast silicon drift detector (SDD)
Peltier electronic cooling
Digital pulse processor
Automated or user configurable shaping times for optimum analytical performance

Sample chamber
Large 30.5 (W) X 30.5 (D) x 10.5 (H) cm sample chamber allows for various sample sizes

Software
Menu-based software for control of spectrometer functions and data analysis
Simple flow bar wizard to create new methods
Empirical calibration with overlap and matrix compensation
EZ Analysis interface multi-language support
Data download via USB or Ethernet

Environmental conditions
Ambient temperatures 10 – 28°C (62 – 82°F)
Relative humidity ≤75%
Vibration undetectable by human
Free from corrosive gas, dust, and particles

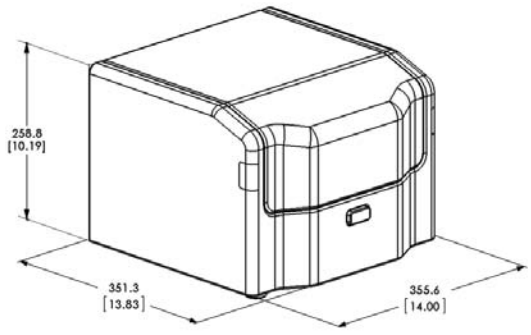
Computer
External PC: desktop or laptop
Microsoft® Windows® operating system
Keyboard and mouse (if desktop type)
LCD monitor

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
RPF-SQX fundamental parameters for qualitative and quantitative analysis
Helium purge
Single sample vacuum system
Single position 32 mm sample spinner
15-position 32 mm automatic sample changer
10-position 40 mm automatic sample changer
9-position 50 mm automatic sample changer
UPS 865 W / 1500 VA Battery backup / transient surge protection
Printer

Spectrometer data	
Single phase AC	100/240 V, 1.5 A (50/60 Hz)
Dimensions:	35.6 (W) x 35.1 (D) x 26 (H) cm (14.0 x 13.8 x 10.2 in)
Weight:	<27 kg (<60 lbs.)



Autosampler and sampling options

In addition to the standard single-position (32 mm) sample holder (page 9 image, shown with optional sample spinner) and large object configuration (lower left image), three automatic sample changers are offered as options. A 15-position changer accommodates 32 mm samples, while the 10-position variation accepts 40 mm and the 9-position takes 50 mm samples. All autosampler trays take the industry standard sample cups. Extra trays may be used to preload trays for batch analysis.

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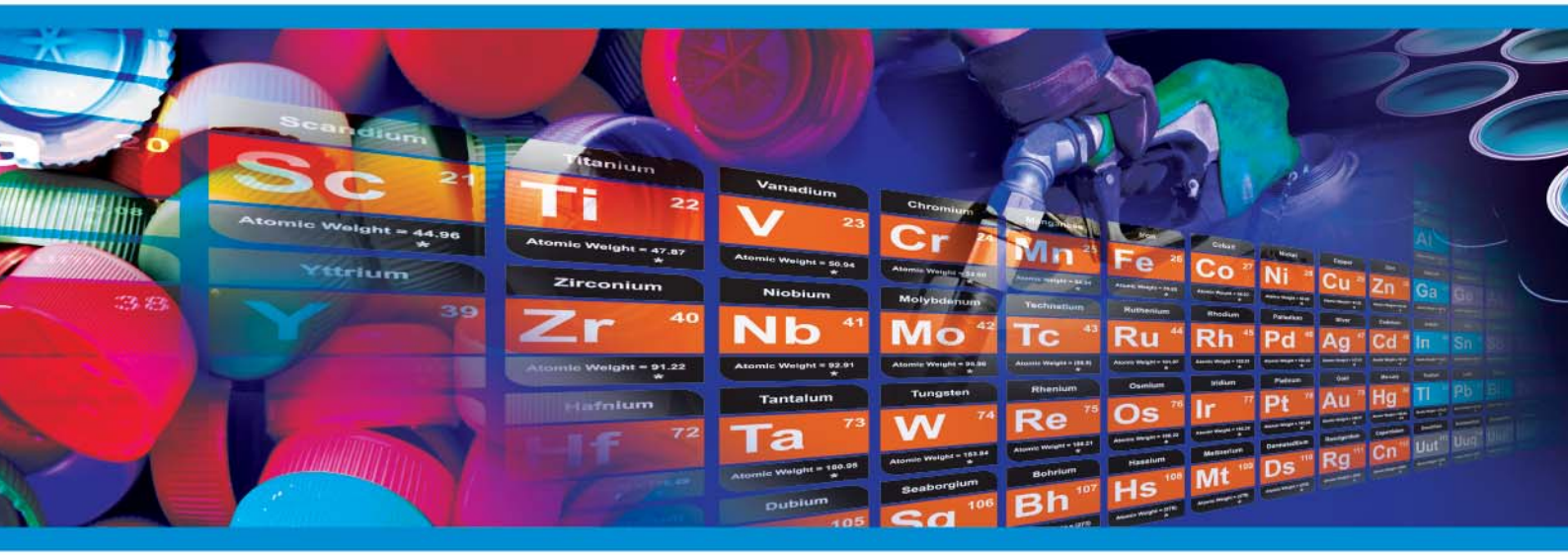

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