

Energy Dispersive X-ray Fluorescence Spectrometer for RoHS/ELV Screening

EDX-GP / LE





"This is the first time I've used a spectrometer.

Will it be easy for me to use without any special knowledge?"

"Can it make correct judgments even with very strict threshold values?"

When it comes to the demands required of X-ray fluorescence spectrometers for RoHS/ELV hazardous element screening, Shimadzu provides:

Security - provided by user-friendly features that allow judgments to be entrusted to the instrument

Reliability - provided by performance that allows precise analysis of a wide range of elements

The EDX-GP and EDX-LE are optimized to the extreme to meet these user needs.

EDX-GP / LE

Energy Dispersive X-ray Fluorescence Spectrometer for RoHS/ELV Screening



Choose from two different models,

EDX-GP

Great Performance contributes to Green Procurement for customers

Suitable for screening required by RoHS/ELV and various other regulations

- Industry-leading detection sensitivity and resolution
- Fast, high-sensitivity measurements of even trace elements
- High-precision measurement, even of multi-element compounds

Comparison of Applicability of EDX-Series Products for Screening Applications

Note: Symbols in the chart do not indicate a comparison of instrument performance.

Regulation											
Element	Cl	Br	Hg	Cr	Pb	Cd	Sb	As	Ba	Se	Ni
EDX-GP / LE	○	◎	◎	◎	◎	◎	○	○*	○*	○*	△*

◎: Standard applicability

○: Optional applicability

△: Applicability depends on analytical conditions

*Additional function kit is required for EDX-LE.

Making the Difficult Simple

- The [Screening Analysis] window makes operation easy
- Fully automatic, from determining main components to selecting conditions

Fully Equipped with Essential Functions

- RoHS/ELV analysis functions are standard
- Large Sample Chamber enables as-is measurement of large samples

depending on objectives.

EDX-LE

Light and Easy, destined to be the Leading Expert for screening

Makes RoHS/ELV screening even easier

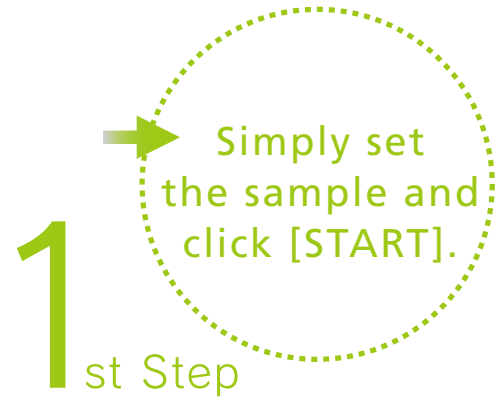
- Reduces routine maintenance (no liquid nitrogen necessary)
- Protection functions restrict changing conditions or data
- Simple screening setting functions can be easily changed according to the control system on user side



Making the Difficult Simple

Easy Screening, Even for First-time Users

Start sample measurement from [Screening Analysis] using simple steps. The selection of measurement conditions, which typically relies on the judgment of the experimenter, is determined automatically. This means that even first-time users can rest assured.



Place the Sample

- After placement, the sample observation camera observes the sample and confirms the sample's analysis position.
- Set the analysis area to 3 mm, 5 mm, or 10 mm diameter.
- Close the sample chamber.

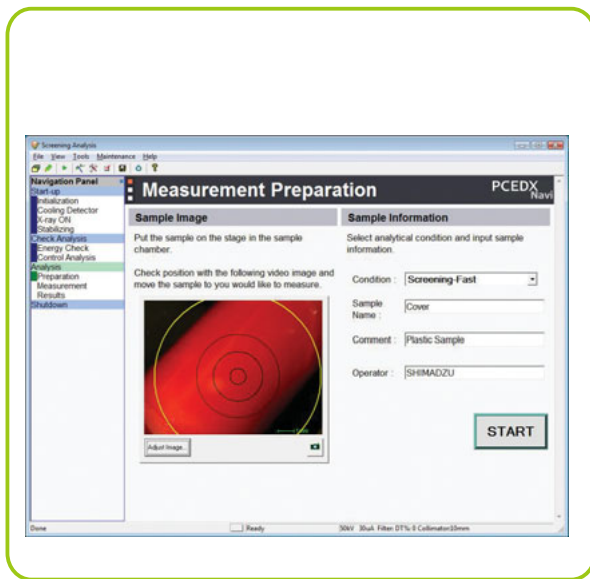


To check the results to date...

Results List: Lists data of completed measurements (with photographs)

Sample ID	Element	Concentration	Status	Sample ID	Element	Concentration	Status	Sample ID	Element	Concentration	Status	
2018-03-16-01-12	Cd	ND (20.0) ppm	OK	PN	ND (20.0) ppm	OK	Cr	ND (12.4) ppm	OK	Hg	ND (5.0) ppm	OK
2018-03-16-01-41	Cd	717.8 (105.9) ppm	NG	PN	ND (15.0) ppm	OK	Cr	ND (11.0) ppm	OK	Hg	ND (2.2) ppm	OK
2018-03-16-04-21	Cd	ND (25.0) ppm	OK	PN	29043.4 (1429.1) ppm	NG	Cr	1083.7 (182.0) ppm	NG	Hg	ND (49.5) ppm	OK

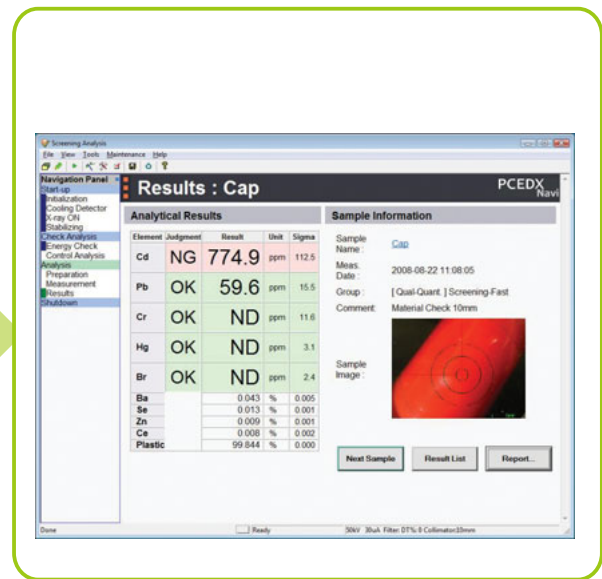
2nd Step



Select Analysis Conditions/ Enter Sample Name

- The [Measurement Preparation] window displays the current sample image. Use this window to select analysis conditions and enter a sample name.
- Start measurement with a single click.

3rd Step



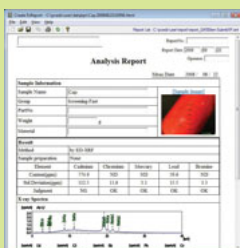
Display of Analysis Results

- After measurements are completed, [Pass/Fail Judgment], [Concentration], and [3σ (Measurement Variance)] are displayed for all 5 elements in an easy-to-understand layout.
- Display the [Result List] and [Individual Report] with a single mouse click.



If you want to create a report...

Individual Report: Displays a report of the current sample

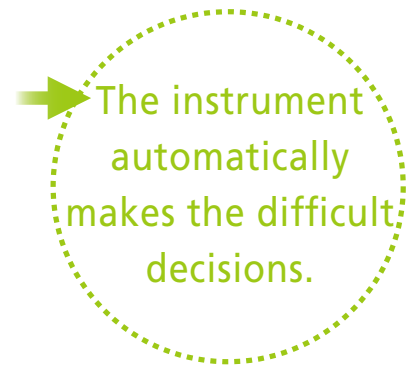


Create reports in Excel or HTML format. Reports can also be created for non-RoHS 5 element data.

*Note that this requires installation of Microsoft Office Excel before use.

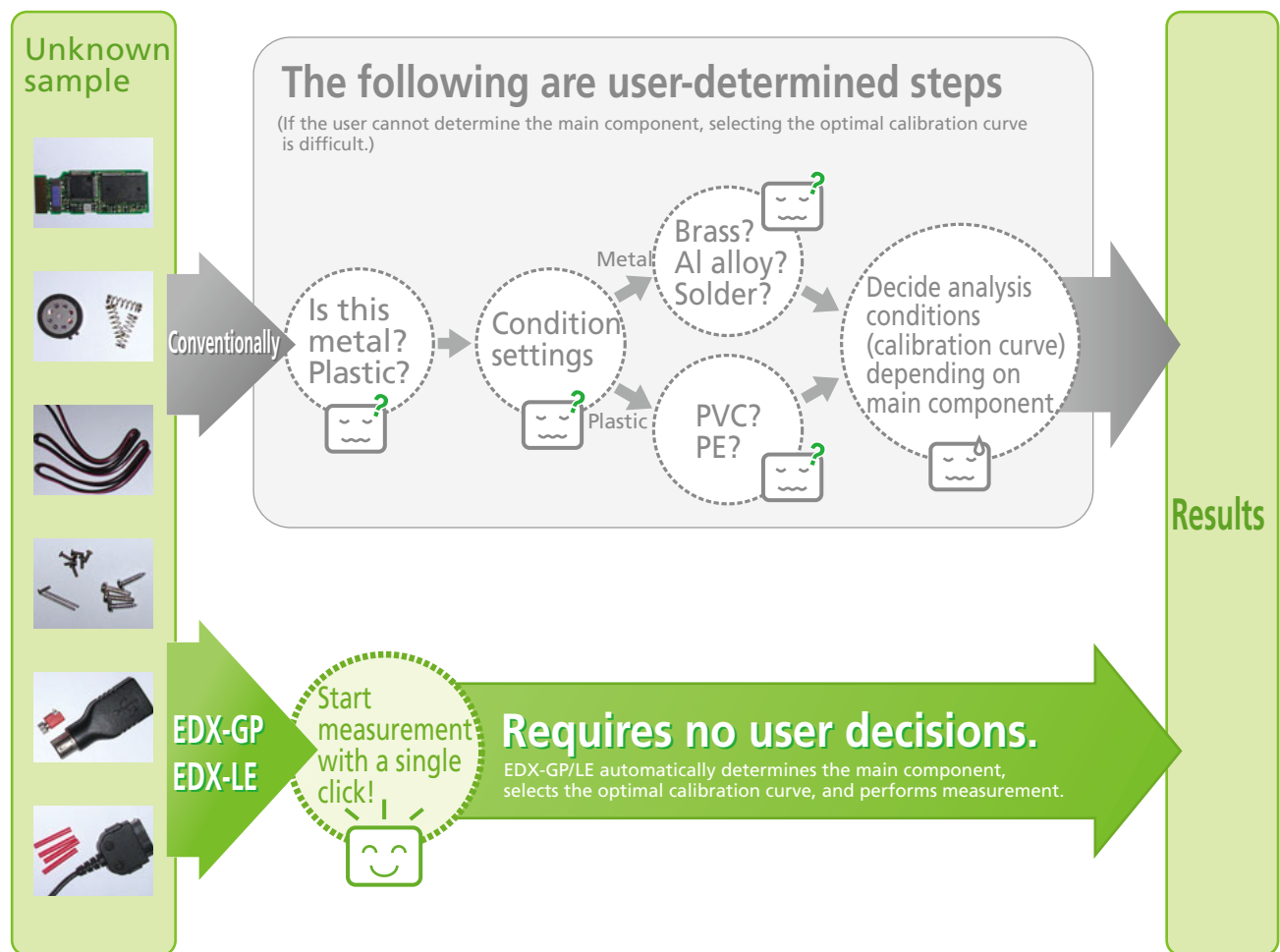
Screening Software Features

A single click in the [Screening Analysis] window automatically performs everything from measurement to the display of results, in accordance with your pre-registered analysis conditions.



All steps, from judgment of the main components to the selection of conditions, are automated

Automatic Calibration Curve Selection Function



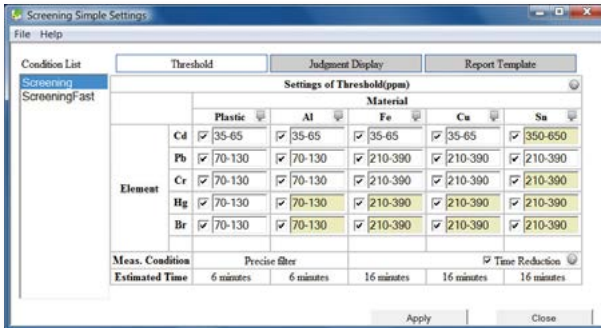
Variety of functions makes screening easier

Simple Screening Setup

Screening conditions can be customized easily according to the control system.

Changing Threshold Values

Threshold values can be set for each material or element. The screening judgment method can also be changed in accordance with the input method used for threshold values. Furthermore, lower limits for threshold values can be referenced for each material, which helps to set threshold values.

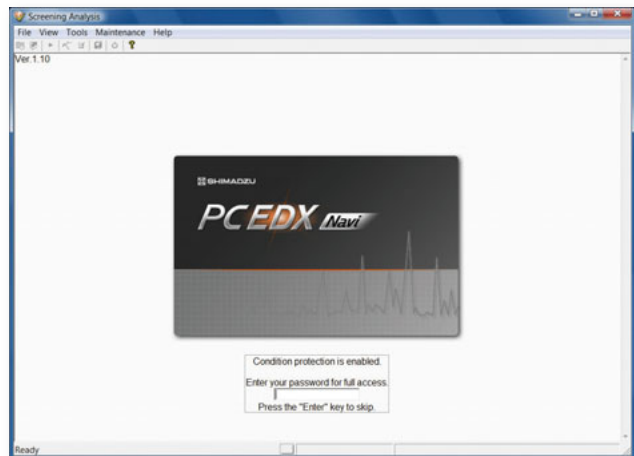


Condition List	Threshold	Settings of Threshold(ppm)				
		Material	Plastic	Al	Fe	Cu
ScreeningFast	Cd	<input checked="" type="checkbox"/> 35-65	<input checked="" type="checkbox"/> 35-65	<input checked="" type="checkbox"/> 35-65	<input checked="" type="checkbox"/> 35-65	<input checked="" type="checkbox"/> 350-650
	Pb	<input checked="" type="checkbox"/> 70-130	<input checked="" type="checkbox"/> 70-130	<input checked="" type="checkbox"/> 210-390	<input checked="" type="checkbox"/> 210-390	<input checked="" type="checkbox"/> 210-390
	Cr	<input checked="" type="checkbox"/> 70-130	<input checked="" type="checkbox"/> 70-130	<input checked="" type="checkbox"/> 210-390	<input checked="" type="checkbox"/> 210-390	<input checked="" type="checkbox"/> 210-390
	Hg	<input checked="" type="checkbox"/> 70-130	<input checked="" type="checkbox"/> 70-130	<input checked="" type="checkbox"/> 210-390	<input checked="" type="checkbox"/> 210-390	<input checked="" type="checkbox"/> 210-390
	Br	<input checked="" type="checkbox"/> 70-130	<input checked="" type="checkbox"/> 70-130	<input checked="" type="checkbox"/> 210-390	<input checked="" type="checkbox"/> 210-390	<input checked="" type="checkbox"/> 210-390
Meas. Condition		Precise filter		<input checked="" type="checkbox"/> Time Reduction		
Estimated Time		6 minutes	6 minutes	16 minutes	16 minutes	16 minutes

EDX-LE Offers Improved Security for Software Operations

Condition Protection Function

Restrictions can be specified for screening conditions and various other settings.



Changing Judgment Character Strings

The character strings displayed for judgments in analysis results, used to indicate whether they are below the threshold value, in the gray zone, or above the threshold value, can be specified.

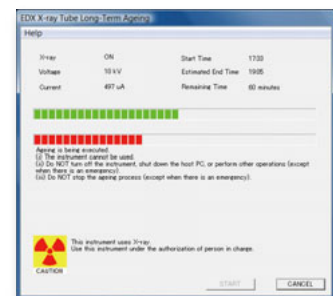
Changing the Report Template

The style used for reports can be changed. The standard templates provided can be selected.

Variety of functions minimizes instrument maintenance requirements

Automatic X-ray Tube Ageing Function

If the instrument has not been used for a long time, the X-ray tube must be aged when it is restarted. To prevent malfunction, this process has been automated.



Fully Equipped with Essential Functions

All-in-One Design Includes All Functions Required for RoHS/ELV Screening

Overall RoHS/ELV analysis performance is tied to the smooth coordination of a variety of analytical systems, creating a synergistic effect. For this reason, EDX-GP/LE standard equipment includes all the functions required for RoHS/ELV analysis, providing users with the optimal RoHS/ELV screening System.

Obtaining highly reliable analytical results

Calibration Curve Method and FP Method

To improve the reliability of analysis results for elements specified by the RoHS/ELV directive, the elements are analyzed using the calibration curve method and standard sample (check sample) provided with the instrument. (The

Fundamental Parameter (FP) method is used to analyze some RoHS elements in metal samples.) Any other elements detected are analyzed using the FP method, which uses theoretical calculations to provide additional information.

Compensates for the influence of differences in shape of actual samples on analysis results

Shape Correction Function

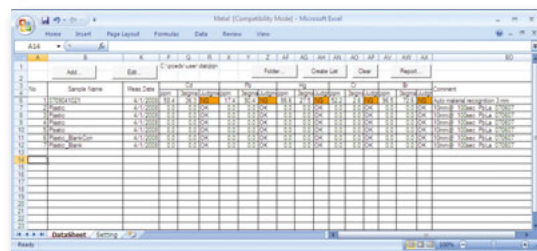
X-ray intensity differs with the shape and thickness of samples, even if they contain the same material, and will have an impact on quantitative values.

EDX-GP/LE utilizes a BG internal standard method* to eliminate the effect of shape and thickness in order to provide highly precise results.

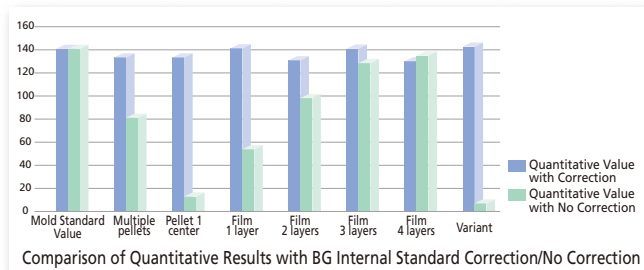
Organize measurement results in a list

List Creation Function

List data stored in Excel format.



Note that this requires installation of Microsoft Office Excel before use.



*BG internal standards method:
Fluorescent X-ray intensity of each element is standardized using scattered X-ray intensity.

Large Sample Chamber

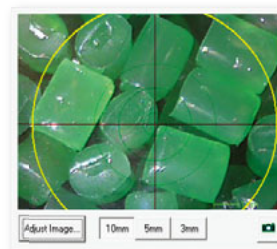
Despite its compact body, the EDX can accommodate sample larger than one would imagine (up to W 370 mm x D 320 mm x H 155 mm).



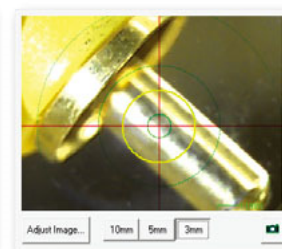
Accommodates a Variety of Samples

Sample Observation Function

When measuring foreign substances and samples with multiple parts, the sample observation camera allows the analysis position to be easily specified by checking the camera image. If the sample is small or if specific locations on the sample are being measured, the collimator can be used to change the X-ray exposure region.



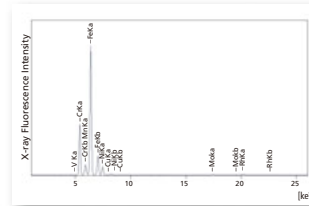
10 mm dia. image (plastic)



3 mm dia. image (metal)

Qualitative-Quantitative Analysis *Additional function kit is required for EDX-LE.

The EDX-GP is equipped with software that supports general analysis, so it can also perform qualitative analysis and non-standard quantitative analysis based on the FP method. This means it can be used to analyze foreign substances or differentiate between different materials.



Qualitative Profile of Stainless Steel

Analyte	Result	[D-orig]	Proc. Calc.	Line
Fe	71.443 %	[0.241]	Quant.-FP	FeKa
Cr	18.810 %	[0.105]	Quant.-FP	CrKa
Ni	7.662 %	[0.155]	Quant.-FP	NiKa
Mn	1.444 %	[0.054]	Quant.-FP	MnKa
Cu	0.239 %	[0.033]	Quant.-FP	CuKa
V	0.242 %	[0.059]	Quant.-FP	VKa
Ti	0.053 %	[0.014]	Quant.-FP	TiKa

Quantitative Analysis Results for Stainless Steel (FP Method)

Matching (Steel Type Identification, Product Identification) *Additional function kit is required for EDX-LE.

Comparing measurement data to a data library of steel types allows automatic identification for everything from materials closest to the sample, to the 10th position on the library list. In addition to matching by intensity, matching by content is also available if the user creates and registers libraries of concentrations and elements.

Candidate	Dif. Factor
SUS_304N2	0.62107
SUS_304L	0.62523
SUS_304	0.68544
SUS_321	0.67971
SUS_304LN	0.74885
SUS_347	0.82780
SUS_305	0.85301
SUS_303	0.93634
SUS_303Se	0.95500
SUS_302	1.07375

Intensity Matching Results

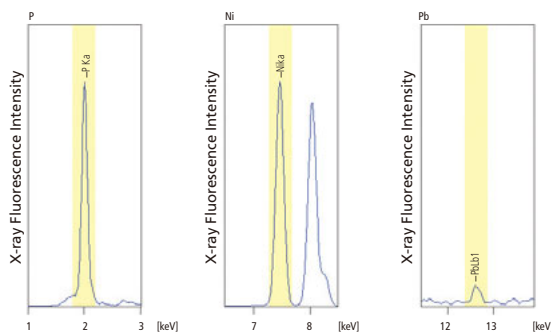
Element	Content(%)	Element	Content(%)
1	71.443	17	0.053
2	18.810	18	0.242
3	7.662	19	0.239
4	1.444	20	0.054
5	0.239	21	0.033
6	0.242	22	0.059
7	0.053	23	0.014
8	0.014	24	0.014
9	0.014	25	0.014
10	0.014	26	0.014
11	0.014	27	0.014
12	0.014	28	0.014
13	0.014	29	0.014
14	0.014	30	0.014
15	0.014	31	0.014
16	0.014	32	0.014

Element and Content Registration Window

Thin-Film Analysis *Additional function kit is required for EDX-LE.

The Film FP method obtains not only single layer, but multilayer film thickness, composition, and deposit volume. It is also well-suited to the measurement of Pb contained in plating. (Information on the layer order (including base) and the constituent elements is necessary.)

Result of Qualitative Analysis

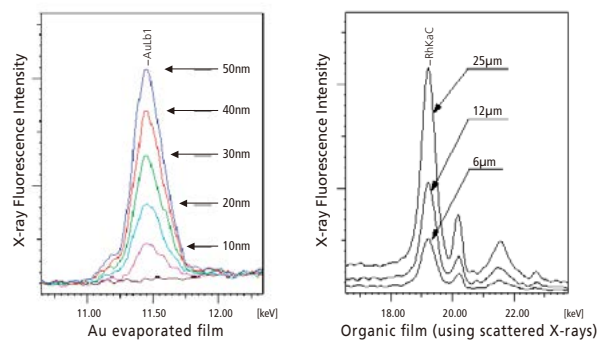


* Trace amounts of lead as a stabilizer detected

Result of Quantitative Analysis

Layer Info	Analyte	Result	(Std. Dev.)	Proc.-Calc.	Line
1 Layer1					
1 Layer Layer1				Total	
1 Elem. Ni		5.632	μm	(0.052)	Quan FP NiKa
1 Elem. Pb		286.656	ppm	(24.888)	Quan FP PbLb1
1 Elem. P		9.371	%	(0.037)	Quan FP P Ka
B Base					
B Elem. Cu		100.000	%	(-----)	Fix

Example of Measurement of Electroless Ni-P Plating



Example of Thickness Measurement for Thin-Film Sample

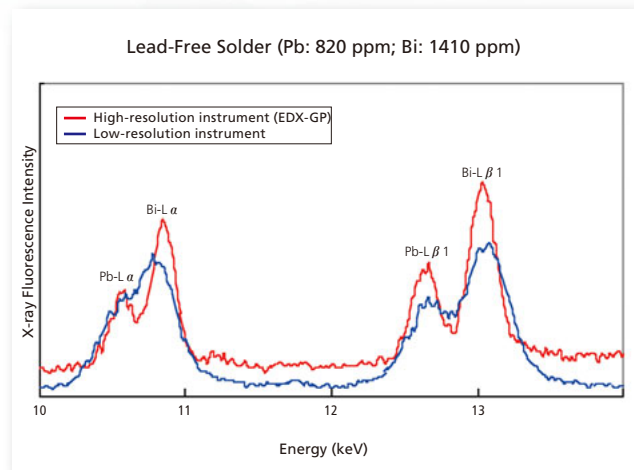
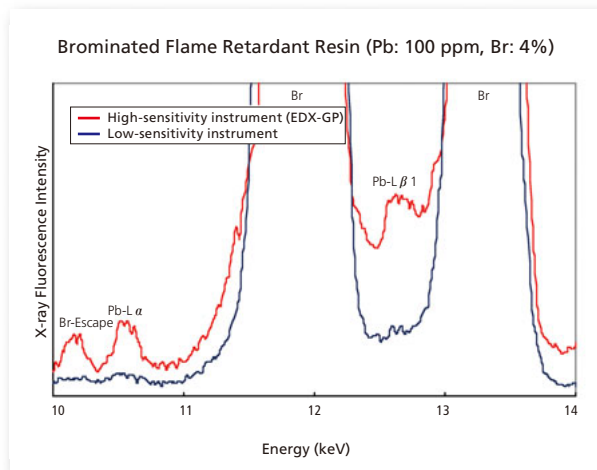
EDX-GP

Suitable for screening required by RoHS/ELV and various other regulations

- Industry-leading detection sensitivity and resolution
- Fast, high-sensitivity measurements of even trace elements
- High-precision measurement, even of multi-element compounds



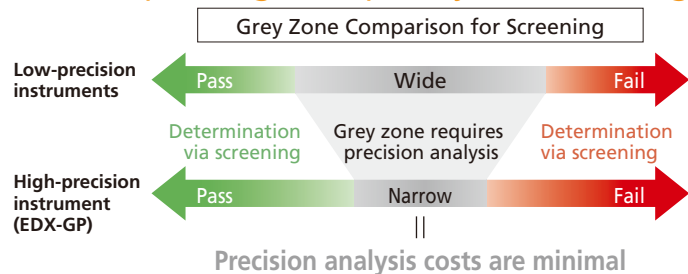
A high-sensitivity, high-resolution instrument is essential for screening complex samples containing many kinds of coexisting elements



To precisely analyze the hazardous element lead in samples containing brominated flame retardant or in solder samples containing bismuth, it is necessary to increase the intensity of X-ray fluorescence peaks for lead or increase their separation from neighboring peaks for other elements.

A highly precise instrument is essential for improving the quality of screening

According to the IEC recommendation, pass/fail judgments greatly rely on measurement repeatability. As a result, the better the measurement repeatability (i.e. the higher precision), the better the pass/fail judgment will be.



EDX-LE



Makes RoHS/ELV screening even easier

- Reduces routine maintenance (no liquid nitrogen necessary)
- Protection functions restrict changing conditions or data
- Simple screening setting functions can be easily changed according to the control system on the user side

Variety of functions minimizes instrument maintenance requirements

Detector Does Not Require Liquid Nitrogen

The EDX-LE is equipped with a detector that does not need to be cooled with liquid nitrogen, providing significantly reduced operating costs.

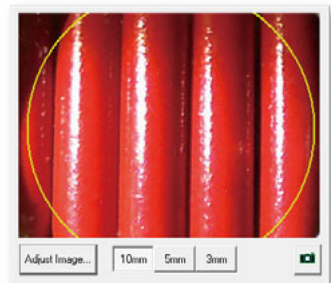
For routine screening work, it is essential to obtain correct judgment results while minimizing operating costs

Example of Measuring Polymer Material (PVC Wire Coating Material)

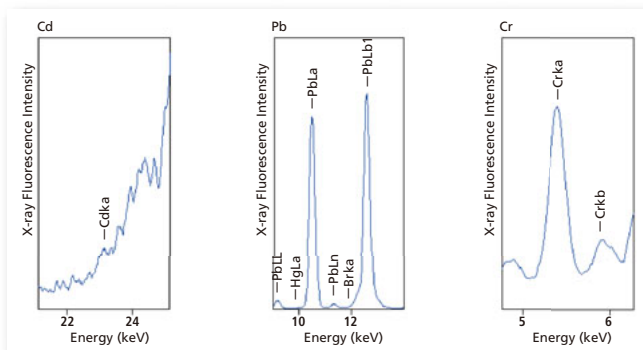
Pass, Fail, and "gray zone" judgment results can be obtained easily for the control criteria.

*The maximum concentrations allowed by the RoHS directive were set as the control criteria for these results.

Element	Cd	Pb	Hg	Br	Cr
Judgment Result	Pass	Fail	Pass	Pass	Gray zone
Quantitative Value (ppm)	Not detected	25500	23.4	26.1	901
3σ (ppm)	7.1	790	19	12	120



PVC Wire Coating Material



Also recommended for China RoHS

Catalog of Items Subject to Pollution Control of Electronic and Electrical Products

On August 30, 2011, the Ministry of Industry and Information Technology of the People's Republic of China officially announced rules for voluntary certification (Uniform Government Promotion of Electronic Information Products' Pollution Control Voluntary Certification).

These rules have been in effect since November 1, 2011 and apply to the following six product categories.

- (1) Small desktop computers and portable computers
- (2) Computer display devices
- (3) Computer printers
- (4) Residential televisions

(5) Mobile communication devices (mobile phones, etc.)

(6) Telephones (including corded and cordless phones)

In addition, the requirements of concentration limits for certain restricted substances in electrical and electronic products (GB/T26572-2011) and determination of six regulated substances (lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls, polybrominated diphenyl ethers) (GB/T26125-2011) took effect on August 1, 2011, and are referred to in the rules for voluntary certification.

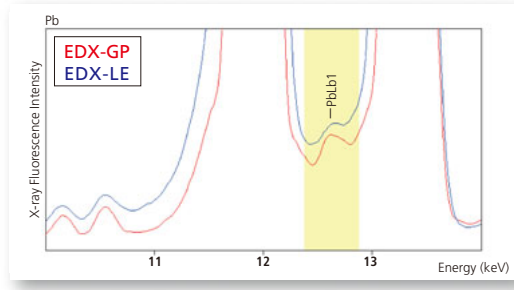
Note: For details regarding these regulations, verify the most up-to-date information.

Differences Between the EDX-GP and EDX-LE

EDX-GP

The EDX-GP is equipped with a high-resolution detector that requires a supply of liquid nitrogen. It is suited to screening applications involving composites or other samples containing many kinds of coexisting elements. Also, because it includes general-purpose analytical software as a standard feature, it can be used for various analytical applications.

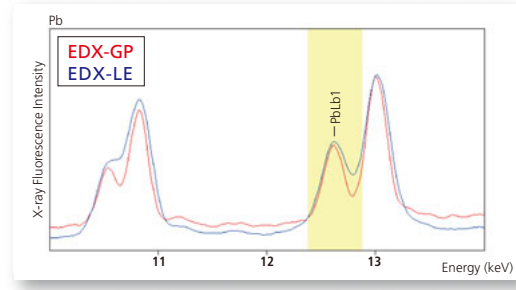
Analysis of Pb in Brominated Flame Retardant



EDX-LE

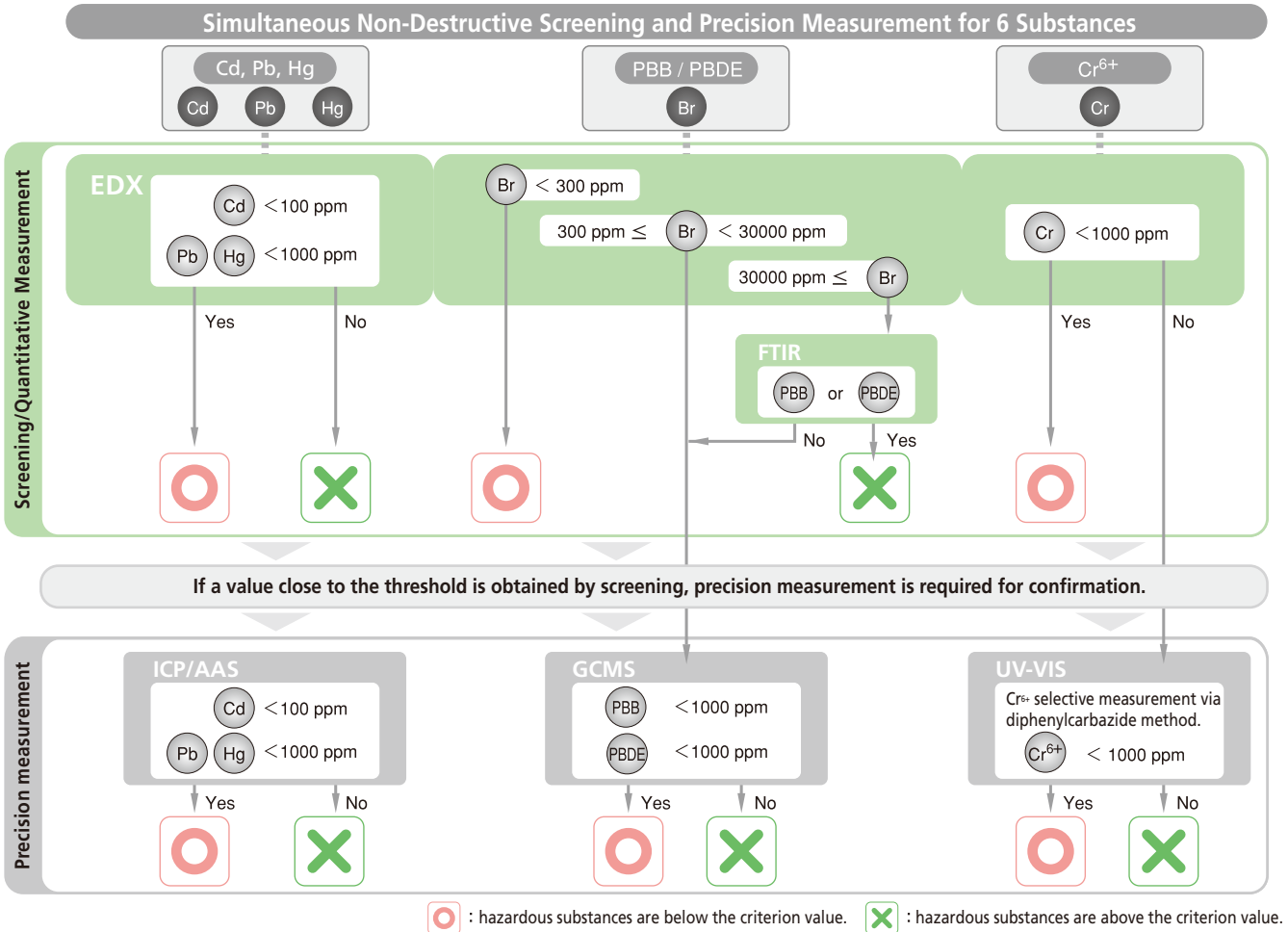
The EDX-LE is equipped with a detector that does not require a supply of liquid nitrogen. It has been optimized for the RoHS/ELV screening of materials, individual parts, and other samples that are substantially homogeneous. It is suited to screening a limited range of samples for fixed control criteria.

Pb and Bi in Solder



Screening Process for RoHS/ELV Judgment

This flowchart shows the procedures recommended by Shimadzu, not those recommended by the IEC.



* The criteria above are the definitive values adopted in RoHS and ELV. If this procedure is used in the manufacturing process for acceptance/shipping inspections for raw materials, parts and materials or products, stricter criteria may have to be adopted in accordance with the client's acceptance standards. Caution is also required regarding the many exempted applications.

* Relationship between Br concentration (assuming Br: 80), and maximum permitted content of polybrominated biphenyl (PBB) and polybrominated diphenyl ethers (PBDE)

- Br concentration in 1000 ppm mono-BB: $1000 \times 80 / 233 = 343$ ppm
- Br concentration in 1000 ppm mono-BDE: $1000 \times 80 / 249 = 321$ ppm

If the quantity of Br in resin is known to be less than 320 ppm, whatever the bromine substitution, the concentration of a PBB or PBDE will be less than 1000 ppm. On the other hand, even if the Br concentration is 650 ppm, which is below 1000 ppm, we cannot say that this is a conforming result, because if all the Br originates from mono-BDE, then the PBB/PBDE concentration will in fact be 2000 ppm or more.

Instrument Specifications

Primary Specifications	EDX-GP	EDX-LE
Measurement Principle	X-ray fluorescence spectrometry	
Measurement Method	Energy dispersive	
Measurement Sample Type	Solids, liquids, or powder	
Elements to be Detected	¹³ Al to ⁹² U	
Sample Chamber Size	Max. W 370 mm × D 320 mm × H 155 mm	

X-Ray Generator

X-Ray Tube	Rh target	
Tube Voltage	5 kV to 50 kV	
Tube Current	1 μA to 1,000 μA	
Cooling Method	Air cooling (with fan)	
Exposure Area	Automatic switching between 1, 3, 5, and 10 mm dia. areas	Automatic switching between 3, 5, and 10 mm dia. areas (1 mm is an option)
Primary Filter	Automatic switching between: 5 types + OPEN	

Detector

Type	Si (Li) semiconductor detector	Si-PIN semiconductor detector
LN ₂ Supply	Only during measurement	Not required
Dewar Capacity	3 L	—
Nitrogen Consumption	Approx. 1 L/day	—
Counting Method	Digital filter counting	

Sample Chamber

Measurement Atmosphere	Air
Sample Observation	CCD camera

Data Processing Unit

Main Unit	IBM PC/AT compatible equipment
Memory	1 GB min.
HDD	80 GB min.
Resolution	1024 × 768 pixels min.
Printer	Color inkjet printer
CD	CD-ROM drive
OS	Windows 7

Software

Screening Analysis	Simple operation software	
Qualitative Analysis	Measurement/analysis software	
Quantitative Analysis	Calibration curve method, FP method	
	Thin-Film FP method, BG-FP method	Option
Matching Software	Intensity/content	Option
Utilities	Automatic calibration functions (energy calibration, full-width half-maximum calibration)	
Other Functions	System-status Monitoring Function	
	Analysis-results Tabulation Function	
	Analysis-results Report Creation Function	

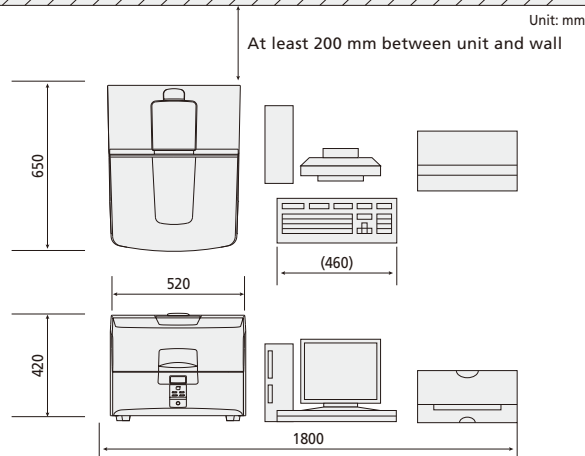
Installation Requirements

	Guaranteed Performance	Guaranteed Operation
Temperature	10°C to 30°C (fluctuations should be 2°C/hour max.)	5°C to 35°C
Humidity	40% to 70% (No condensation)	40% to 70% (No condensation)
Power Source	AC 100V to 240V +/-10% 50/60Hz, 150VA grounded outlet Power for peripheral devices (printer, PC, display monitor, etc.) must be provided separately.	

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Installation Example

Dimensions of the main unit	W 520 mm × D 650 mm × H 420 mm
Main Unit Weight	GP: Approx. 65 kg LE: Approx. 60 kg



Options

Halogen Screening Analysis Kit

P/N 212-24908-91

This kit includes an instruction manual for Halogen analysis and a check sample required for measurement of 6 elements (Cd, Pb, Hg, Cr, Br, and Cl) specified by the RoHS directive and Halogen regulation.

Small Spot Solder Analysis Kit

P/N 212-24850-41

This kit includes an instruction manual for small spot solder analysis and a small spot collimator plate required for measurement of a print circuit board.

RoHS, Halogen, and Antimony Screening Analysis Kit

P/N 212-24922

This kit includes an instruction manual and a check sample required for measurement of 7 elements including those specified by the RoHS directive, Halogen regulation, and Antimony (Cd, Pb, Hg, Cr, Br, Cl, and Sb)

Additional Function Kit for EDX-LE

P/N 212-24922-91

Adds a general-analysis function to the EDX-LE. For details, please contact your Shimadzu representative.

Sample Cells

3571 General Open-End X-Cell (no lid)

P/N 219-85000-55 (100 pcs/set)

(Outer diameter: 31.6 mm, volume 10 mL)

Polyethylene sample cell used for liquid and powder samples. Used with Mylar or polypropylene films.



3529 General X-Cell (with lid)

P/N 219-85000-52 (100 pcs/set)

(Outer diameter: 32 mm, volume 8 mL)

Used for liquid samples. Equipped with relief hole and liquid retainer in case of liquid expansion.



3577 Micro X-Cell

P/N 219-85000-54 (100 pcs/set)

(Outer diameter 31.6 mm, volume 0.5 mL)

For trace samples. Use with a collimator is recommended to reduce scattered radiation emitted by sample cell.



3561 Universal X-Cell

P/N 219-85000-53 (100 pcs/set)

(Outer diameter 31.6 mm, volume 8 mL)

For liquid and thin-film samples. Equipped with a relief hole and liquid retainer in case of liquid expansion. Equipped with a ring for tightly holding thin-film samples with film.



Polypropylene Film

P/N 219-82019-05 (73 mm W × 92 m roll)

Sample-holding film. (For light element analysis)

Mylar Film

P/N 202-86501-56 (500 sheets/set)

Sample-holding film. (For heavy element analysis)

X-ray Fluorescence Spectrometer Product Line

XRF-1800 Sequential X-ray Fluorescence Spectrometer



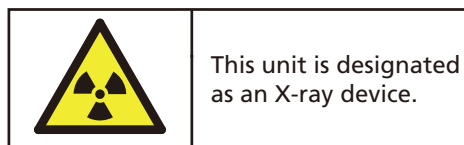
- World's first 250- μm mapping capability achieved with wavelength-dispersive instrument (patented)
- Accurate qualitative-quantitative analysis using higher-order X-ray profiles (patented)
- Background FP method enables measuring thickness and inorganic components in thin polymer films (patented)
- Greater stability achieved by incorporating hardware with proven track record
- Template and matching functions incorporate Shimadzu's accumulated know-how

EDX-720/800HS

Energy Dispersive X-ray Fluorescence Spectrometer



- Large sample chamber with automatic opening and closing
- Equipped with 5 types of filters, providing high-sensitivity analysis
- Equipped with high-count rate circuit, ensuring high speeds and precision
- Analysis is possible in both He and vacuum environments (optional)
- High-sensitivity analysis is possible with everything from light to heavy elements
- Continuous measurements with a 16/8 sample turret (optional)



Shimadzu Corporation

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