



BLUE DRAGON T E C H N O L O G Y

ElementX B1

VACUUM BENCHTOP X-RAY FLUORESCENCE SPECTROMETER

Operation, Installation & Maintenance Manual



Blue Dragon Elemental Analysis & Materials Characterization

Document No. BD-EXB1-MAN-EN | Revision A | 27 July 2026
For trained and authorised operation and maintenance personnel



Document Control

This manual consolidates the approved Blue Dragon product configuration, the available manufacturer operation manual, technical specification brochure, manufacturer clarifications, and Blue Dragon safety and quality guidance. The packing list, factory test report, certificate package, final software build, installed application modes, and serial-number-specific labels supplied with the instrument govern the delivered configuration.

Field	Details
Product	Blue Dragon ElementX B1 Vacuum Benchtop X-ray Fluorescence Spectrometer
Document	Operation, Installation & Maintenance Manual
Document number	BD-EXB1-MAN-EN
Revision	A - Initial Blue Dragon release
Release date	27 July 2026
Language	English
Product family	Blue Dragon ElementX Series - Elemental Analysis & Materials Characterization
Standard configuration	Mg-U vacuum benchtop EDXRF; Fast-SDD detector; 50 kV / 1 mA X-ray tube; single 6 mm collimator; 10.1-inch integrated touchscreen; 90 L/min vacuum pump; Blue Dragon elemental analysis software
Standard warranty	12 months, subject to the sales contract

Revision History

Revision	Date	Description	Prepared by
A	27 July 2026	Initial Blue Dragon manual incorporating manufacturer documentation, technical clarifications, Blue Dragon branding, and enhanced safety, maintenance and quality guidance.	Blue Dragon Technology

IMPORTANT

The ElementX B1 generates ionising radiation when the X-ray tube is energised. Operate only under applicable national and local radiation-control requirements. Normal operation is conducted with the sample chamber fully closed and the interlock system functional. Do not defeat shielding or interlocks. Validate analytical performance for the intended sample matrix before compliance, custody-transfer or safety-critical decisions.



Contents

Section	Title	Page
1	Product Overview and Box Opening Inspection	3
2	Safety Information	5
3	Product Structure and Controls	6
4	Product Installation	8
5	Operating Precautions and Start-up	10
6	Sample Handling and Routine Measurement	12
7	Measurement Principle and Analytical Performance	13
8	Software Installation and Configuration	14
9	Software Interface	15
10	Spectral Display and Interpretation	17
11	Preheat, Initialization and Calibration Verification	18
12	Measurement Settings and Test Workflow	19
13	Results, Reports, History and Reference Spectra	20
14	Data Management and Software Maintenance	22
15	Routine Maintenance and Service	23
16	Troubleshooting and Frequently Asked Questions	24
17	Storage, Transportation and Disposal	25
18	Warranty and Technical Support	26
Appendix A	Quick Start Checklist	27
Appendix B	Installation and Commissioning Checklist	28
Appendix C	Maintenance Log	29
Appendix D	Configuration Record	30
Appendix E	Application Data Sheet	31
Appendix F	Standard Supply and Optional Accessories	32
Appendix G	Radiation-Safety Verification Record	33



1. Product Overview and Box Opening Inspection

1.1 Product Overview

The Blue Dragon ElementX B1 is an integrated vacuum benchtop energy-dispersive X-ray fluorescence spectrometer for rapid, non-destructive qualitative and quantitative elemental analysis. The X-ray source, Fast-SDD detector, digital pulse-processing electronics, vacuum chamber, industrial computer, touchscreen and analysis software are housed in a compact laboratory platform. An external precision vacuum pump evacuates the sample chamber to improve the measurement of lighter elements within the configured Mg-U range.

1.1.1 Design and Performance Advantages

- Integrated architecture: the industrial computer and 10.1-inch touchscreen are built into the instrument, reducing desk space and external cabling.
- Vacuum optical path: the evacuated measurement chamber reduces air absorption and improves sensitivity for lighter elements, subject to calibration and sample preparation.
- Fast-SDD detection: the large-area electrically cooled detector supports high count rate, good peak-to-background performance and nominal energy resolution of 129 eV +/- 5 eV for the confirmed configuration.
- Flexible analytical software: Blue Dragon elemental analysis software supports Fundamental Parameters, empirical-coefficient and working-curve methods, spectrum review, configurable reports, historical queries and reference-spectrum comparison.
- Closed-chamber safety: radiation shielding, hardware interlocks, status indicators and audible/visual alarms are designed to prevent X-ray generation under unsafe conditions.
- Integrated sample camera: the autofocus macro camera supports sample positioning and documentation.

1.1.2 Technical Parameters

Parameter	Specification
Product	Blue Dragon ElementX B1 Vacuum Benchtop X-ray Fluorescence Spectrometer
Measurement principle	Energy-dispersive X-ray fluorescence (EDXRF)
Element range	Mg to U, subject to installed calibration, matrix and application mode
Concentration range	Nominal 1 ppm to 99.99%; not a universal detection limit for every element
Detector	Large-area Fast-SDD; nominal resolution 129 eV +/- 5 eV
Pulse processor	Digital multi-channel analyser; 4096 channels standard, up to 8192 configurable
X-ray tube	Tungsten target; beryllium window; maximum 50 kV / 1 mA
High-voltage control	Continuously adjustable 5-50 kV; overload protection and emergency-stop functions; stated 8-hour stability <=0.05%
Collimator	Single 6 mm aperture, confirmed standard configuration
Camera	Autofocus 8 MP macro camera
Vacuum chamber	Nominal diameter 120 mm x height 80 mm
Vacuum pump	Low-noise precision pump; nominal geometric pumping rate 90 L/min
Computer	Industrial 4-core / 4-thread controller, nominal 2.5-2.6 GHz, 8 GB RAM
Display	10.1-inch capacitive multi-touch display
Software	Blue Dragon elemental analysis software; multiple languages; FP, empirical-coefficient and working-curve methods
Interfaces	USB 2.0 x2; RJ45 x1; vacuum-control interface x1; Wi-Fi where fitted
Dimensions	470 mm (L) x 390 mm (W) x 350 mm (H)
Weight	Approximately 35 kg, main unit
Operating environment	15-35 degC; 30-80% RH, non-condensing
Power supply	AC 220 V +/-5 V, 50 Hz unless otherwise stated on the delivered nameplate/order
Reported best repeatability	RSD <=0.1% using a suitable national standard reference sample under controlled conditions

NOTE

Specifications describe the confirmed standard configuration and available source documentation. The delivered nameplate, factory test report, software About screen and order confirmation take precedence. Performance depends on element, concentration, matrix, preparation, measurement time and calibration.



1.1.3 Intended Applications

Application capability is determined by the installed calibration package. Typical uses include:

- Alloy composition analysis, positive material identification, metal recycling and sorting.
- Metallurgy, power generation, coal and chemical materials, including fly ash, fluxes, slags, catalysts, refractories, ferroalloys, cement raw materials and clinker.
- Mining and mineral materials, including iron, lead-zinc, manganese, titanium, copper and chromite ores; limestone, dolomite, quartz, gangue and related geological samples.
- Precious-metal processing and screening, subject to the installed curve and validation.
- Soil and environmental heavy-metal screening.
- RoHS and packaging-hazardous-substance screening where the appropriate application package is installed.
- Coating and layered-material evaluation where an approved coating-thickness method is supplied.

IMPORTANT

An element being within the Mg-U range does not establish a guaranteed detection limit or quantitative accuracy. Confirm the installed curve and validate representative samples against certified reference materials or a suitable laboratory method.

1.2 Box Opening Inspection

Inspect the outer packaging before opening. Record any impact, crushing, water entry, puncture or tampering. Open the package carefully and retain all packaging for future transport, storage or warranty evaluation.



Figure 1-1. Blue Dragon ElementX B1 vacuum benchtop X-ray fluorescence spectrometer.

Verify the delivered items against the serial-number-specific packing list. The standard supply normally includes:

- ElementX B1 main instrument.
- Precision vacuum pump, vacuum hose and required connection cable(s).
- Standard or calibration sample block.
- Main power cable.
- USB flash drive, nominal 32 GB.
- Wireless keyboard and mouse set.
- Test films, nominal quantity 20.
- Operation manual and certificate of conformity.
- Factory test report and CE documentation where included in the order.

Inspect the chamber, detector window, sample stage, collimator, camera, lid, gas supports, touchscreen, switches, indicators, connectors, vacuum pump and cables. Do not energise equipment that is visibly damaged, wet, deformed or missing safety components.

2. Safety Information

WARNING

The ElementX B1 contains an X-ray tube and generates ionising radiation only when the tube is energised.



Never operate the instrument with the lid open, a defeated interlock, damaged shielding or an abnormal X-ray status indication.

2.1 Authorised Use

- Operate only after completing instrument, application and radiation-safety training required by the responsible organisation and local regulator.
- Keep the instrument and administrator credentials secured against unauthorised access.
- Do not alter tube settings, calibration factors, interlocks, shielding or service menus without written technical authorisation.
- Use the instrument only for samples and applications compatible with the installed calibration and chamber arrangement.

2.2 Radiation Safety

- Normal measurement is performed with the chamber fully closed and interlocked. Protective clothing is not required for routine intact closed-chamber operation unless required by local rules or the site radiation-safety programme.
- Observe the X-ray active indicator and software status. Do not open the chamber until the measurement is complete and the high-voltage indicator is off.
- Do not bypass the lid interlock. Do not place hands, tools or samples into the chamber while the X-ray tube is active.
- Complete acceptance testing, radiation surveys and periodic leakage verification where required by regulation or site procedure.
- Apply time, distance and shielding principles during service, abnormal-condition management and radiation surveys.
- If the instrument is dropped, deformed, opened without authorisation or shows abnormal X-ray status, stop use, disconnect power, secure the instrument and contact Blue Dragon Technology.

2.3 Electrical and Vacuum Safety

- Use a correctly grounded AC supply matching the nameplate. Do not use damaged cords, loose sockets, unapproved adapters or wet connections.
- Power off and disconnect the mains before connecting or disconnecting the vacuum pump or opening external service panels.
- The vacuum chamber and hose can experience pressure differential. Use only approved hoses and fittings; inspect for cracking, collapse or leaks.
- Keep pump ventilation unobstructed. Stop use if the pump becomes unusually hot, noisy, smoky or unable to achieve vacuum.
- Do not place volatile, flammable or reactive materials in the chamber.

2.4 Detector and Sample Safety

CAUTION

The detector entrance window is extremely fragile. Do not touch, wipe, brush, blow compressed air at or puncture the detector window. Damage from external contact is not covered by warranty.

- Review samples for heat, pressure, sharp edges, toxicity, corrosivity, radioactivity, flammability and contamination before testing.
- Contain powders and liquids in approved sample cups with intact film. Prevent spills and loose particles from entering the chamber.
- Do not test wet, leaking or outgassing samples under vacuum unless an approved method explicitly permits it.
- Use tongs or suitable fixtures for hot, sharp or contaminated specimens.

2.5 Measurement Limitations

XRF results are affected by sample matrix, particle size, moisture, density, thickness, surface finish, curvature, homogeneity, coating, contamination, measurement time, vacuum condition and calibration selection. Use laboratory confirmation and a documented quality-control plan when required.



3. Product Structure and Controls

The illustrations in this section are unbranded reference drawings. The delivered instrument may show minor external differences while retaining the same functional arrangement.

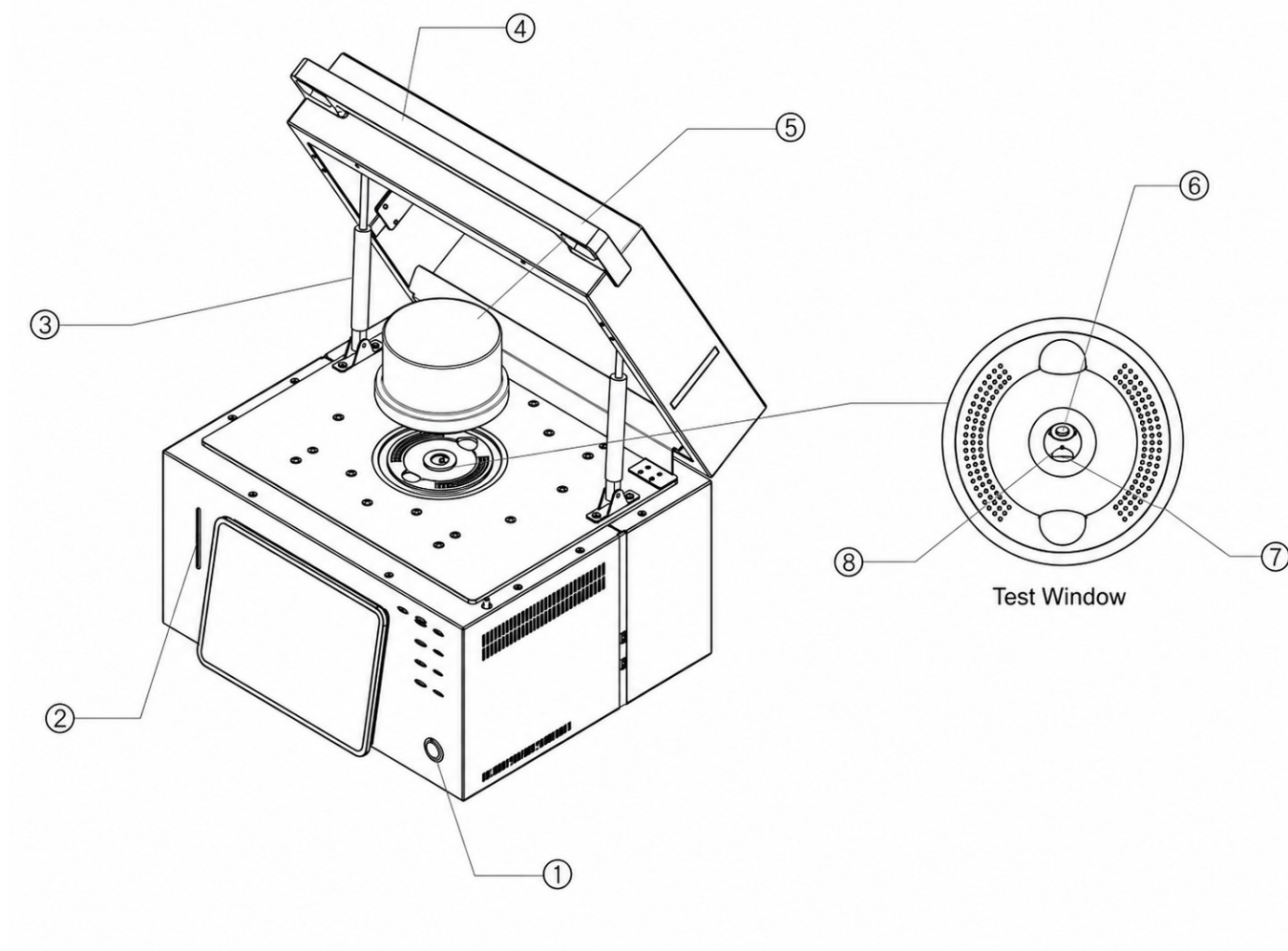


Figure 3-1. Main instrument structure and measurement window.

No.	Component	Function
1	Front power button	Starts or shuts down the integrated computer and control system.
2	X-ray / excitation indicator	Shows X-ray generation or instrument excitation status.
3	Gas support	Supports the lid during sample loading.
4	Handle	Used to open and close the chamber lid.
5	Vacuum cover / lid	Provides chamber closure, shielding and interlock engagement.
6	Detector	Measures characteristic X-ray fluorescence; entrance window is fragile.
7	Collimator	Defines the nominal 6 mm measurement aperture.
8	Camera	Supports sample positioning and image capture.

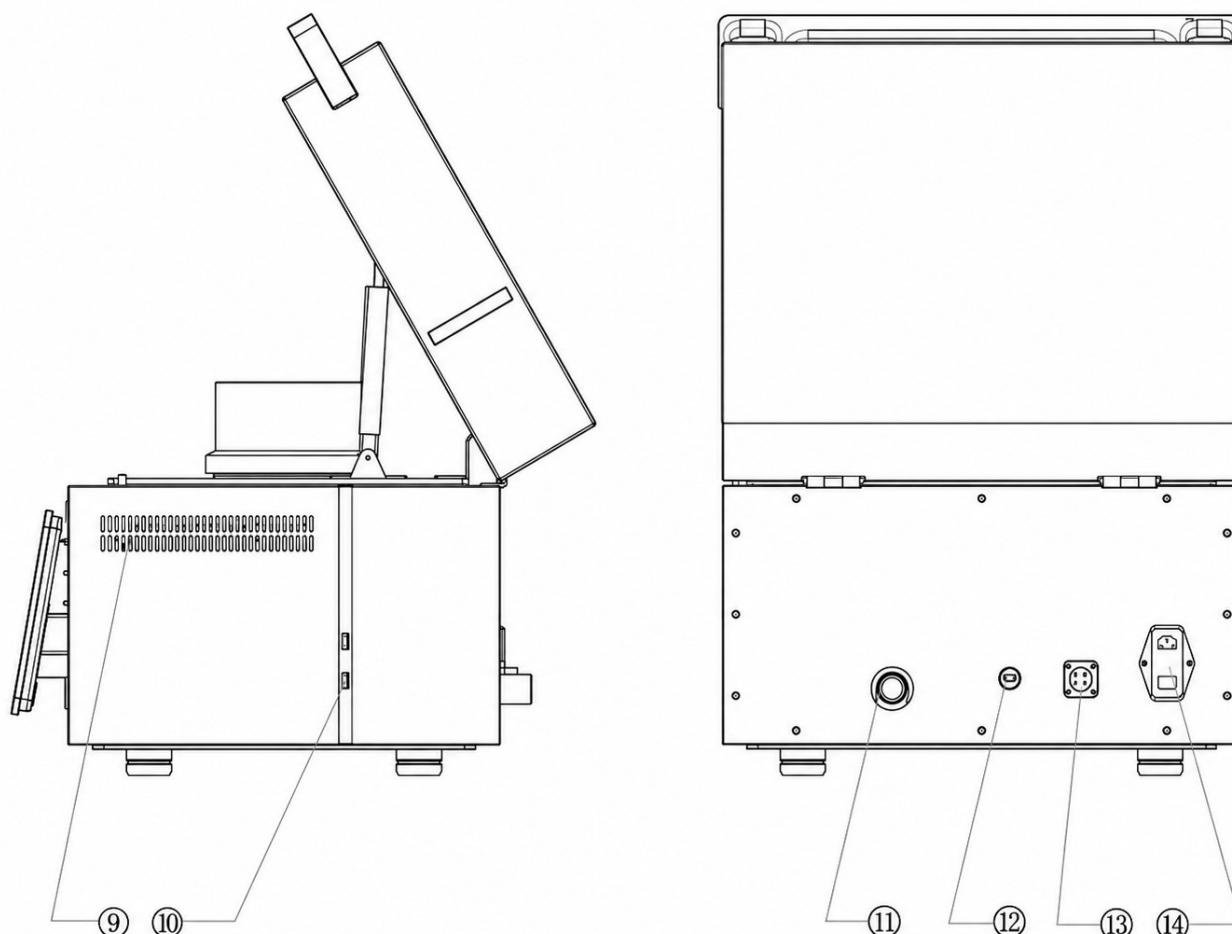


Figure 3-2. Side and rear connections.

No.	Connection / feature	Purpose
9	Heat-emission opening	Instrument ventilation; keep unobstructed.
10	USB port	Keyboard, mouse, storage or approved peripherals.
11	Vacuum-tube interface	Connects the chamber to the vacuum pump.
12	RJ45 network interface	Wired network connection.
13	Vacuum-pump power/control interface	Supplies or controls the approved vacuum pump.
14	Main power interface and switch	AC input and master power isolation.

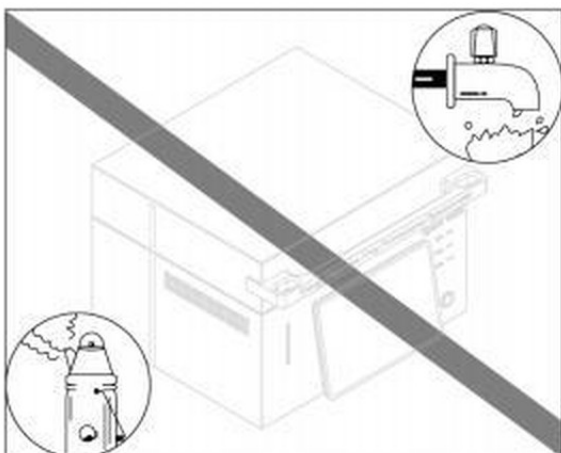


4. Product Installation

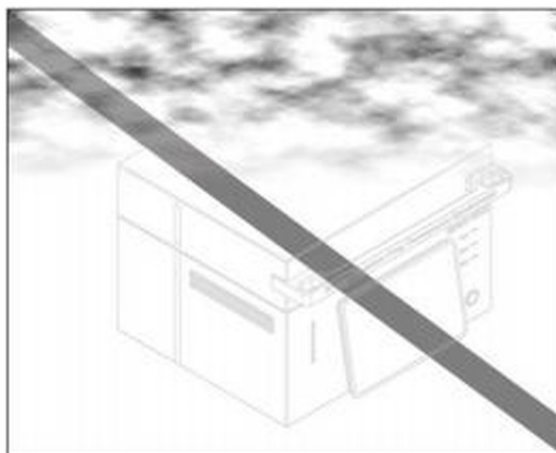
4.1 Installation Environment Requirements

- Indoor laboratory with heating and cooling capable of maintaining 15-35 degC and 30-80% RH, non-condensing.
- Clean, dry, low-dust environment without direct sunlight, water sources, corrosive vapours, strong electromagnetic fields or excessive vibration.
- Stable laboratory bench rated for the instrument, pump, samples and accessories.
- Protective earth connection and dedicated mains supply matching the nameplate.
- Space for lid opening, operator access, vacuum hose routing, ventilation and service.

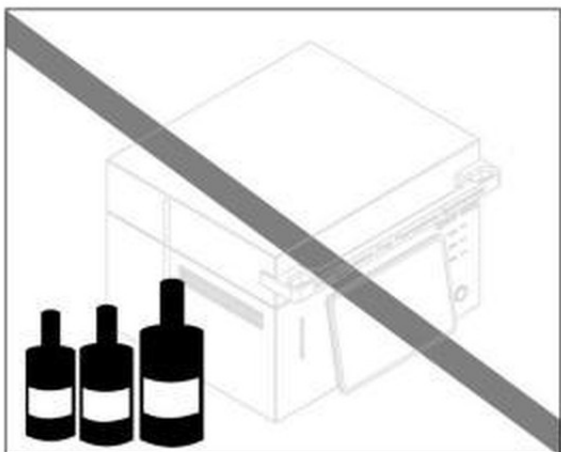
4.2 Installation Precautions



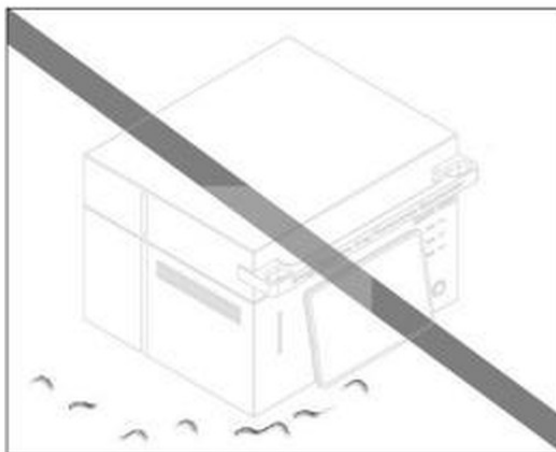
Avoid high humidity, condensation and very low temperature.



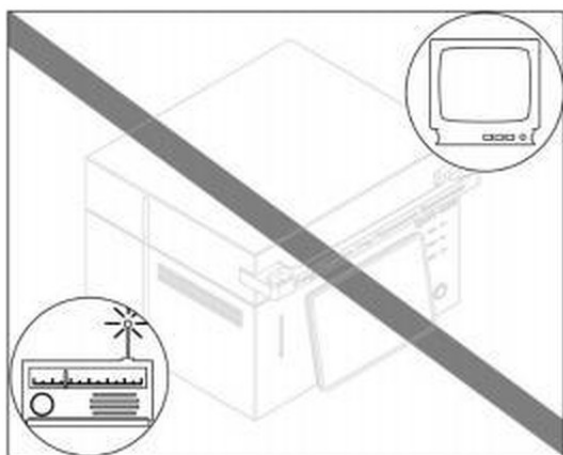
Avoid excessive dust and airborne particles.



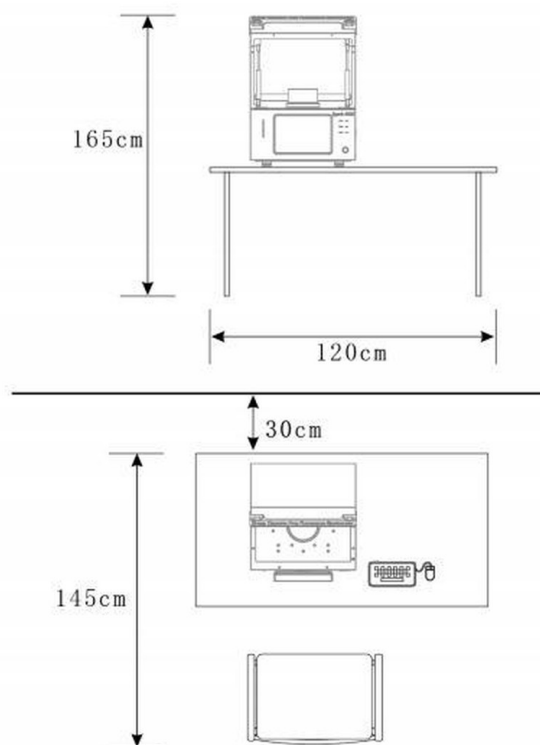
Keep away from volatile or flammable substances.



Do not install on unstable or vibrating supports.



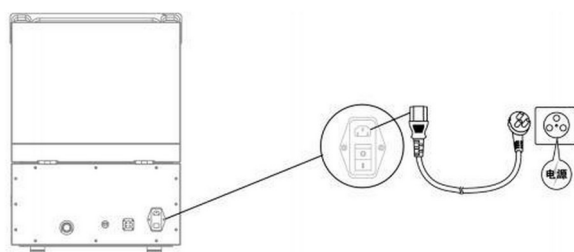
Avoid strong electromagnetic interference.



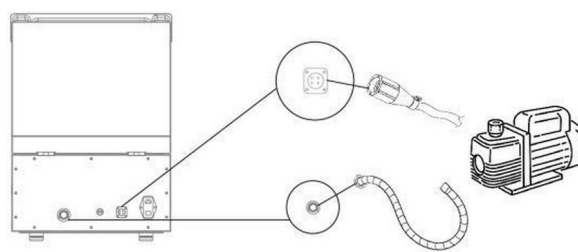
Provide adequate operating and service clearance.

Maintain at least 300 mm clearance from walls and obstructions on each side unless the approved site drawing requires more. The source installation diagram shows a typical 1200 mm wide bench and a minimum working zone sufficient for the open lid and operator access. Verify local ergonomic and safety requirements.

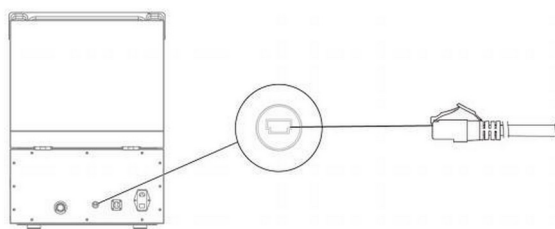
4.3 Instrument Connections



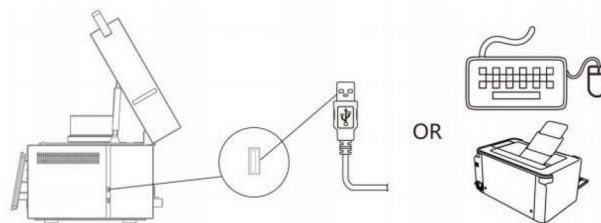
Connect the approved grounded power cable.



Connect the vacuum hose and approved pump connection.



Connect RJ45 or approved Wi-Fi where available.



Connect the supplied keyboard, mouse or approved USB device.

1. Place the instrument and pump on a stable bench. Ensure all ventilation openings remain clear.
2. With all power switches OFF, connect the vacuum hose firmly between the instrument and pump.
3. Connect the pump power/control cable to the designated interface. Do not connect an incompatible pump.
4. Connect the grounded main power cable to the instrument and dedicated outlet.
5. Connect keyboard, mouse, network and printer only after the required drivers and site security controls are confirmed.

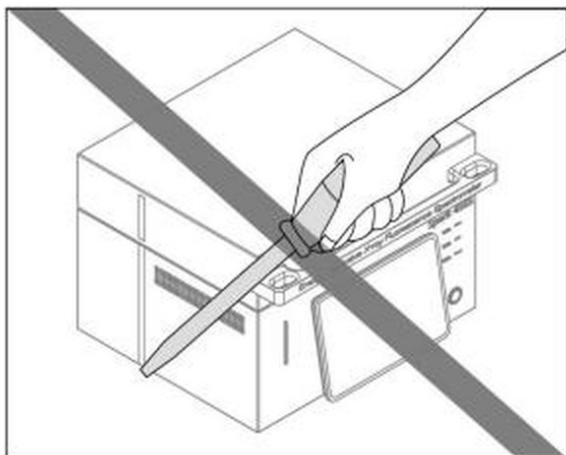


4.4 Commissioning

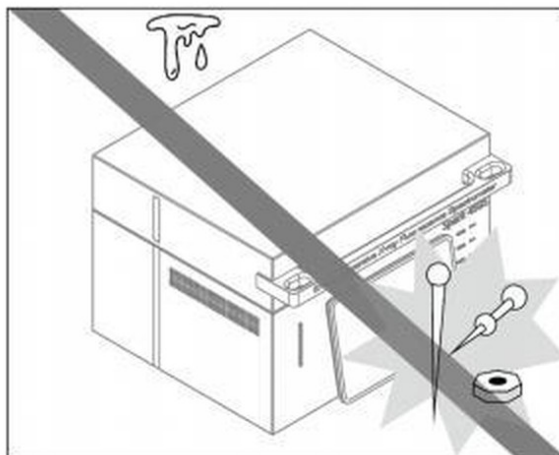
- Confirm model, serial number, nameplate supply, factory test report and certificate package.
- Inspect chamber, lid, interlock, detector window, collimator, camera and vacuum connections.
- Start the instrument and verify normal indicators, touchscreen, pump operation and vacuum status.
- Review software version, installed curves, administrator credentials, report settings, language and system time.
- Complete preheat, calibration verification and a repeatability check using the supplied reference.
- Record acceptance results in Appendix B and radiation-safety verification in Appendix G.

5. Operating Precautions and Start-up

5.1 General Operating Precautions



Do not disassemble or modify the instrument.



Prevent liquid entry and foreign objects.

- Do not place objects on the lid or obstruct the touchscreen, indicators, ventilation or gas supports.
- Do not move the instrument while a measurement is active or while the chamber is under vacuum.
- Do not use sharp tools near the detector window, sample stage or chamber seal.
- Use only approved sample cups, films, reference materials and cleaning supplies.

5.2 Shutdown and Extended Inactivity

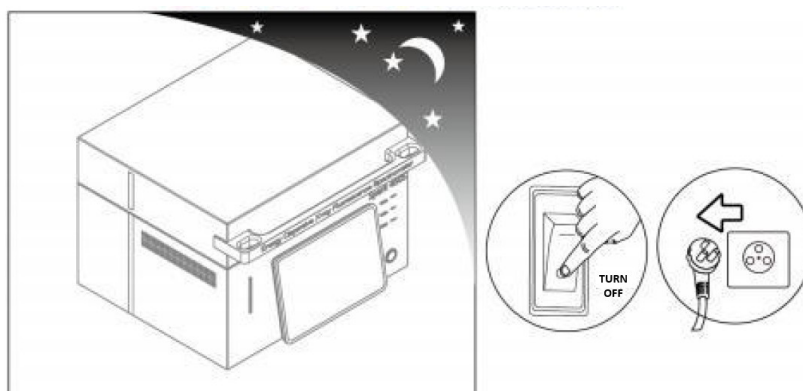


Figure 5-1. Power off and disconnect the instrument for extended inactivity.

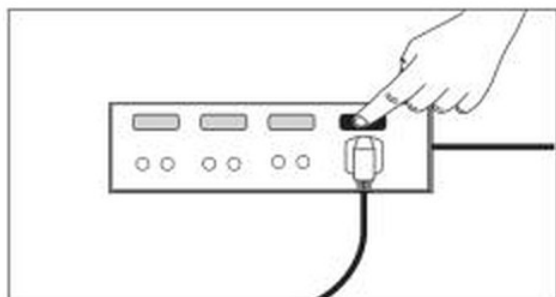
At the end of routine work, complete any active measurement, save and back up data, exit the analysis software, shut down the computer normally, switch off the main unit and vacuum pump, then isolate mains power if required by site procedure. For holidays or extended inactivity, clean and dry the chamber, apply a dust cover after cooling, and store the instrument in a secure ventilated area.

5.3 Detector Protection

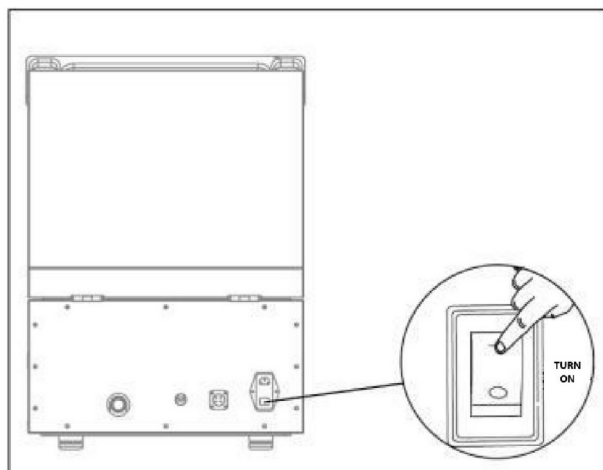
- Never touch or clean the detector window directly.
- Do not use compressed air, brushes, swabs or solvents on the detector.
- Keep powders and sharp specimens away from the detector aperture.
- Avoid impact, strong electrostatic discharge and high-intensity external radiation.
- If the window is damaged or contaminated, stop use and contact authorised service.



5.4 Power-on Sequence



Switch on the external power source or protected outlet.



Turn on the rear main power switch.

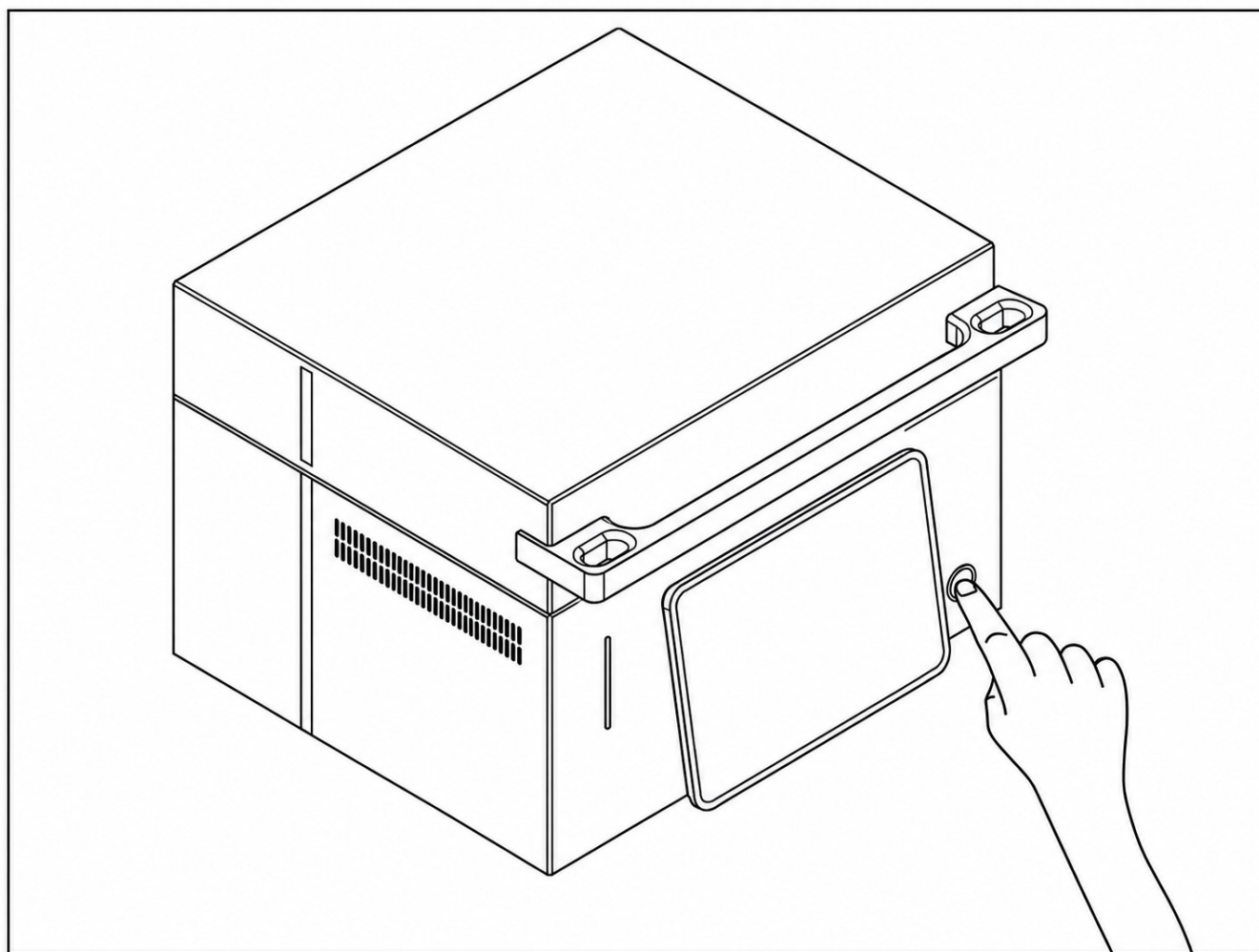


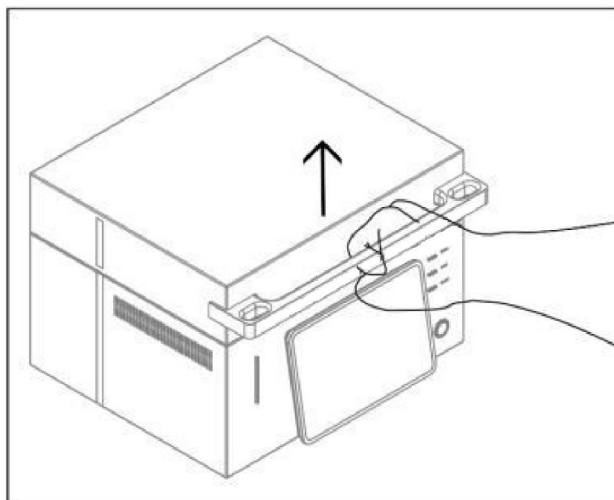
Figure 5-4. Press the front power button and wait for the operating system to load.

6. Confirm the power, pump, hose and peripheral connections.
7. Switch on the protected outlet or distribution box.
8. Switch on the rear main power switch. The power indicator should illuminate.
9. Press the front power button and allow the integrated computer to start fully.
10. Open Blue Dragon elemental analysis software and review the status panel before preheating or measurement.

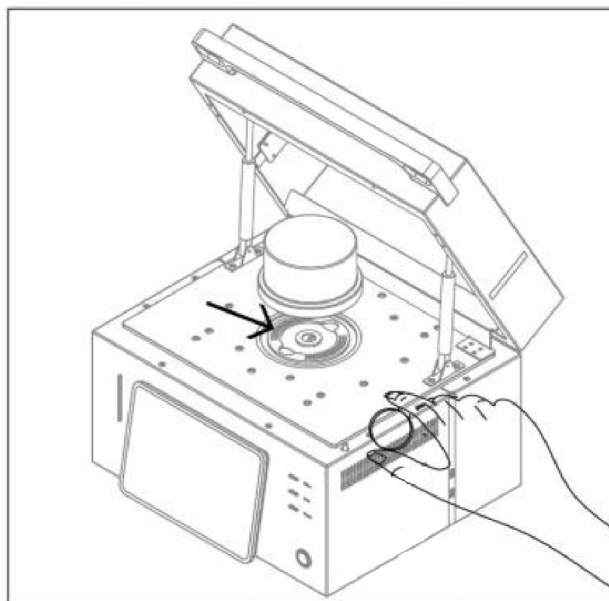


6. Sample Handling and Routine Measurement

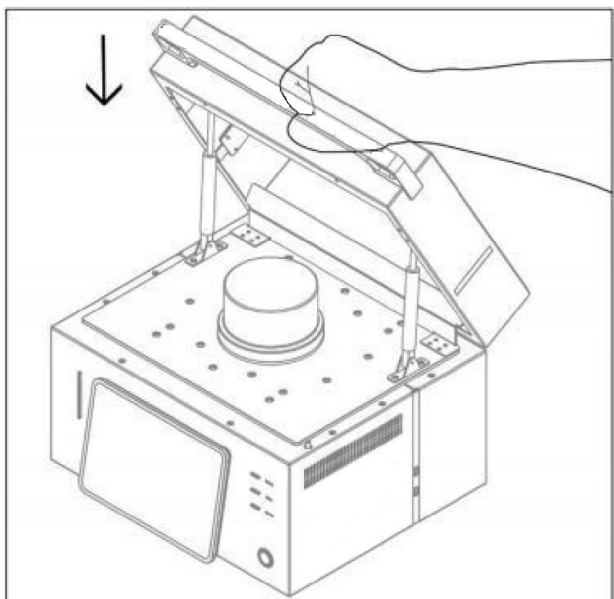
6.1 Loading and Removing a Sample



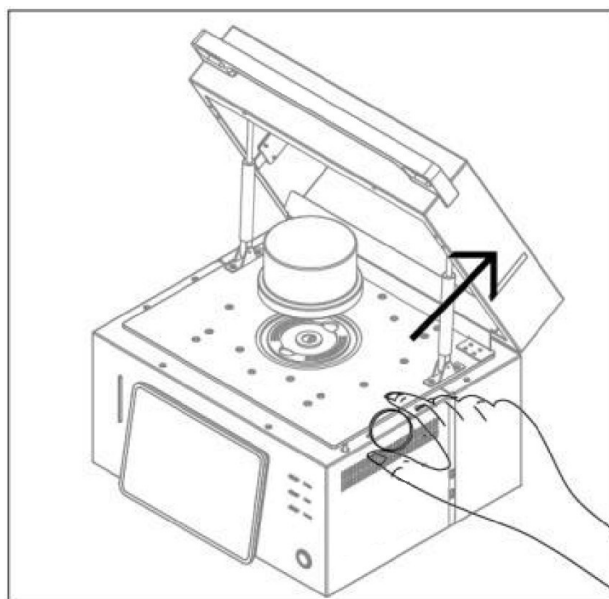
Lift the chamber lid using the handle.



Place the sample over the measurement window.



Close the lid fully and confirm interlock status.



After completion, open the lid and remove the sample.

11. Confirm that the X-ray active indicator is off and the chamber is vented.
12. Open the lid smoothly; do not force the gas supports.
13. Place the sample centrally over the measurement window. Use the camera crosshair and ensure the target area covers the 6 mm aperture.
14. Close the lid until the interlock engages. Never hold the lid partly open during operation.
15. Run the approved method. Wait for Measurement Complete and confirmation that high voltage is off.
16. Open the lid, remove the sample, inspect for residue and clean the chamber exterior surfaces as needed.



6.2 Sample Preparation

Sample type	Preparation guidance	Key risks
Solid metal / alloy	Use a flat, clean representative surface. Remove coatings, scale or oxidation only when the method requires bulk composition.	Curvature, roughness, coating/substrate effects and contamination.
Powder / mineral	Dry if required, grind and homogenise, fill an approved cup, compact consistently and use intact film. Pressed pellets may improve repeatability.	Particle size, segregation, moisture, film damage and loose powder.
Liquid	Use a compatible leak-tight cup and film validated for the liquid and vacuum condition.	Leakage, film failure, vapour, chemical compatibility and contamination.
Irregular specimen	Use a fixture or prepare a flat area. Keep the measurement point stable and fully cover the aperture.	Variable distance, incomplete coverage and poor repeatability.
Layered / coated material	Use the approved coating or layer method and document substrate and thickness.	Combined response from coating and substrate.

CAUTION

Do not place flammable, pressurised, hot, wet, reactive or strongly outgassing samples under vacuum unless an approved method and risk assessment explicitly permit it.

7. Measurement Principle and Analytical Performance

7.1 X-ray Fluorescence Principle

The X-ray tube directs primary radiation onto the sample. When the incident energy is sufficient, inner-shell electrons are displaced. Electrons from higher energy levels fill the vacancies and emit characteristic X-ray fluorescence. The detector measures the energy and intensity of these emissions. Peak energy identifies the element, while intensity is related to concentration through the selected analytical model and calibration.

7.2 Analytical Methods

Method	Use	Qualification
Fundamental Parameters (FP)	Calculates composition using physical models, instrument response and matrix corrections.	Useful for broad applications but dependent on sample condition and model assumptions.
Empirical coefficient (EC)	Applies coefficients derived from reference samples to correct matrix effects.	Requires a representative calibration set and controlled sample preparation.
Working curve	Relates measured response to concentration for a defined matrix using standards.	Usually provides strongest quantitative agreement when unknowns match the calibration set.
Qualitative spectrum review	Identifies likely elements from peak positions and compares spectra.	Peak overlaps, low concentrations and matrix effects require expert interpretation.

7.3 Performance Qualifications

Parameter	Source specification	Qualification
Element range	Mg-U	Capability varies by element, matrix and installed calibration.
Concentration range	1 ppm-99.99%	Broad system range; not a universal detection limit.
Detector resolution	129 eV +/- 5 eV	Confirmed standard configuration; delivered factory test report governs.
Best repeatability	RSD <=0.1%	Reported using a suitable national standard reference sample under controlled conditions.
Single measurement time	User configurable	Longer time can improve counting statistics; use validated method settings.
Vacuum flow	90 L/min nominal	Actual evacuation time depends on chamber loading, seals, hose and pump condition.

7.4 Matrix and Sample Effects

- Absorption and enhancement between elements can alter peak intensity.
- Particle size and mineralogy can produce significant powder-sample bias.
- Moisture dilutes analytes and changes absorption.
- Sample thickness and density affect whether the specimen behaves as infinitely thick.
- Surface roughness, curvature and variable measurement distance reduce repeatability.
- Peak overlaps may require deconvolution, longer time or laboratory confirmation.



8. Software Installation and Configuration

8.1 Standard Software Arrangement

The ElementX B1 is normally delivered with the operating system, drivers and Blue Dragon elemental analysis software installed and configured. Reinstallation should be performed only by authorised personnel using the supplied installation media and version approved for the instrument serial number.

8.2 Preparation Before Installation

- Back up all spectra, history records, reports, working curves, calibration files, licence information and administrator settings.
- Record the current software version, instrument serial number and driver versions.
- Confirm Windows administrator access and disconnect the instrument from untrusted networks.
- Use only the supplied or Blue Dragon-approved installer and licence code.
- Do not overwrite calibration or configuration folders unless instructed by authorised support.

8.3 Installation Procedure

17. Insert the supplied USB drive and open the approved installer folder.
18. Run the setup package as administrator.
19. Select the installation language and destination directory approved for the instrument.
20. Accept the required components and complete installation.
21. Restart the computer if prompted.
22. Open Blue Dragon elemental analysis software, enter the authorised licence code if requested, and verify communication with the instrument.
23. Restore only the approved configuration and calibration files.
24. Perform preheat, calibration verification, test measurement, data export and report checks before returning the instrument to service.

IMPORTANT

Do not use generic or newer software builds without confirming compatibility. A software update can change drivers, report formats, method behaviour or calibration handling. Back up first and validate the complete measurement workflow after any change.

8.4 Initial Configuration

- Set the interface language, system date and time, network settings and report information.
- Change factory administrator credentials and restrict calibration/system menus.
- Confirm the Blue Dragon logo and customer report identity where configured.
- Review the installed work curves and prevent unapproved editing.
- Set data-backup location and retention rules.



9. Software Interface

9.1 Main Interface

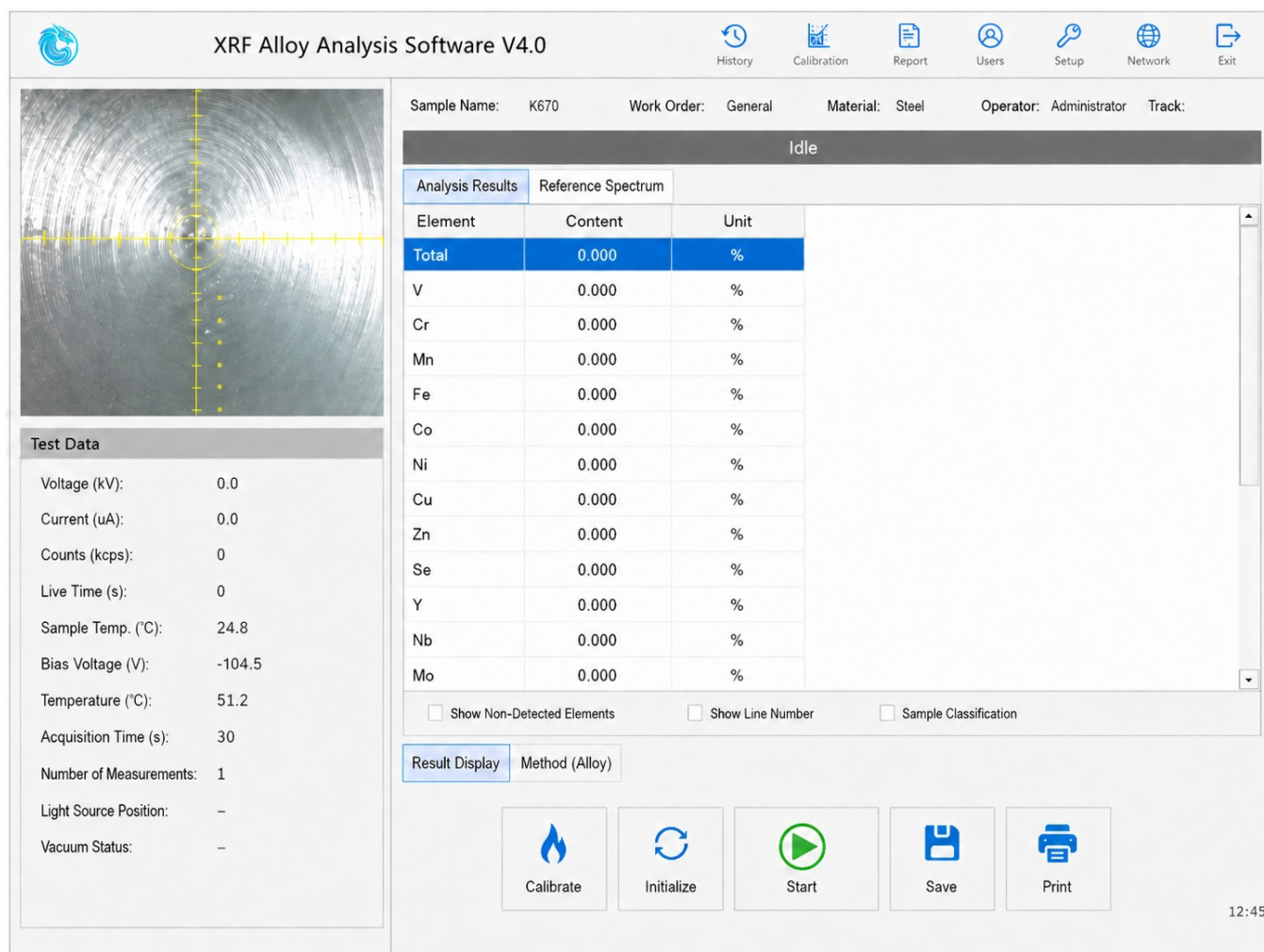


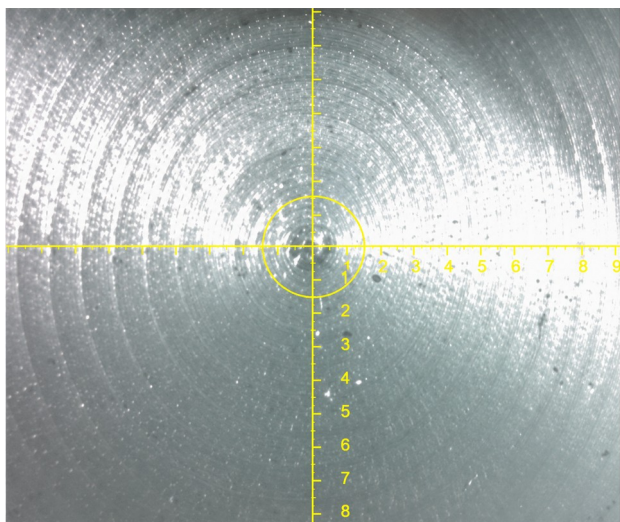
Figure 9-1. Software main interface.

The main interface is organised into eight functional areas: software name and menu bar, sample observation area, status bar, sample information and progress bar, spectrum display, test-result display, common functions and software-version display.

Area	Purpose
Menu bar	History, work-curve selection, report settings, user management, licence, language and exit.
Sample observation	Live sample image, crosshair and central measurement region.
Status bar	Tube voltage/current, count rates, operating time, detector conditions, motor position and vacuum status.
Sample information / progress	Sample name, curve, operator, supplier, test type, elapsed time, repetitions and progress.
Spectrum display	Current and reference spectra, zoom, qualitative peak information and spectrum controls.
Results	Element concentrations, units, grade identification and repeat statistics.
Common functions	Preheat, Initialize, Start, Save and Print.
Version	Software build identification for support and configuration records.



9.2 Sample Observation and Hardware Status



Sample camera and positioning crosshair.

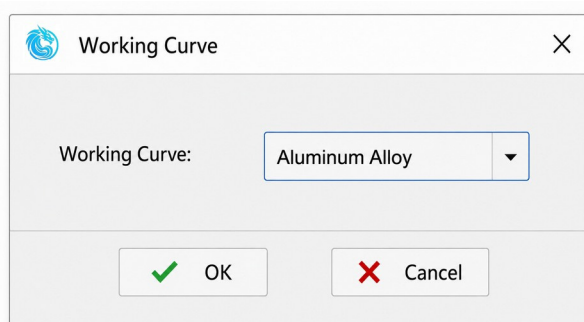
Test Data	
Voltage (kV)	0.0
Current (uA)	0.0
Slow/Fast Count Rate	0
Time Used (s)	0
Cooling Temperature	244.8 K
Bias Voltage	-104.5 V
Temperature	47.5
Measurement Time	30 S
Repeat Count	1
Filter Position	
Vacuum Level	

Hardware status and measurement parameters.

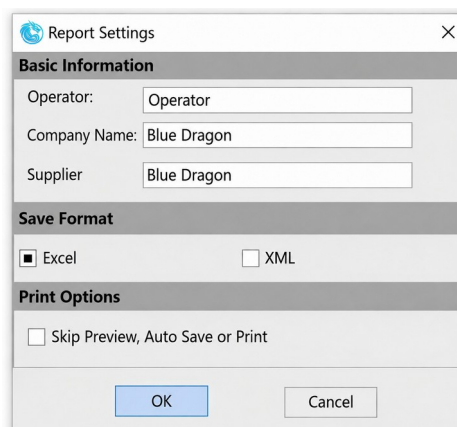
Position the intended test point at the crosshair intersection and ensure that the specimen covers the entire central measurement region. Review vacuum, voltage, current, detector temperature, count rate and fault status before initiating a test.

9.3 Menu Functions

Menu	Function
History	Query, review and export historical test results.
Work Curve	Select the approved calibration/model for the sample matrix.
Report Settings	Set operator, company/testing unit, supplier, save format and print behaviour.
User Management	Administrator login and advanced configuration.
Licence	Enter or review the authorised software licence.
Language	Select Chinese, English, Traditional Chinese or another installed language.
Exit	Close the analysis software safely.



Work-curve selection.

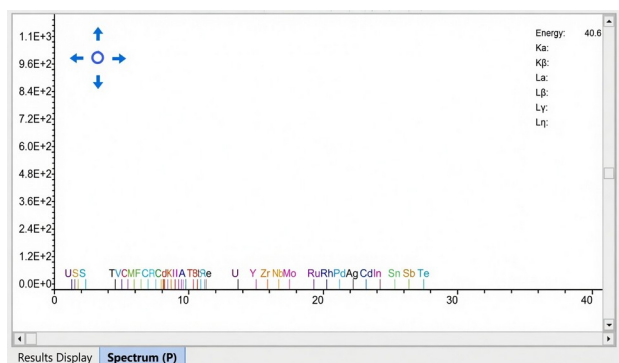


Report-information settings.

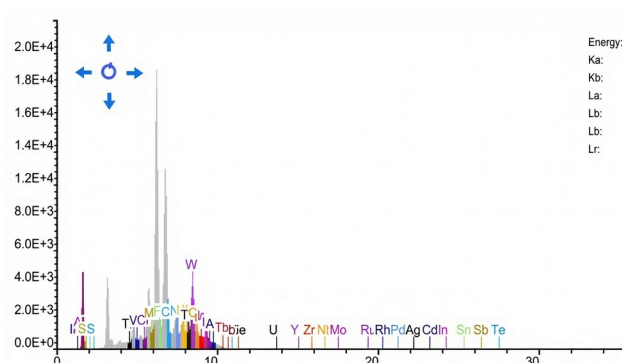


10. Spectral Display and Interpretation

10.1 Spectrum Display



Spectrum plotting area.

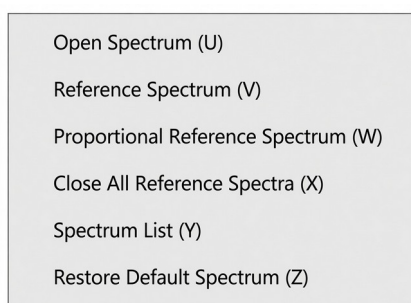


Expanded spectrum with identified peaks.

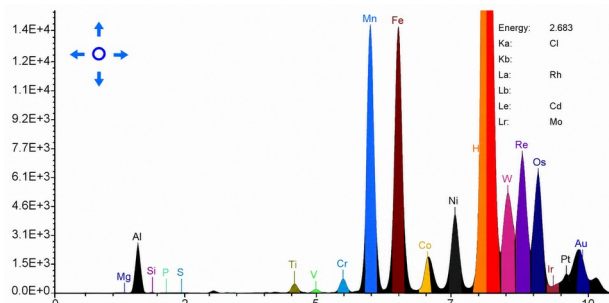
The spectrum display includes the plotting area, horizontal and vertical zoom controls, qualitative element information, count-rate/peak/resolution/dead-time information and a right-click operation menu.

10.2 Zoom and Qualitative Review

- Use horizontal zoom to inspect a restricted energy range and vertical zoom to review low-intensity peaks.
- Restore the default scale before comparing spectra.
- Move the pointer across the spectrum to view candidate K- and L-series lines.
- Treat qualitative labels as indications only; review peak overlap and matrix effects.

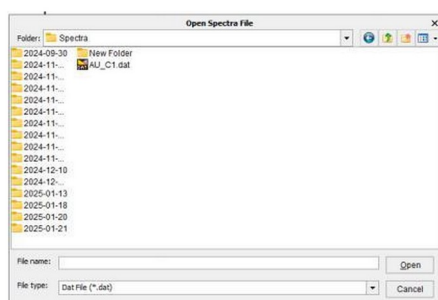


Right-click spectrum operation menu.

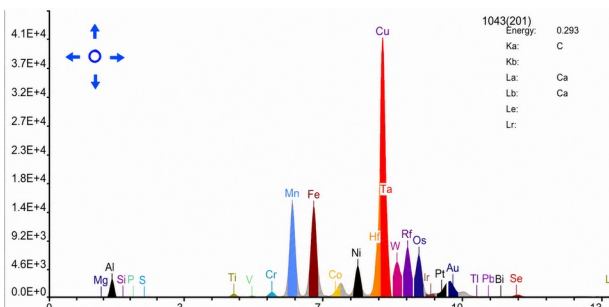


Detailed spectrum acquisition information.

10.3 Open and Reference Spectra



Open a previously measured spectrum.

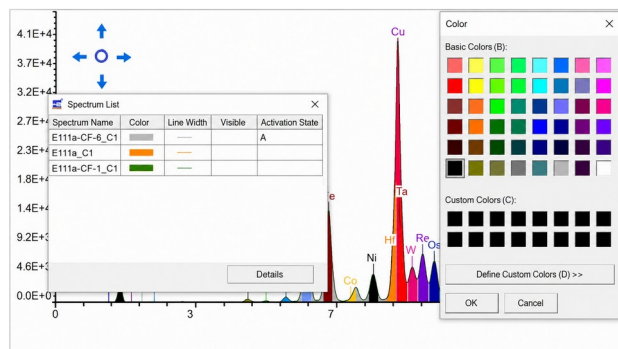


Reference spectrum selected for comparison.

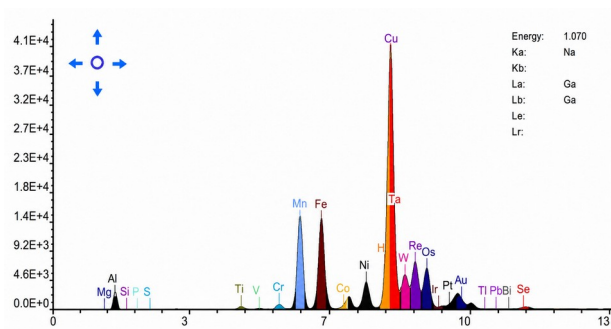
Open Spectrum loads a saved measurement and recalculates/displays its result. Reference Spectrum overlays one or more comparison spectra. Proportional Reference Spectrum scales a comparison spectrum for easier shape assessment. Close All Reference Spectra removes overlays while retaining the current sample spectrum.



10.4 Spectrum List and Appearance



Spectrum list and active traces.



Colour and line-style controls.

Use the spectrum list to control trace visibility, colour, line width and active status. Appearance changes do not alter stored measurement data or calibration.

11. Preheat, Initialization and Calibration Verification

11.1 Preheat

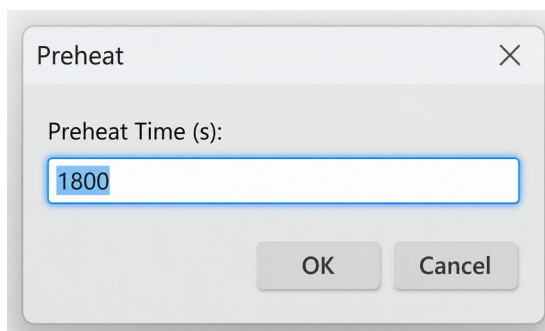


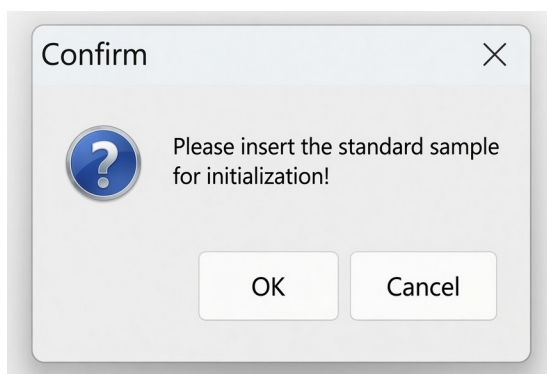
Figure 11-1. Preheat-time setting.

After each cold start, place the supplied copper or approved calibration sample over the measurement window, close the lid and run the Preheat function. The source operating procedure specifies 1800 seconds (30 minutes). Keep the chamber closed and monitor status throughout preheating. Preheating stabilises the X-ray source, detector and electronics and supports repeatable results.

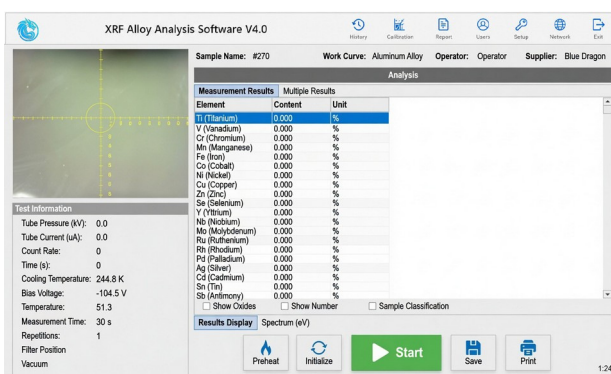
NOTE

Do not confuse software preheat time with total laboratory warm-up. Sites may require additional temperature stabilisation after transport, storage or major ambient change.

11.2 Initialization



Insert the approved calibration sample.



Initialization spectrum and progress.

The instrument is factory initialized and initialization is not normally required before every routine test. Perform initialization after authorised service, software/configuration restoration, abnormal peak displacement or a failed verification that cannot be explained by sample condition. Use the supplied reference, follow the prompt, keep the lid closed and do not interrupt power.



11.3 Calibration Verification

25. Use the supplied standard or an appropriate certified reference material.
26. Select the correct work curve and validated measurement time.
27. Run the required number of replicates under controlled sample positioning.
28. Compare results with assigned values and site acceptance limits.
29. If verification fails, inspect sample condition, film, vacuum, temperature, curve and instrument status; repeat once before contacting support.
30. Do not alter calibration coefficients solely to force a reference result into tolerance.

12. Measurement Settings and Test Workflow

12.1 Test Information Settings

The 'Start' dialog box is shown with the following settings:

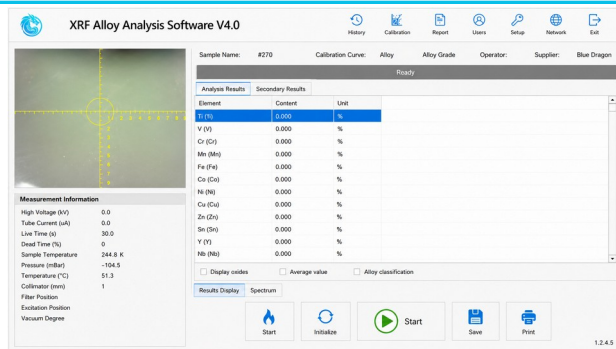
- Sample Name: #270
- Operator: Operator
- Supplier: Blue Dragon
- Work Curve: Aluminum Alloy
- Measurement Time: 30
- Repeat Count: 1
- Interval Time: 3
- Real-time Display Results: ☐
- High Voltage Always On: ☐
- Vacuum: ☒

Figure 12-1. Test-information and measurement settings.

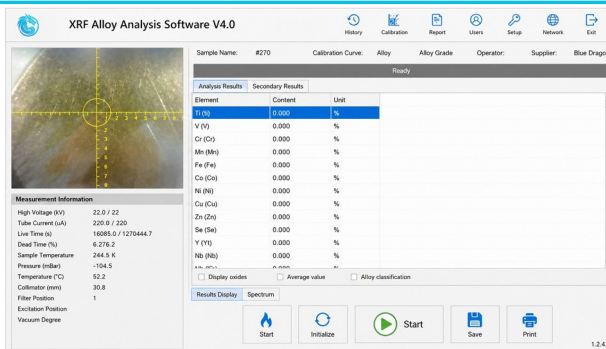
Setting	Guidance
Sample name	Enter a unique traceable identifier, or use automatic naming with a separate sample-reference log.
Testing personnel	Enter the operator name or ID.
Supplier	Record source/supplier information where required.
Work curve	Select the approved quantification model for the sample type.
Test time	Use the validated default unless an authorised method specifies otherwise. Avoid excessively short times.
Repetitions	Set replicate count required by the method or QC plan.
Interval	Set delay between repeated tests.
Real-time results	May be used for EC methods; FP calculation can cause interface delay.
High voltage always on	Use only for approved continuous-testing workflows; leave off for single measurements.
Vacuum extraction	Enable for methods requiring evacuated chamber measurement.

12.2 Routine Test Workflow

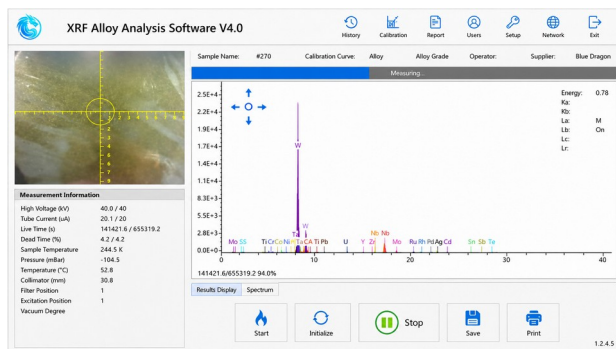
31. Confirm operator authorisation, instrument condition and applicable radiation controls.
32. Start the instrument and allow the operating system and the analysis software to load.
33. Complete preheat. Perform initialization or verification only when required by the quality plan.
34. Prepare and identify the sample; inspect cup and film where used.
35. Open the lid, place the sample over the window and close the lid fully.
36. Select the approved work curve and confirm sample information, time, repetitions, interval and vacuum setting.
37. Press Start. Confirm the high-voltage indicator, vacuum status and measurement progress are normal.
38. Do not open the chamber or move the instrument during measurement.
39. Review Measurement Complete, element results, units, grade, spectrum and repeat statistics.
40. Save/export the required records, then remove the sample after high voltage is off and the chamber is vented.



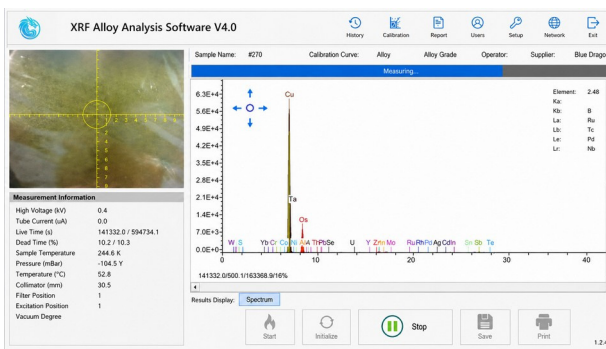
Measurement started.



Spectrum and progress during measurement.



Measurement complete.



Final spectrum and results.

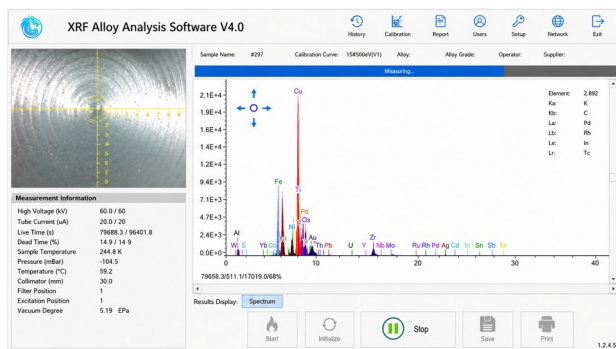
12.3 Result Review Before Release

- Verify sample identity and selected work curve.
- Check for unexpected elements, peak overlaps, high dead time, abnormal count rate or vacuum faults.
- Review replicate spread, standard deviation and RSD where repeated measurements are used.
- Compare QC or reference results with acceptance limits.
- Apply laboratory confirmation where the decision requires higher metrological confidence.

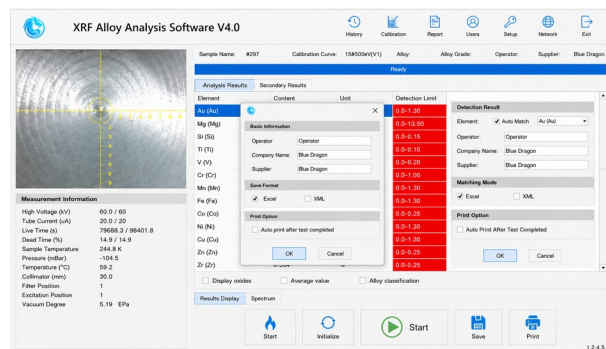
13. Results, Reports, History and Reference Spectra

13.1 Automatic and Manual Saving

After a measurement, the spectrum is automatically stored in the Spectra folder under a date-based path and sample identifier. Use Save to create the full analysis report in the Report folder. Use History to query measurements and export results to Excel. Exact paths depend on the installed software build and configuration.



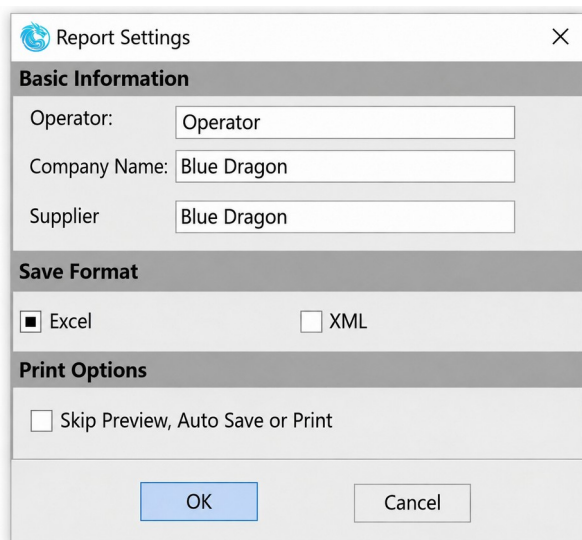
Save or report command.



Report/result output interface.



13.2 Report Information and Printing



Report Settings

Basic Information

Operator:

Company Name:

Supplier:

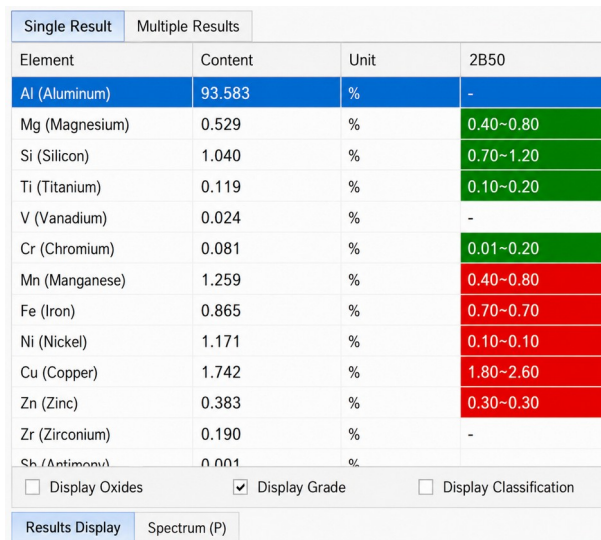
Save Format

☒ Excel ☐ XML

Print Options

☐ Skip Preview, Auto Save or Print

Operator, testing unit and supplier fields.



Element	Content	Unit	2B50
Al (Aluminum)	93.583	%	-
Mg (Magnesium)	0.529	%	0.40-0.80
Si (Silicon)	1.040	%	0.70-1.20
Ti (Titanium)	0.119	%	0.10-0.20
V (Vanadium)	0.024	%	-
Cr (Chromium)	0.081	%	0.01-0.20
Mn (Manganese)	1.259	%	0.40-0.80
Fe (Iron)	0.865	%	0.70-0.70
Ni (Nickel)	1.171	%	0.10-0.10
Cu (Copper)	1.742	%	1.80-2.60
Zn (Zinc)	0.383	%	0.30-0.30
Zr (Zirconium)	0.190	%	-
Sb (Antimony)	0.001	%	-

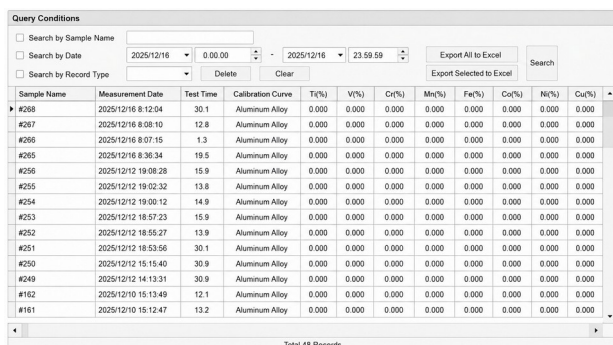
☐ Display Oxides ☒ Display Grade ☐ Display Classification

Results Display ☒ Spectrum (P)

Element result and grade display.

- Confirm the operator, testing unit, supplier, sample ID, curve, date/time, measurement conditions and units.
- Select the approved save format, such as Excel or XML, when available.
- Use Skip Preview, Auto-Save or Print only according to the documented reporting workflow.
- Review the report before release and retain the spectrum and QC evidence required by the quality system.

13.3 History and Result Retrieval



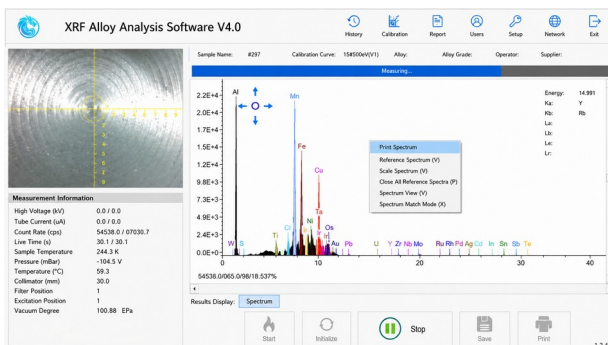
Query Conditions

☐ Search by Sample Name
☐ Search by Date: 2025/12/16 00:00 to 2025/12/16 23:59:59
☐ Search by Record Type

Sample Name	Measurement Date	Test Time	Calibration Curve	Ti(%)	V(%)	Cr(%)	Mn(%)	Fe(%)	Co(%)	Ni(%)	Cu(%)
#288	2025/12/16 8:12:04	30.1	Aluminum Alloy	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
#287	2025/12/16 8:08:10	12.8	Aluminum Alloy	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
#286	2025/12/16 8:07:15	1.3	Aluminum Alloy	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
#285	2025/12/16 8:36:34	19.5	Aluminum Alloy	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
#296	2025/12/12 19:06:28	15.9	Aluminum Alloy	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
#295	2025/12/12 19:02:32	13.8	Aluminum Alloy	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
#294	2025/12/12 19:00:12	14.9	Aluminum Alloy	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
#293	2025/12/12 18:57:23	15.9	Aluminum Alloy	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
#292	2025/12/12 18:55:27	13.9	Aluminum Alloy	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
#291	2025/12/12 18:53:56	30.1	Aluminum Alloy	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
#290	2025/12/12 15:15:40	30.9	Aluminum Alloy	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
#249	2025/12/12 14:13:31	30.9	Aluminum Alloy	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
#162	2025/12/10 15:13:49	12.1	Aluminum Alloy	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
#161	2025/12/10 15:12:47	13.2	Aluminum Alloy	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Total 48 Records

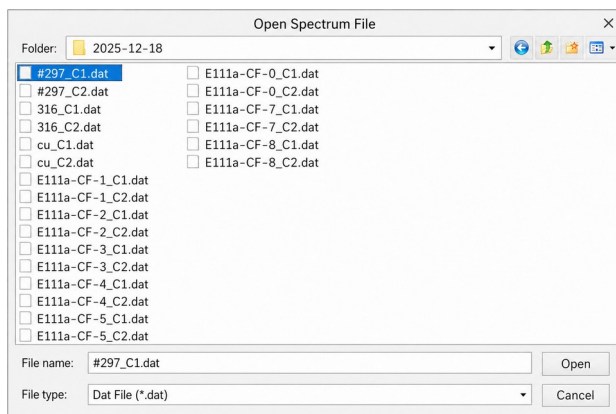
Historical measurement records.



Review and locate stored results.

Use History to filter and locate previous records, export data and reopen associated spectra. If a report has been overwritten or deleted, use the exported Excel file, backup or spectrum archive where available.

13.4 Reference-Spectrum Comparison



Open Spectrum File

Folder: 2025-12-18

☒ #297_C1.dat ☐ E111a-CF-0_C1.dat

☐ #297_C2.dat ☐ E111a-CF-0_C2.dat

☐ 316_C1.dat ☐ E111a-CF-7_C1.dat

☐ 316_C2.dat ☐ E111a-CF-7_C2.dat

☐ cu_C1.dat ☐ E111a-CF-8_C1.dat

☐ cu_C2.dat ☐ E111a-CF-8_C2.dat

☐ E111a-CF-1_C1.dat

☐ E111a-CF-1_C2.dat

☐ E111a-CF-2_C1.dat

☐ E111a-CF-2_C2.dat

☐ E111a-CF-3_C1.dat

☐ E111a-CF-3_C2.dat

☐ E111a-CF-4_C1.dat

☐ E111a-CF-4_C2.dat

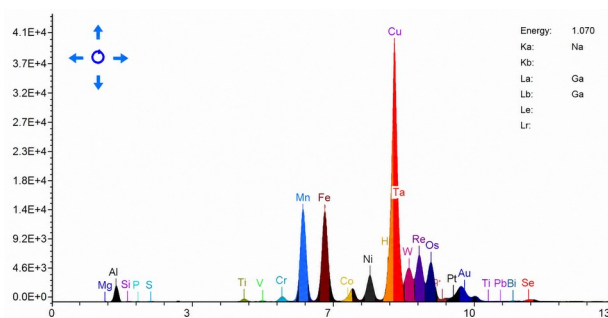
☐ E111a-CF-5_C1.dat

☐ E111a-CF-5_C2.dat

File name: #297_C1.dat

File type: Dat File (*.dat)

Select a comparison spectrum.





For repeatability and stability review, open the first spectrum as the current record, then load later replicates as reference spectra. Under comparable conditions, peak positions should align closely. A horizontal peak shift, abnormal width or major intensity change may indicate sample-position differences, temperature/vacuum instability, wrong curve, detector/electronics drift or a changed sample.

14. Data Management and Software Maintenance

14.1 Data Integrity and Backup

- Use unique sample IDs and controlled operator accounts.
- Back up spectra, reports, exports, working curves, calibration/configuration files and licence information on a defined schedule.
- Verify backups by restoring a test copy to an isolated location.
- Protect customer-confidential and regulated data using site access controls.
- Do not remove USB media during writing; safely eject it before removal.

14.2 Software Updates

Apply updates only when approved for the serial-number-specific configuration. Record the previous and new version, installer checksum where available, date, reason, person performing the update and post-update verification results. Recheck instrument communication, status, preheat, calibration verification, measurement, report, history, export and printing.

14.3 Software Uninstallation

41. Back up all required data and configuration.
42. Record software and driver versions.
43. Use Windows Apps/Programs or the approved uninstaller.
44. Do not delete customer data or calibration folders unless the backup is verified and authorised.
45. Restart the computer when prompted.
46. Reinstall only the approved build and complete full commissioning verification before use.

SECURITY

Remote support or network access shall use a trusted network, authorised accounts and site approval. Disable unused services and do not expose the instrument directly to the public internet.



15. Routine Maintenance and Service

15.1 Operator Maintenance

Interval	Task	Acceptance / action
Before each use	Inspect lid, gas supports, chamber, window area, sample stage, cables, hose, pump and indicators.	No damage, residue, loose parts, leaks or abnormal status.
Daily / after use	Remove samples and external residue; wipe external metal and screen with a soft lint-free cloth.	Clean and dry. Do not clean detector window directly.
Weekly	Inspect chamber seal, hose routing, pump ventilation and USB/network connectors.	No cracks, flattening, obstruction, oil leakage or looseness.
Monthly	Run the approved reference and review vacuum time, count rate and repeatability trend.	Within site limits; investigate drift.
Quarterly or site-defined	Review backup, user accounts, software version, report template, interlocks and X-ray indicator.	Records complete and controls functional.
Annual / regulatory interval	Authorised preventive maintenance, electrical safety, radiation leakage survey and calibration/performance verification.	Completed by qualified personnel and documented.

15.2 Cleaning

- Power off and disconnect mains before external cleaning.
- Use a soft dry or slightly damp lint-free cloth on external surfaces.
- Use only approved cleaner; never apply liquid directly to the instrument.
- Do not use solvents, abrasive pads, compressed air or vacuum cleaners near the detector window.
- Clean powder spills using the approved contamination-control method without disturbing the detector area.

15.3 Vacuum Pump

- Keep pump vents and fan openings clear.
- Inspect hose and fittings for leaks and secure connections.
- Follow the pump manufacturer maintenance schedule for oil, filters or service, according to pump type.
- Record evacuation time trends; a gradual increase can indicate leaks, seal wear, hose restriction or pump degradation.
- Do not operate a pump that is unusually hot, noisy, leaking or unable to reach the expected vacuum.

15.4 Service Restrictions

WARNING

The housing contains high voltage, an X-ray tube, radiation shielding and fragile detector components. Internal service is restricted to authorised personnel. Disconnecting mains does not make unauthorised disassembly acceptable.



16. Troubleshooting and Frequently Asked Questions

16.1 Troubleshooting

Condition	Possible cause	Action
Instrument does not start	No mains power, rear switch off, front button not pressed, damaged cable or internal fault.	Verify grounded supply, cable and switch sequence. Do not open housing; contact support if unresolved.
Software cannot communicate	Driver/service fault, cable issue, software mismatch or controller not ready.	Restart normally, check approved connections/version and record error.
Vacuum not achieved	Lid not sealed, hose leak, loose fitting, damaged seal or pump fault.	Stop test, inspect lid/seal/hose/fittings and pump status. Do not bypass vacuum alarms.
X-ray will not start	Lid interlock not engaged, method not ready, active fault or safety function.	Close lid fully, review status and method. Never bypass interlock.
Preheat or initialization fails	Reference misplaced, wrong curve, unstable temperature, vacuum fault or hardware fault.	Reposition approved reference, allow stabilisation, inspect vacuum and retry once.
Results unstable	Heterogeneous sample, movement, rough surface, moisture, short time, wrong curve or poor vacuum.	Prepare representative sample, stabilise geometry, use validated time/curve and verify vacuum.
Unexpected element/result	Contamination, overlap, wrong curve, coating/substrate effect or matrix mismatch.	Repeat on clean representative sample, review spectrum and confirm by laboratory method.
USB export fails	Media not recognised, write protection, storage error or unsafe removal.	Use approved media, check capacity/permissions and retry after safe removal.
Instrument damaged or unsafe	Impact, cracked enclosure, interlock fault, overheating, smoke or abnormal X-ray status.	Stop use, disconnect power, secure and label instrument, contact Blue Dragon Technology.

16.2 Frequently Asked Questions

Question	Answer
Is protective clothing required?	Not for routine operation with the intact chamber fully closed and interlocks functional, unless local regulation or the site radiation programme requires it.
Is initialization required before every test?	No. The instrument is factory initialized. Preheat after startup; initialize only according to the quality plan or after significant deviation/service.
Which elements can be measured?	The confirmed standard range is Mg-U, but actual capability and accuracy depend on the installed curve, matrix and validation.
Can powders and liquids be measured?	Yes, using compatible approved sample cups and intact films, with risk assessment for vacuum compatibility and leakage.
Can the collimator be changed?	The confirmed standard configuration uses one 6 mm collimator. Do not alter it without authorised service.
What detector resolution applies?	Nominal 129 eV +/-5 eV for the confirmed standard configuration; the delivered factory test report governs.
How long should preheat run?	The source operating procedure specifies 1800 seconds after startup. Follow the approved site method.
What should be sent to support?	Model, serial number, software version, work curve, sample type, exact sequence, screenshots, status values, verification results and relevant photographs.



17. Storage, Transportation and Disposal

17.1 Storage

- Power off, disconnect mains, remove samples, clean and dry the chamber and external surfaces.
- Secure the lid and protect the touchscreen, cables, vacuum hose, pump and accessories.
- Store in a clean, dry, secure area protected from heat, condensation, corrosive vapours, dust, vibration and unauthorised use.
- Retain the factory packaging or a suitable shock-protected crate.
- Back up data before extended storage and retain configuration, certificate and serial-number records.

17.2 Transportation

- Transport only with the instrument and pump powered off, cooled and secured.
- Use the supplied packaging or engineered equivalent; protect the gas supports, lid, chamber and connectors.
- Remove loose accessories from the chamber.
- Comply with applicable rules for transport of X-ray equipment and electronic equipment.
- After transport, allow temperature stabilisation and inspect for condensation or damage before power-up. Complete verification before use.

17.3 Disposal

Do not dispose of the instrument, X-ray tube, detector, electronics, vacuum pump or accessories as unsorted municipal waste. Return through Blue Dragon Technology, an authorised service organisation or an approved electronic/radiation-equipment waste route according to local law. Remove or securely erase customer data before disposal where required.



18. Warranty and Technical Support

18.1 Warranty

The standard warranty is 12 months from successful acceptance, subject to the sales contract, correct operation and stated exclusions. Damage caused by unauthorised disassembly, misuse, impact, liquid entry, unsuitable samples, incorrect power, detector-window damage, bypassed interlocks, operation outside specified conditions or unapproved software/configuration changes may be excluded.

The source after-sales information also describes installation, commissioning and training at delivery, lifetime maintenance availability, lifetime software-upgrade support and stated response targets. The signed quotation and sales contract govern the actual service scope, location, response time and commercial terms.

18.2 Before Contacting Support

- Record model, serial number, software version, installed work curve and nameplate supply.
- Describe the sample, preparation, selected settings and exact sequence leading to the issue.
- Provide screenshots, photographs, status-panel values, vacuum behaviour, verification result and example data.
- State whether the instrument has been moved, impacted, opened, updated or exposed to liquid/contamination.
- Do not send confidential customer data unless authorised and appropriately protected.

18.3 Contact

Channel	Details
Website	bluedragontechnology.com
Technical support	Use the support contact stated on the quotation, sales contract or product page.
Product reference	Blue Dragon ElementX B1 / Document BD-EXB1-MAN-EN



Appendix A - Quick Start Checklist

Check	Complete
Operator authorised and radiation requirements confirmed	☐
Instrument, lid, chamber, detector area, pump, hose and cables inspected	☐
Correct power supply and grounding confirmed	☐
Analysis software opened; status normal	☐
Preheat completed	☐
Approved work curve selected	☐
Calibration verification completed when required	☐
Sample prepared, identified and correctly positioned	☐
Lid fully closed and interlock engaged	☐
Measurement settings reviewed	☐
Result, spectrum, repeatability and QC reviewed	☐
Report saved/exported and sample removed safely	☐
Instrument shut down and workspace cleaned	☐



Appendix B - Installation and Commissioning Checklist

Commissioning item	Result / initials / date
Packaging and shock indicators inspected	
Model, serial number and nameplate match order	
Main unit and pump undamaged	
Packing list complete	
Bench, clearance, temperature, humidity and ventilation acceptable	
Grounded supply verified	
Vacuum hose and pump connections leak-free	
Keyboard, mouse, USB and network verified	
Lid, gas supports and interlock functional	
X-ray indicator and alarm functions verified	
Software version and installed curves recorded	
Administrator password changed	
Preheat completed	
Reference verification passed	
Repeatability check passed	
Report/export/print checked	
Radiation-safety acceptance completed	
Operator training completed	
Packaging retained	



Appendix C - Maintenance Log

Date	Operating hours	Task / observation	Result / parts	Performed by	Next due



Appendix D - Configuration Record

Configuration item	Recorded value
Instrument model	ElementX B1
Serial number	
Main unit nameplate supply	
Vacuum pump model / serial	
Software name / version	
Operating system / computer	
Detector resolution from factory report	
Collimator	Single 6 mm
Installed work curves / modes	
Administrator / user-control record	
Network configuration	
Report template / export format	
Reference material ID / certificate	
Commissioning date	
Next verification / service due	



Appendix E - Application Data Sheet

Application information	Details
Industry / site	
Sample type / material	
Target elements and expected ranges	
Required reporting units	
Sample form: solid / powder / pellet / liquid / other	
Typical moisture and particle size	
Surface condition / sample geometry	
Required detection or decision limits	
Reference laboratory method	
Available certified reference materials	
Expected daily sample count	
Required measurement time / throughput	
Radiation-control and operator requirements	
Recommended mode / curve - to be confirmed by Blue Dragon Technology	
Validation plan and acceptance criteria	



Appendix F - Standard Supply and Optional Accessories

Category	Item	Status / qualification
Standard	ElementX B1 main unit	1
Standard	Precision vacuum pump, nominal 90 L/min	1
Standard	Vacuum hose and required pump cable(s)	As packing list
Standard	Standard / calibration sample block	1
Standard	Power cable	1
Standard	USB flash drive, nominal 32 GB	1
Standard	Wireless keyboard and mouse	1 set
Standard	Test films	Nominal 20
Standard	Manual, conformity certificate and factory documentation	1 set
Optional	Laser printer	Order-specific
Optional	Integrated vibration grinding mill	Order-specific
Optional	24-ton powder press with mould	Order-specific
Optional	Additional certified reference materials	Application-specific
Optional	Customer-specific working curves and validation	Project-specific

NOTE

The serial-number-specific packing list and order confirmation govern. Do not assume an optional item is included unless it appears on those documents.



Appendix G - Radiation-Safety Verification Record

Record item	Details
Responsible organisation / site	
Instrument model / serial	ElementX B1 /
Radiation-safety officer / qualified person	
Applicable licence / registration / exemption	
Acceptance survey instrument and calibration due date	
Background reading	
Maximum measured leakage / location	
Lid interlock test	Pass / Fail
X-ray active indicator test	Pass / Fail
Alarm / abnormal-state test	Pass / Fail
Shielding/enclosure inspection	Pass / Fail
Operating procedure and training reviewed	Pass / Fail
Result / restrictions	
Verification date / signature	
Next due date	

IMPORTANT

This record is a template only. Radiation surveys and acceptance criteria must be established and completed by appropriately qualified personnel under the applicable jurisdiction and site programme.



BLUE DRAGON TECHNOLOGY

Scientific Precision, Strategic Success.

bluedragontechnology.com