





X-ray fluorescence



Thermo Scientific ARL 9900 IntelliPower Series

Unique X-ray fluorescence spectrometers with integrated XRD capability

Iron and Steel • Cement • Aluminum • Copper • Mining

thermo scientific



ARL 9900 IntelliPower Series X-ray Spectrometers

A complete laboratory in one instrument

The Thermo Scientific™ ARL™ 9900 IntelliPower™ series of X-ray spectrometers is the most capable and most versatile ever offered for process control.

The key to its versatility is the patented technology which allows two X-ray techniques—X-ray fluorescence (XRF) and X-ray diffraction (XRD) to be combined in one instrument. This makes the ARL 9900 highly productive. It permits the rapid and accurate analysis of solid samples of various kinds. In simultaneous configuration, a new sample can be loaded every minute for an analysis. Up to 86 elements (from B to Am, 5 to 95 in the Mendeleev table) in concentrations ranging from parts per million to 100% can be detected with the goniometer. Advanced integrated software bestows fast commissioning of new methods and permits quick reporting and storing of the analytical results where it matters most.

Modular construction and a range of options allow the ARL 9900 IntelliPower series to be specified to suit any particular process control application. Installation requirements are straightforward and can be easily accommodated in most industrial environments.

A high degree of automation and digital control make the ARL 9900 easy to use. Specified with the appropriate automatic sample introduction equipment, it can be programmed to conduct continuous process monitoring in unattended mode with direct connection to automatic sample preparation machines.

And it naturally comes with the world-wide after-sales support of Thermo Fisher Scientific.

The ARL 9900 IntelliPower series in summary

Every analytical requirement met

- Choice of generator power according to your application demands: from 1500 W to 4200 W
- The IntelliPower technology allows to operate up to 2500 W without requirement of external water cooling
- Versatility, convenience and productivity brought by the combination of two X-ray technologies in one instrument
- Depending on configuration, capable of detecting and analyzing up to 86 elements from ppm levels to 100%
- Modular construction allowing the instrument to suit the particular requirements of the application
- Unique WDXRF sequential and fixed channel capabilities including quantitative XRD analysis cover any analytical needs
- Fast, simple and highly reliable sample introduction system
- Easily upgraded to handle evolving analytical requirements
- Can be linked to automatic sample preparation machines for on-line process control
- Successor instruments to the proven and highly successful ARL 9800 range.

ARL 9900 IntelliPower applications

A wide range

The ARL 9900 series is designed to meet the requirements of industries where fast process monitoring is critical to quality control. Among them, those producing or processing:

- Metals: iron, steel, aluminum, copper, and their alloys, titanium, magnesium, tin, zinc, slags, sinters
- Mining: ores, minerals, limestone, beach sands
- Cement
- By-products
- Refractories and others.

ARL 9900 IntelliPower versatility

High performance in every application

The ARL 9900 is capable of detecting a large number of elements. Its modular design allows to closely tailoring the instrument to the intended use. It is possible to configure the instrument with:

- Up to 32 fixed monochromators for fast analysis
- Up to three goniometers programmed to analyze specific elements (quantitative and standard-less analysis) or to scan the X-ray spectrum to detect elements present in a given sample (qualitative and semi-quantitative analysis)
- The compact integrated X-ray diffraction system for phase analysis in process control.





Small and large cassettes can accommodate samples of various sizes



Full automation through ARL SMS-2500



Large X-Y sample changer

ARL 9900 IntelliPower technical features

X-ray system

Designed for effectiveness and reliability:

- Optical system optimized to give very precise measurement, high sensitivity and stable analysis
- X-ray tube mounted above the sample preventing damage to the X-ray tube and instrument from defective samples such as fragile pellets or metal drillings
- Maximum reliability and durability in service assured by careful and robust design
- Close proximity of X-ray tube to the sample brings increased sensitivity and lower limits of detection for all elements. The Rh anode produces effective excitation of the whole spectrum without interfering with the most common elements. Extra thin Be window (50 microns) allows best transmission of radiation efficient for light elements excitation. LoVap technology prevents any W coating of the inside face of the window thus ensuring excellent long term analytical stability.
- Analyses take place within a vacuum chamber closed by a single lid. The number of vacuum seals are therefore minimized and hence the risk of leakage
- Constant temperature control as well as regulated vacuum pressure assure excellent short and long term stability.

Power supply: A choice to suit your application

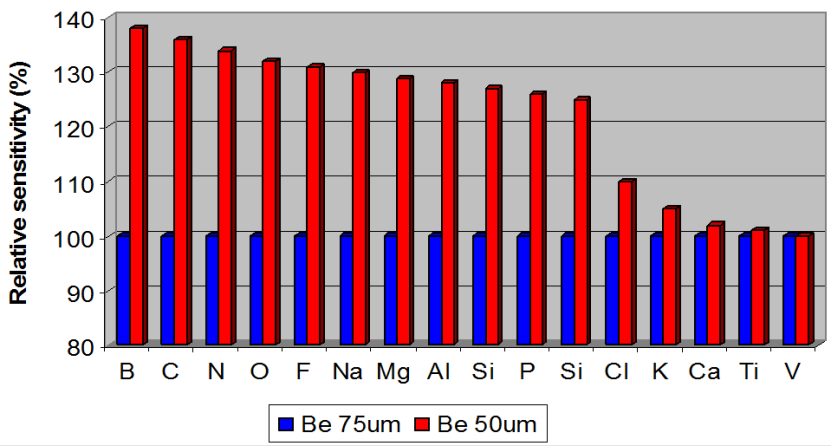
ARL 9900 Series instruments can be specified with an integrated high frequency solid-state generator of medium or high power to best suit each application.

- 1500 W or 2500 W power supplies are cooled with their own independent circuit, thus avoiding the requirement for an external water chiller
- 4200 W power supply for those applications where low limits of detection and high performance is required. The standard generator provides maximum output of 60kV-70 mA or 35 kV-120 mA.

Sample introduction: Several degrees of automation

- Fast, simple and highly reliable sample introduction system using a 12-position sample changer
- Large X-Y magazine allows automatic handling of larger series of samples. The X-Y magazine has 98 coded positions for samples in cassettes or on specific supports. Coding of each position allows unattended operation and saves time and effort in determining which sample belongs to a particular analysis. This larger magazine can easily replace the basic 12-position system if the need arises
- A version of the X-Y sample changer allows connections to transport belts suitable for one sample form e.g. pressed powders in steel rings. This simple automation is named ARL SMS-XY
- Optional ARL SMS-2300, SMS-2500 and SMS-3500 robotic systems offer fully automatic sample preparation and introduction for multiple sample forms
- With the SMS options, the instrument can automatically conduct continuous process monitoring unattended and raise an alarm if any anomaly is detected. The ARL SMS-2300 and SMS-2500 are flexible and very powerful tools that link the whole sample preparation and analysis process. The ARL SMS-3500 series is the latest innovation in automation using a larger and faster robot which serves both an OES and an XRF instrument.

Sensitivity improvement with thinner Be window



Full microprocessor control

Putting the emphasis on reliability and ease of use

Full digital control makes the ARL 9900 easy to use. It also ensures consistent results over many operations.

The microprocessor architecture comprises clusters of microprocessors, microcontrollers and digital signal processors connected by full duplex links. They control the overall operation of the instrument, monitor several hundred status points every few seconds and direct the goniometer(s), integrated diffraction system and monochromators functions.

The analyst's instructions transmitted through the OXSAS analytical software are processed in the master microprocessor and sent to the appropriate cluster. The resulting analytical data is displayed on the screen.

Fixed monochromators

High speed simultaneous analysis

Fixed channels offer fast analysis, high sensitivity and rapid processing as each one is dedicated to detecting and analyzing just a single element. The ARL 9900 series can be equipped with up to 32 monochromators for simultaneous analysis or 24 of them when a goniometer is fitted.

Compact slit-crystal geometry optimizes the sensitivity and spectral background levels to permit detection of elements at very low concentrations. The latest detectors ensure a wider linearity of response and very precise analysis. In a simultaneous configuration there is no need of detector gas for all elements from Na.

Each monochromator has its own temperature control system (to ± 0.1 °C) ensuring excellent stability of analysis. For the analysis of light elements, multilayer synthetic crystals are used. Adjustment of pulse height discrimination, high voltage and deadtime correction are totally programmed through the software.

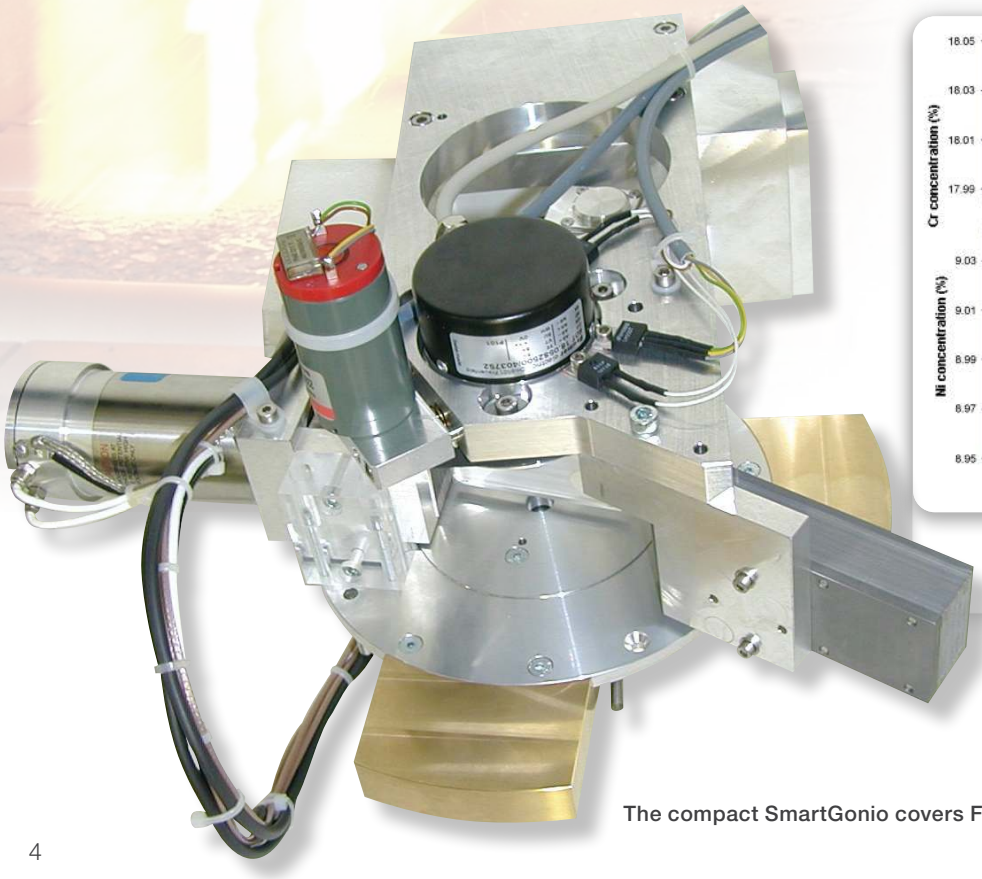


Goniometers

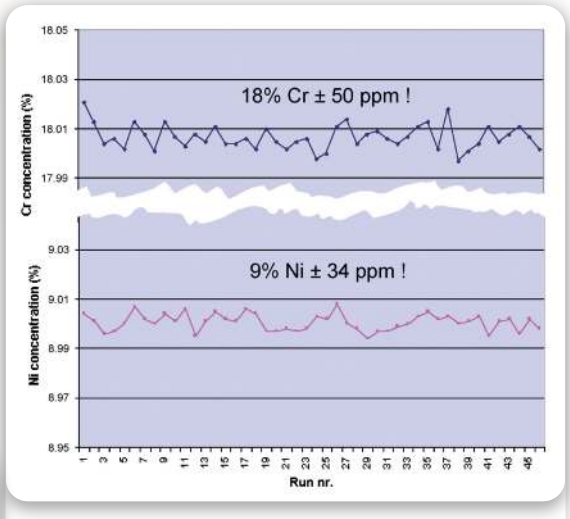
Very precise sequential analysis

The goniometers can be programmed to analyze specific elements (quantitative analysis) or to scan the X-ray spectrum to detect elements present in a given sample (qualitative analysis). Two very fast and highly accurate gearless goniometers allowing qualitative, quantitative and standard-less analysis are available for ARL 9900 series instruments.

The Thermo Scientific SmartGonio allows analysis of elements from F to Am. It is a compact goniometer using three crystals and two detectors to provide a versatile and affordable detection system. Up to three SmartGonio can be fitted in the instrument.



The compact SmartGonio covers F to Am

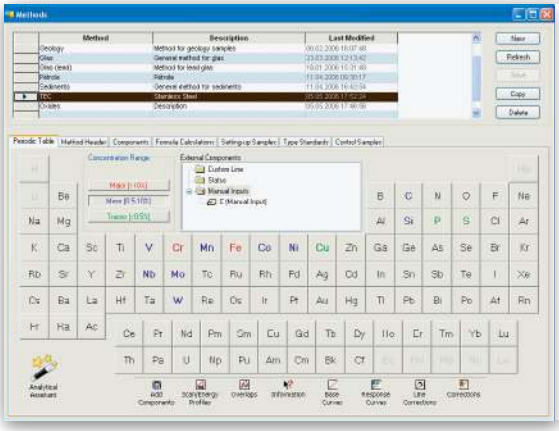


Excellent repeatability over 24 hours, here for Cr and Ni in steel

The F45 universal goniometer is the alternative when additional crystals and collimators are required for specific applications. Up to two universal goniometers can be fitted.

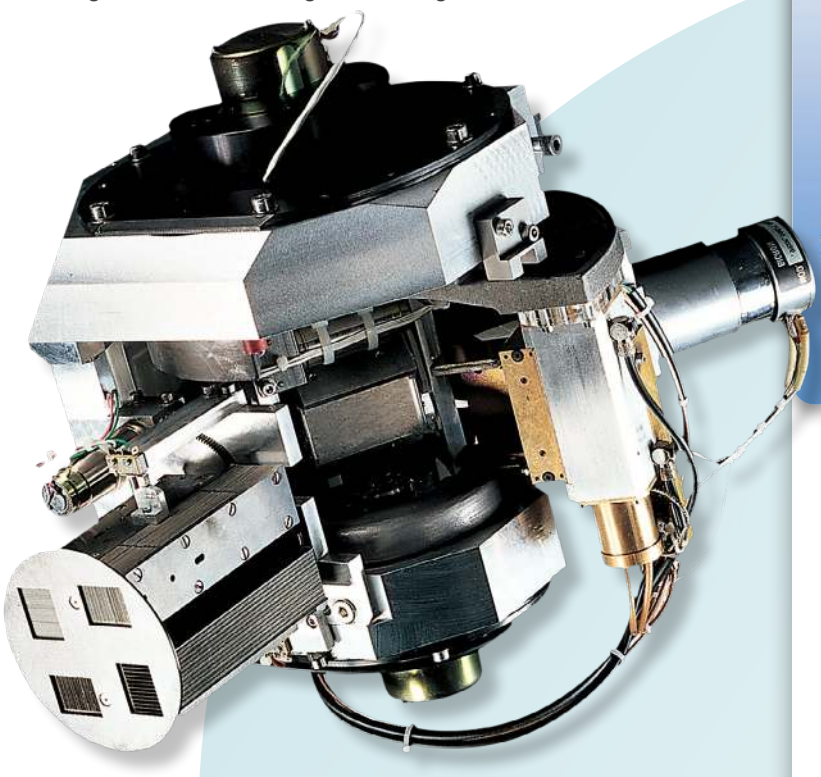
Both goniometers provide high quality sequential X-ray spectrometry as a result of the crystal and detector being positioned rapidly with great precision by microprocessors using Moiré fringe technology. This design brings several important advantages

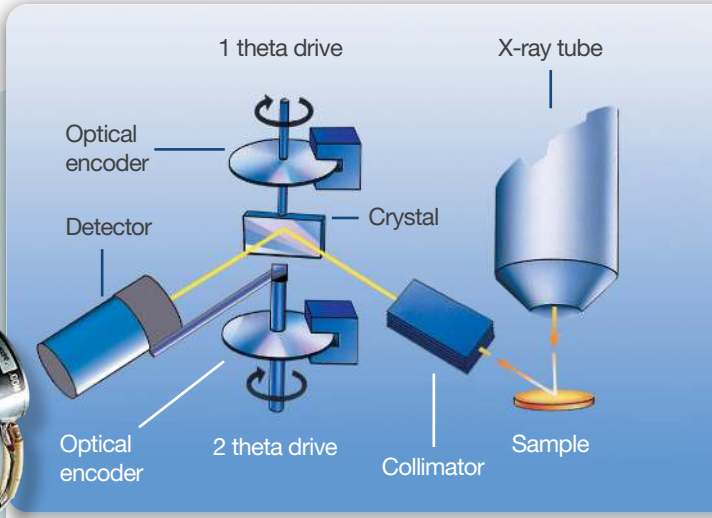
- Fast positioning—a slewing speed of up to 4800° 2theta per minute is five times faster than a conventional goniometer and up to twenty times faster than a scanner
- Automatic alignment of the theta/2theta angular relationship between crystal and detector—this alignment is performed electronically by the microprocessor and, unlike conventional systems, no mechanical adjustments are needed
- Rapid qualitative analysis—continuous digital scanning allows ultra-fast acquisition of spectra at speeds up to 1200°/minute. Peak identification is automatic
- No wear, no performance degradation—the absence of gears, hence of friction, makes them 'no wear' systems assuring consistent excellent angular reproducibility (< ± 0.0002°) and precision (0.001°)
- High accuracy of peak positions (e.g. 0.01° with LiF crystal)—analytical peaks are found exactly at their theoretical positions, a performance up to ten times better than conventional systems
- Independent rotation of crystal and detectors allows two detectors to be mounted side by side. Secondary collimators in front of each detector optimize count-rate or resolution
- When specialized applications require specific crystals, up to nine of them can be fitted on the universal goniometer allowing the analyst to choose the best crystal for each region of the X-ray spectrum. Up to four primary collimators (fine, medium, coarse, extra-coarse) are available in order to optimize resolution or intensity.
- Both goniometers offer full capability for the analysis of non-routine elements. They can back up any of the fixed channels and provide standard-less analysis when coupled to appropriate software packages (e.g. Thermo Scientific™ UniQuant™ software or Thermo Scientific QuantAS software).



Analytical Assistant helps definition of analytical programs, calibrations and instrument use

The 5th generation Moiré fringe universal goniometer

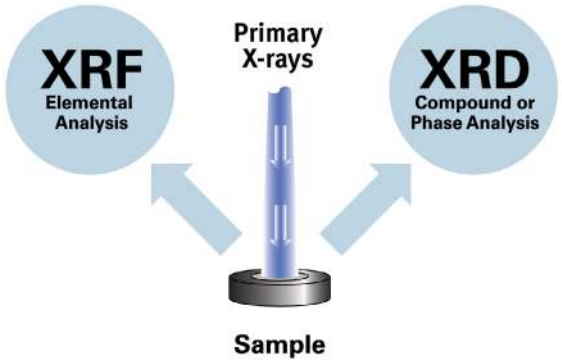




Goniometer principle of operation

- Angular positioning to ensure θ/2θ relationship between crystal and detector is achieved through Moiré fringe optical encoders:
  - no friction
  - no wear
  - excellent angular positioning accuracy
- Temperature regulation of crystals for best analytical stability.

Two techniques integrated in a single instrument



Integration of XRF and XRD in the same instrument: one sample, one instrument, one analysis for two techniques

Undertaking both types of analysis has traditionally called for two separate X-ray instruments, maintained and operated at significant cost to the user. But the integration of innovative X-ray diffraction systems allows both techniques to be included in the same ARL 9900 instrument bringing significant advantages to the user, e.g:

- Only one sample introduction
- Single user interface for both techniques
- Elemental and phase results merged into one single analysis bulletin
- Minimized floor space
- No water cooler at mid power levels.

XRF and XRD capability in one instrument

X-ray fluorescence (XRF) analysis determines the elemental composition of a sample but does not provide information about how the various elements are combined together. Such mineralogical information is only available through **X-ray diffraction** (XRD). In a typical crystalline sample, XRF might measure for example the total Ca concentration or the total Fe concentration. XRD permits analysis of the phases or compounds in crystalline materials such as rocks, minerals and oxide materials and products. So in the same sample, XRD takes the analysis a stage further and gives information about CaO, $CaCO_3$, $Ca(OH)_2$ contents and other Ca phases or the levels of Fe phases, such as FeO, Fe_2O_3, Fe_3O_4, Fe_3C and other Fe phases. Therefore combining the results of both XRF and XRD techniques allows for a better and more complete characterization of any given crystalline sample.

Compact integrated XRD systems

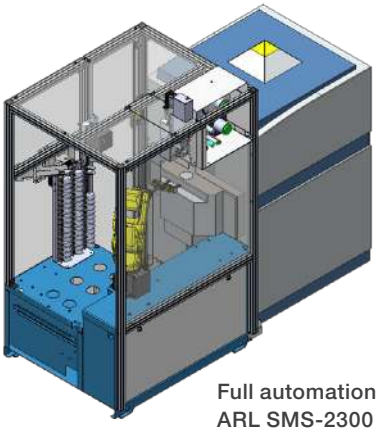
Productive, precise

Our **compact integrated XRD systems** are capable of making qualitative scans and quantitative analysis thanks to the high precision of their Moiré fringe positioning mechanism. Accurate sample positioning and parallel beam X-ray geometry prevent any sample alignment problems. The benefits of working under vacuum and in a stable temperature environment are the excellent sensitivity and repeatability of analysis, notably for sensitive phases like free lime. Typical and documented applications include among others:

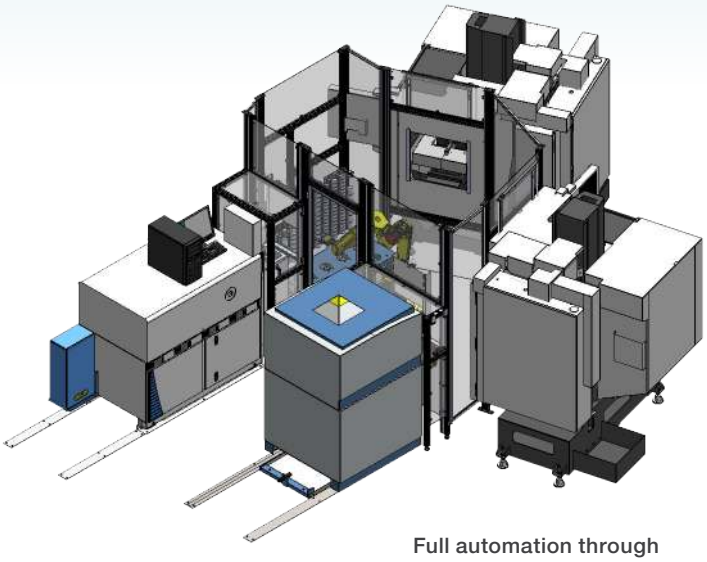
- Free lime in clinker and in slags
- Clinker phases (C_3S, C_2S, C_3A and C_4AF) for which the ClinkerQuant calibration is available
- Fe^{2+} determination in sinters
- Iron phases in DRI (Direct Reduced Iron) processes
- Phases related to electrolysis of aluminium
- Other mineral and mining applications
- Amorphous content in GBFS and slag cement.

A dedicated version of our compact Integrated XRD system is called **Free Lime-Quartz-Limestone Channel**. It provides the same performance at a fraction of the cost and still allows free lime determination in clinker and slags, limestone additions in cement, hot meal calcination monitoring and quartz content in raw meal.

Automated options



Full automation through
ARL SMS-2300



Full automation through
ARL SMS-3500 linking ARL iSpark and ARL 9900



Full automation through
ARL SMS-2500



Full automation through
ARL SMS-XY

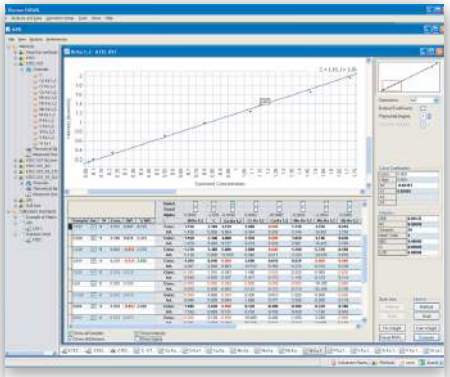
Software

Reliable analysis made easy

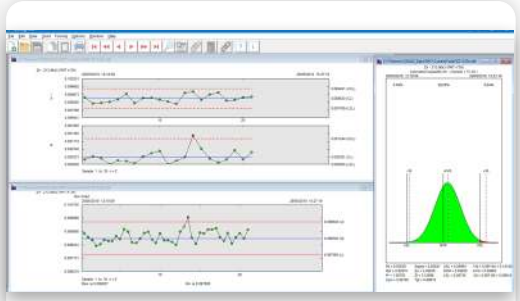
Operating the ARL 9900 and the rapid processing of data to deliver highly accurate analytical reports is achieved through state-of-the-art OXSAS software. OXSAS is a modern software platform designed to evolve and meet customer's needs with up-to-date solutions throughout the lifetime of the instrument. It uses Windows® 10 operating system.

More details can be found in a separate Product Specification but its key features and benefits are:

- State-of-the art software with modern Graphic User Interface
- Complete and very rich functionality
- Mature software with many convenient features
- Ease of use, no matter what requirements are. From simple tasks to complex jobs, all defined easily and performed quickly
- OXSAS allows performing rapid high quality analysis with templates leading through the analysis operation
- Simple definition and comprehensive operation of sample batches. With support of priority samples. Makes unattended analysis handy
- Integrated Analytical Assistant guides the creation or extension of methods with best analytical parameters for rapid and accurate analyses
- ast calibration with curve display of multiple analytes, instant base curve calculation, templates for edition and measurement of calibration standards
- Calibration curve determination using multi-variable regression with a range of correction models and integrated theoretical alphas calculation
- Optional standard-less analysis packages: UniQuant and the semi-quantitative QuantAS offer additional analysis versatility
- Flexible display of scans with graphical user interface
- Multi-purpose analysis display with wide-ranging optional data, e.g. the analysis calculation steps help the validation of methods
- Numerous customizable on-line processing functions, with manual or automatic application
- Comprehensive post-treatment of results, including direct export to Excel (*.xls files)
- Real on-line integrated Statistical Process Control (SPC)
- SCT Manager provides status and history of Setting-up Samples, Control samples and Type standards thus giving overview of the analytical capability of the instrument and of each method at any time
- Easy to run: one click creation of a batch including all samples requiring analysis
- Effective monitoring and maintenance tools maximize the system uptime
- Very comprehensive contextual Help including "How-To" guides
- Integrated Microsoft® SQL Server Express relational database which stores your set-up and all analysis results
- Runs both XRF and XRD analyses and merges each one into a single result.



MVR calibration curve: real concentrations vs. intensities



Statistical Process Control—typical screen

Other options for OXSAS software:

- SPC-full: On-line Statistical Process Control, full graphical package extension
- ARLcom: Software package for the transmission of results using network and serial communication
  - Network: result transmission solutions via Local Area Network to computer applications using TCP/IP or to files
  - Serial: result transmission solutions to computers, printers or terminals over serial RS-232 lines
- OEM mode: connection to an external process computer for automation purposes
- Layerquant for multilayer coating thickness determination.

Quantitative analysis

Accuracy made easy

Analytical programmes and calibrations are defined with the help of the on-line Analytical Assistant. Calibration curves are built using the multi-variable regression (MVR) programme.

Correction models are used to minimize the influence of interfering elements in multi-component matrices and achieve better accuracy of analysis. These models are:

- Line overlap correction
- Additive correction on intensities
- Additive correction on concentrations
- Multiplicative correction on intensities
- Multiplicative correction on concentrations
- Multiplicative and additive corrections on concentrations
- COmprehensive LAchance (COLA) with 3 term alphas to be used with the NBSGSC fundamental parameters programme, which can simulate analytical calibrations for homogeneous materials. Inter-element correction factors (theoretical alphas) are calculated and used as known coefficients in the MVR. This minimizes the number of standards necessary to produce calibrations and improves the accuracy of analysis.

Total elemental analysis

Two choices of standard-less analytical packages are available on option:

- QuantAS software automatically processes a wide scan covering up to 70 elements from F to U using the F45 universal goniometer
  - Semi-quantitative analysis can be produced within three minutes
  - Automatic smoothing, background subtraction, peak identification, overlap and matrix corrections, calculation of semi-quantitative concentrations and normalization to give a fast and easy semi-quantitative analysis of unknown samples
- UniQuant software provides standard-less results in 4 to 14 minutes depending on the number of elements analyzed and their counting time. It can be installed either on the F45 universal goniometer or on the SmartGonio. The extended counting time per element (2 to 20s or more) makes it the first choice if the application puts emphasis on great accuracy and the detection of low concentration levels
  - Standard-less analysis of up to 79 elements when specific standards are not available. Ideal when samples are obtained
    - In small quantities
    - In irregular shapes
    - As monolayer coatings
  - Calculation of the balance of unanalyzed elements present in the sample, e.g. organic and ultra-light elements.

QuantAS and UniQuant packages are fully calibrated and installed in the factory. They are therefore ready to use immediately after the instrument is commissioned. Stable samples for setting-up and maintenance over time are included.

Turnkey calibrations

Ex-works calibrations can be delivered for various materials such as:

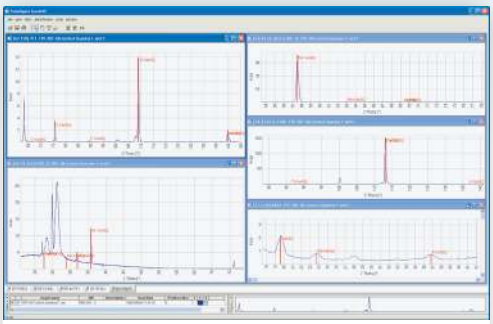
- Cement and clinkers
- Iron, steels and slags
- Copper, bronzes and brasses
- Aluminum and alloys
- Nickel, stellites and super-alloys
- Various oxides through the General Oxide calibration
- Traces in soils and sediments
- Clinker phases (C_3S, C_2S, C_3A and C_4AF)
- Iron ores according to ISO 9516
- Titanium alloys
- Tin and zinc low alloys
- Ferro-alloys and others for which analytical specifications are available on request.

Customer support

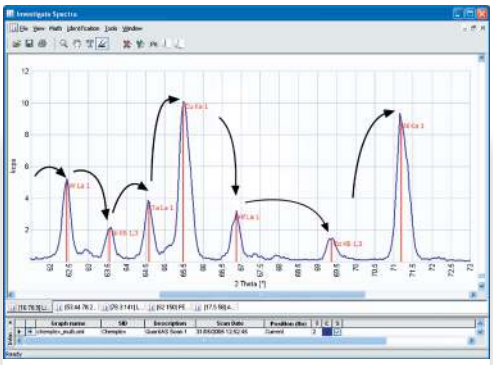
The backing of a major international corporation

Our company offers you worldwide support.

- Application product teams can advise on the most suitable ARL 9900 for a given application and help to draw up specifications
- Dedicated training allows operators to exploit the full capabilities of their ARL 9900
- A comprehensive worldwide after-sales service network assists with the resolution of day to day queries and ensures that the ARL 9900 achieves the very high standards of reliability and durability that it is designed to provide.



Example of QuantAS scans from which concentrations for the various elements in the sample are derived



UniQuant uses "peak hopping" to acquire intensities for up to 122 line and background positions



General specifications for ARL 9900 Intellipower

Element range

Boron (Nr. 5) to Americium (Nr. 95) providing all necessary crystals are fitted on a universal goniometer. Oxygen (Nr. 8) to Americium (Nr. 95) with SmartGonio.

Spectrometer environment

Stabilized vacuum using molecular pump.

Spectrometer design

Analysis devices contained in a vacuum chamber made of grey cast iron and temperature controlled. Temperature control by a differential heating and cooling system. Crystals regulated to ± 0.1°C.

Spectrometer arrangement

X-ray tube mounted vertically at 90° above sample surface. Analytical devices positioned on a 360° ring looking down at the sample surface.

X-ray tube

Latest generation high performance Rh anode end window tube. Extra thin Be window (0.05 mm) increases sensitivity for light elements. LoVap technology ensures excellent long term stability. Optional W and Mo anodes.

Monochromators

Fixed mechanical systems using curved crystal optics (flat optics for light elements) and flow proportional, sealed or scintillation detectors. Each monochromator has its individual temperature control to ± 0.1°C. For ultra-high countrates, absorbing filters can be fitted. Dual Pulse height integration to discriminate and correct for 2^{nd} order peaks.

Universal goniometer

Gearless, microprocessor controlled goniometer using optical encoders. Fully automatic programming of:

- Up to 9 flat crystals
- Up to 4 primary collimators: fine, medium, coarse, extra-coarse
- 2 detectors: scintillation and flow proportional (Ar/CH4 10 %: ultra-low flow 3 ml/min).

Independent rotation of crystals and detectors.

Maximum slewing speed: 4800° 2θ/min.

Accuracy of peak positions vs. ASTM table on LiF crystals: 0.015°.

Angular reproducibility < ± 0.0002°.

Angular resolution 0.001°.

Total angle range: 0°-153° 2θ (Flow proportional counter: 17°-153°. Scintillation counter: 0°-115°).

Continuous digital scans: from 0.25°/min to 1200°/min as function of measuring time and increment.

Step scan range: Minimum step: 0.001°.

Maximum practical: 1.00°.

Time of measurement for each step: 0.1 s. – 655 s.

SmartGonio

Gearless, microprocessor controlled compact goniometer using optical encoders. Fully automatic programming of:

- 3 flat crystals
- 2 detectors: scintillation and flow proportional (Ar/CH4 10 %: ultra-low flow 3 ml/min).

Fixed collimator selected according to customer's application.

Independent rotation of crystals and detectors.

Maximum slewing speed: 5500° 2θ/min. Accuracy of peak positions vs. ASTM table on LiF crystals: 0.015°.

Angular reproducibility: < ± 0.0002°.

Angular resolution: 0.001°.

Total angle range: 0°-150° 2θ (Flow proportional counter: 17°-150°. Scintillation counter: 0°-90°).

Continuous digital scans: from 0.25°/min to 1200°/min as function of measuring time and increment.

Step scan range: Minimum step: 0.001°.

Maximum practical: 1.00°
Time of measurement for each step: 0.1 s. – 655 s.

Free lime-quartz-limestone channel

Microprocessor-controlled compact X-ray diffraction system for determination of free lime in clinker and slags, limestone additions in cement, hot meal calcination monitoring and quartz in raw meal.

Compact XRD system

Microprocessor-controlled compact X-ray diffraction system for determination of phase content in various process monitoring.

Counting electronics

Multi-channel analyzer to discriminate peaks of higher energy.

Digital Automatic Gain Control (AGC) for pulse shrinkage correction. Automatic dead time correction ensures linearity of response up to 2 Mcps on flow proportional counter, 1.5 Mcps on scintillation counter, 1 Mcps on sealed detectors.

Sample changer and cassettes

Basic magazine: 12 cassettes for samples of max. height 40 mm and diameter 60 mm. Large capacity X-Y changer: 98 cassettes for samples of max. height 30 mm and diameter 52 mm or 98 samples on supports for direct introduction. Exposed opening 29 mm diameter (basic). Rotation of cassettes in analysis position: 60 rpm. Large changer is easily retrofittable.

Primary beam filter

Up to 4 position programmable primary beam filter for modifying X-ray excitation.

- Cu: For analysis of Ru, Rh, Pd, Ag and Cd (elements that are interfered by Rh lines from the X-ray tube) in light and variable matrices
- Al: To improve peak to background ratio on Pb or As in light matrices
- Others filters on request.

Laboratory information

Optional phone service support through Internet connection.

Electrical safety: IEC 61010 – 1.

Radiation safety: fully protected system—interlock system complying with ISO 13489-1.

Electromagnetic compatibility:
EN 61326-1 (group 1, class a, industrial).

Particular specifications for ARL 9900 IntelliPower 1500

Spectrometer capacity

- 12 fixed channels or
- 1 goniometer + 8 fixed channels or
- 1 goniometer + 1 compact XRD system + 8 fixed channels.

X-ray generator for 1500 W

Solid state 1.5 kW high frequency generator of maximum voltage 60 kV and maximum current 70 mA. All kV/mA combinations must be chosen to be less than 1500 W. Maximum line voltage variation -15 % to +10 %. Stability ± 0.0001 % per 1 % variation.

Power requirements

3.8 kVA single phase for 1500 W.

Cooling system

Closed circuit for deionised water flowing through liquid/air heat exchanger. Flow is regulated between 0.5 and 5 lt/min according to generator setting (to keep X-ray tube temperature constant).

Dimensions and weight for 1500 W

H 166 cm, D 136.5 cm, W 93 cm with basic sample changer + H 47 cm, L 83.5 cm, W 41 cm. Weight: 785 kg.

Particular specifications for ARL 9900 IntelliPower 2500

Spectrometer capacity

- 12 fixed channels or
- 1 goniometer + 8 fixed channels or
- 1 goniometer + 1 compact XRD system + 8 fixed channels.

X-ray generator for 2500 W

Solid state 2.5 kW high frequency generator of maximum voltage 60 kV and maximum current 100 mA. All kV/mA combinations must be chosen to be less than 2500 W. Maximum line voltage variation -15 % to +10 %. Stability ± 0.0001 % per 1 % variation.

Power requirements

5 kVA single phase for 2500 W.

Cooling system

Closed circuit for deionised water flowing through liquid/air heat exchanger. Flow is regulated between 0.5 and 5 lt/min according to generator setting (to keep X-ray tube temperature constant).

Dimensions and weight for 2500 W

H 166 cm, D 136.5 cm, W 93 cm with basic sample changer + H 47 cm, L 83.5 cm, W 41 cm. Weight: 785 kg.

Particular specifications for ARL 9900 IntelliPower 4200

Spectrometer capacity

- 32 fixed channels or
- 1 goniometer + 24 fixed channels or
- 1 goniometer + 1 compact XRD system + 14 fixed channels

Up to three goniometers configurations also available.

X-ray generator for 4200 W

Solid state 4.2 kW high frequency generator (max. settings: 60 kV-70 mA or 35 kV-120 mA). All combinations must be chosen to be less than 4200 W. Maximum line voltage variation -15 % to +10 %. Stability ± 0.0001 % per 1 % variation.

Power requirements

7 kVA single phase for 4200 W.

Cooling system

Built-in closed circuit for deionised water flowing through liquid/liquid heat exchanger. External water needed is <18°C, pressure ≥ 2 bar, flow is regulated between 0.5 and 4.5 lt/min according to generator setting (water consumption minimization).

Dimensions and weight for 4200 W

H 166 cm, D 136.5 cm, W 93 cm with basic sample changer. Weight: 750 kg.



XRF and XRD analysis capabilities from Thermo Fisher Scientific



Thermo Scientific Niton XL5
XRF Portable Analyzer



ARL QUANT'X
Versatile EDXRF



ARL OPTIM'X
Compact WDXRF



ARL PERFORM'X
Advanced WDXRF



ARL EQUINOX 100
Compact low power XRD



ARL X'TRA Companion
Benchtop Process XRD



ARL 9900 XRF/XRD

X-ray spectrometry is a common and very powerful technique for fast, non-destructive, quantitative analysis of major, minor and trace components in all types of materials, including solids, powders, aqueous or organic solutions, and layered structures. It has numerous applications in every industry: pharmaceuticals, environmental monitoring, metals, cement, electronics, glass, polymers, ceramics, refractories, geochemistry, petroleum, chemicals and mining.

Thermo Fisher Scientific provides a full range of X-ray fluorescence and X-ray diffraction instrumentation (EDXRF, WDXRF, XRD, EDS, ESCA) that covers every aspect of X-ray spectrometry from routine to highly specialized research applications. From the versatile ARL QUANT'X to the ultra-precise ARL 9900 XRF-XRD Spectrometer, each instrument combines leading-edge technology with a long history of quality, durability and exceptional analytical performance.

Since X-rays are used in these instruments, please check all local laws and regulations in advance of the installation to avoid any regulatory problems.

Learn more at **thermofisher.com/9900**

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