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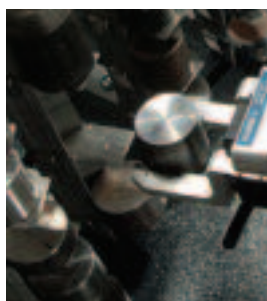
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ARL SMS-2000 Automated XRF Spectrometer

The intelligent solution

The Thermo Scientific ARL SMS-2000 is the state-of-the-art solution for unattended automatic sample preparation and elemental analysis by X-ray fluorescence (XRF). Most popular system with nearly 400 installations worldwide, the ARL SMS-2000 automates a single spectrometer XRF or OES (optical emission).

Product Specifications



An opportunity to seize

Convinced that putting robots to work analyzing samples was part of the new strategies required to improve the efficiency of industrial production control, our company was first to use modern robotics for optical emission (OES) and for X-ray fluorescence (XRF) spectrometer automation.

Proven and recognized technology

The Thermo Scientific ARL SMS (Sample Manipulation System) is a third generation product that has proven exceptional reliability in the most demanding XRF and OES production control applications all around the world. Over the last two decades, it has established our undisputed leadership in automated metals quality control.

The latest ARL SMS-2000 version sets new performance standards in speed, precision, lifetime and reduced operating costs in metals, cement and mining applications.

Major productivity gains

With the Thermo Scientific ARL SMS-2000, the samples are prepared and analyzed at a very rapid, fully sustainable and perfectly predictable rate without operator intervention. Operating and analysis costs are cut significantly:

- The results are available faster to improve production turnover
- More samples can be processed, so frequently eliminating production bottlenecks
- Qualified laboratory personnel can be released from routine duties
- Automatic instrument monitoring functions ensure that instrument performance is permanently under control. This includes running control samples and advanced notification of abnormal conditions using SPC Statistical Process Control techniques
- The improved instrument monitoring and trace ability facilitates the implementation of a laboratory quality system, in compliance with ISO standards for instance

Thermo Fisher Scientific: Partners in productivity

Better analysis dependability

Automation with ARL SMS-2000 reduces chemical analysis variation, eliminates many of the causes of measurement delays and fully exploits the analytical performance of Thermo Scientific process control XRF spectrometers.

All samples are processed under rigorously identical and reproducible conditions following procedures defined and set up in advance.

Advanced technologies like a vision system can be applied to reject difficult metal samples.

The system supports the most complex analysis procedures and applies them systematically.

A very fast payback

More dependable and less expensive analyses make for a rapid return on investment (typically less than one year), not only for the automatic system but also for the spectrometer itself.

Smoother production flows with more efficient quality control tools cut manufacturing costs.

The critical phases of production are monitored more effectively, so enabling commitments to be given for compliance with still more stringent product specifications.

The same SMS automation system is available for XRF and OES spectrometers, which simplifies instrument operation and maintenance; it also reduces supervisor training in metallurgical applications requiring both analytical techniques.

A unique automation choice

The ARL SMS series is not merely limited to XRF automation:

- ARL SMS-2000 EL entry level version and full ARL SMS-2000 for the ARL 3460 and ARL 4460 metals analyzers and for the ARL Fire Assay Analyzer

For XRF applications which do not require all the ARL SMS-2000 power and flexibility, there is an entry level Thermo Scientific solution as well:

- The ARL SMS-XY, a simple solution for the ARL 9900 and ARL ADVANT'X XRF spectrometers using a large XY magazine for sample handling
- The ARL SMS-Omega for automation of the ARL OPTIM'X XRF spectrometer

And to double your analytical power, there is a Thermo Scientific high-end solution:

- The ARL SMS-3000 for the automation of twin XRF and OES spectrometers with support of up to two sample preparation machines

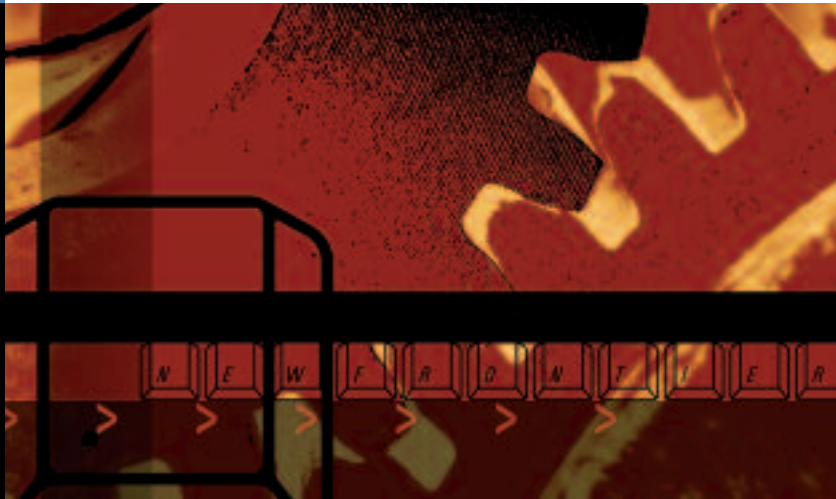
Our company is unique in designing and manufacturing XRF and OES spectrometers with their automation systems. This means one partner, one competence and one responsibility for your specific metallurgical application.



ARL SMS-XY



ARL SMS-3000



ARL SMS-2000

A third generation product at the leading edge of technology

Powerful, multi-purpose and entirely customizable

The remarkable quality and speed of the ARL SMS-2000 industrial robot combined with the unique Thermo Scientific SMS automation software provide standard and very comprehensive automation tools to cover the most demanding applications. This avoids having to redesign the system for each customer and guarantees optimum support and evolution.

Personalized configuration

This single product strategy does not limit the choice of the configuration best suited for your specific application and needs.

Options are available to simplify sample registration and introduction as well as for further sample processing such as radioactivity measurement and sample labeling.

Production samples can be registered on-line manually via terminal(s). Options are available to facilitate and speed up registration such as reading data via network files, bar code readers, selecting from sample lists. Registration via network by means of computers (process computers, laboratory management systems) is also possible to avoid errors and save time.

Other prepared samples can also be registered and introduced directly in the ARL SMS-2000 system for analysis between priority production samples.

High quality, reproducible and reliable sample preparation is an essential component of the automated XRF spectrometer which influences directly the analytical performance and the system uptime. Thermo offers a complete range of fully automatic machines for the preparation of:

- Metallic samples to provide the surface quality required for reliable analysis by XRF

- Oxides associated with metal production (mineral ore, sinters, baths, slag and blast furnace slag), minerals and cement

Magazines can be used for sample introduction.

When automatic preparation is unavailable, the samples can be prepared outside the system and introduced manually in the ARL SMS-2000 system for automatic analysis.

The analysis results are immediately and automatically transmitted to addressees according to their specific needs.

In-situ analysis

When the analysis must be closer to the process, the ARL QuantoShelter is the ideal solution.

The ARL QuantoShelter (also called the lab in a box), is a container specially designed for housing the automated Thermo Scientific XRF spectrometer with sample preparation; it is used when no protected premises are available in production to install the system.

The ARL QuantoShelter operates very much like a process sensor or an on-stream analyzer. The laboratory being brought to the samples rather than the other way around, the sample transport times are reduced to a minimum.

Laboratory applications

The system is fully compatible with laboratories equipped with one or more preparation and analysis lines and linked to sampling locations via air tube systems for sample transport.

Simple and normalized interfaces ease communication with other laboratory and process computers while providing all the necessary functionality. This permits to optimize the performance of large automated laboratories and reduces commissioning times to a strict minimum.

A very fast system designed for easy maintenance

As supplier of the XRF spectrometer with all necessary application and support expertise, we are best able to integrate sample preparation and analysis into a fully automated robotics cell to minimize response time and optimize analysis cadences.

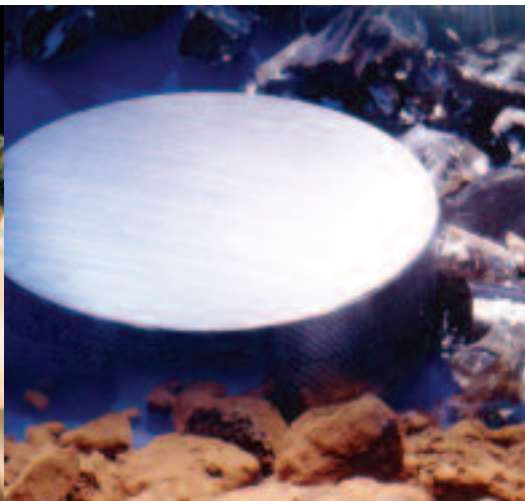
Each component of the system (spectrometer – SMS system – preparation machine) has its own intelligence and works simultaneously and independently of the others. This distributed processing concept, with each component working at its optimum rate, maximizes the system efficiency; tasks are performed in parallel rather than purely sequentially. Samples are prepared while other samples are analyzed.

Each system component can also be used manually as a stand-alone device when necessary for maintenance or for back-up purposes.

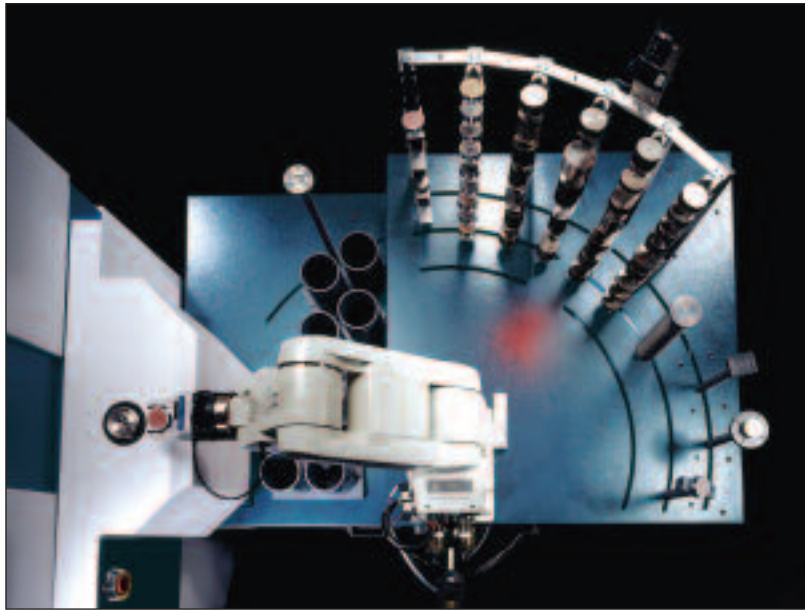
The SMS system has its own "brain" in the form of an autonomous automation software running in parallel with the analytical software. This distribution of tasks increases the modularity of the software and simplifies testing, diagnostics and maintenance; very few spectrometer extensions are required for automation, facilitating the automation of manual ARL 9800 and ARL 9900 XRF instruments in the field.



ARL QuantoShelter: The lab in a box



ARL SMS-2000: Automation tailored to your needs



The ARL SMS-2000 industrial robot

The SMS robot stands on a chassis linked to the Thermo Scientific XRF spectrometer. The robot control unit with its digital signals interface performs all hardware monitoring functions, which simplifies considerably the automation. It is located under the chassis with the SMS power supplies, electronics and the sample sorting and filling recipients.

High precision brushless AC-servo motors provide for an almost maintenance free robot operation. Integrated absolute encoder technology is used to achieve a position repeatability of ± 0.02 mm. The origin is established once for ever when the unit is powered for the first time and there is no need for complex, time-consuming reference traverses. The arm length of 0.5 m and the maximum speed of 2.1 m/s provide for a sample handling speed that no manually operated instrument can cope with.

Waiting positions are also used to further optimize throughput when several production samples have to be processed: prepared samples can be stored temporarily to free the preparation machine for the processing of subsequent samples.

Automatic XRF analyses without sample loading in cassettes

To ensure a high system speed and reduce the number of mechanical components, no cassette is used for production samples. These automatic samples are transferred directly by the SMS robot to the XRF spectrometer loading position. Samples of non-conforming size are automatically detected to protect the instrument. The height is measured automatically to ensure precise positioning in the primary chamber for analysis purposes.

More accurate and reproducible analyses

The global system reliability being no better than that of the weakest component, each device of the automatic system has been selected based on very strict quality criteria, including the sample preparation machine. The SMS software is subject to the most comprehensive tests ever done by our company.

The essential purpose being to supply high quality sample analyses, the ARL 9900 series XRF spectrometer lies at the heart of the system. The instrument features a variety of simultaneous/sequential configurations for optimum combination of speed and flexibility, an X-ray tube mounted above the sample and even full X-ray diffraction capabilities.

Sample management following analysis

The metal production samples are automatically sorted and filed. Eight containers are available for this purpose. Production samples can also be returned to the preparation system in large automated applications (for instance for centralized sorting and filing).



Oxide samples are returned to the preparation system for recycling the supports (steel rings for pellets and holders for fused beads).

Full trace ability of quality control activities

In addition to the analytical performance, events of interest can be recorded and communicated to other computers. These functions are fully automatic and do not slow sample processing.

Unattended instrument monitoring and verification

Ensuring that the automated XRF spectrometer permanently delivers quality results is essential to prevent scrap and rework in production.

Control samples are regularly analyzed and processed by statistical evaluation techniques (SPC) to detect eventual anomalies. Automatic instrument standardization is triggered by the system when necessary and alarms are produced when manual interventions are required to prevent the system going out-of-control.



For certification purposes, the instrument analytical performance can be permanently recorded in the form of control charts (SPC-Full option) without operator intervention. The SPC-Full software is not merely limited to instrument monitoring; it can be applied automatically to production control as well for quick review of the performance and identification of possible process improvements.

Type standards can also be used to correct response differences between the instrument calibration and the composition of particular alloys. Conditioning samples can be used to condition sample preparation grinding belts for instance.

The ARL SMS-2000 magazine for standards is fixed and universal. It can store as many as 45 metallic cylindrical and/or conical setting-up, control samples and type standards of variable diameter. Pellets in steel rings and fused beads on holders are supported as well. Higher storage capacities are available as options.

If necessary, the metal setting-up, control samples and type standards can be re-prepared automatically when a preparation machine is available.

Automation to advance quality control capabilities

Increased availability for processing production samples

Direct user access

Authorized users can perform various tasks on-line without interfering with the automatic processing of the production samples:

- Synoptic system monitoring to display the sample positions and the status of each system component
- Registration of manual samples introduced directly in the ARL SMS-2000
- Consulting the audit trail of recorded system activities
- Request to run a control sample or to standardize the instrument
- Manual introduction of samples prepared off-line
- SPC control charts can be displayed and printed
- Stored analyses or the latest standardization can be examined.

User accounts allocate the system resources and protect the system against unauthorized changes.

Selective standardization

Only the instrument channels 'out of control' are then corrected. The number of samples to analyze is reduced.

Simplified and efficient maintenance

Many on-line diagnosis tools enable system and component tests to be performed to reduce breakdown times. The system activity in the form of log files can be checked remotely by our specialists and the software can be quickly updated.

Simple restart procedures guide the operator to start the system up again.

Cassettes can be used as standard for the analysis of samples of irregular shapes and dimensions.

Options

A wide range of options is available to satisfy your specific needs:

- Up to 5 different production sample shapes
- Labeling of production samples on the analysis surface or on their back
- A vision system to reject difficult metal samples without analysis trial (avoiding releasing plausible but wrong results)
- Sample collections and batches software to facilitate the registration and processing of repetitive series of production samples (for instance, pellets samples from aluminum electrolytic baths)
- Security system compliant to safety norms
- Remote control of the automated Thermo Scientific XRF spectrometer
- Digital signals for communication with external customer devices
- Automatic re-preparation of metallic production samples which cannot be analyzed
- Sample radioactivity measurement
- Larger standards magazine capacity
- Sample registration via terminal or network
- Registration of production samples from the list of samples announced by computers or using sample identification parameters recorded on a network disk
- Chronological filing of production samples on one or more slides

A flexible and extremely powerful automation tool

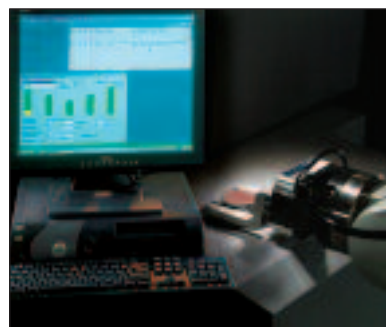
To satisfy the requirements of the most varied applications with a standard solution, very comprehensive functionality and total operational flexibility are incorporated into the automated XRF spectrometer software.

This permits us:

- To propose, with the ARL SMS-2000, the first generic spectrometer automation solution and concentrate on testing a single software version for XRF and OES applications and for all customers
- To release the most thoroughly verified software components ever produced for spectrometer automation applications requiring high reliability and uptime
- To ensure the full durability of the customer investment and simplify after-sales support of a product strictly identical for all applications
- To permit short installation and commissioning times.

We configure and customize every SMS system according to your particular needs before delivery.

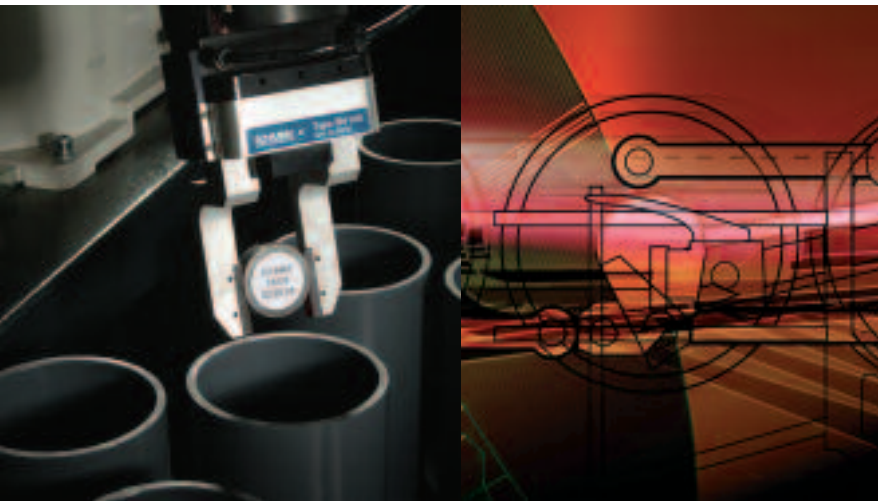
Additionally, all the functions and operating flexibility of the system remain accessible after its installation. The ARL SMS-2000 can be further fine-tuned to take advantage of your experience in using it and to handle changing or new requirements which are difficult to anticipate. This greatly reduces dependency on the supplier once the system is commissioned.



A strong, multi-purpose platform

The ARL SMS-2000 system benefits directly from synergy effects with other optical emission applications. It is designed, industrialized, documented, manufactured and maintained according to ISO 9001:2000 procedures. The result is unmatched features and performance with the most advanced automation system available today.

Updates are regularly made available by Thermo, as and when new possibilities arise. This expandability protects the ARL SMS-2000 system from obsolescence and keeps it in pace with the fast evolution of the technology.



XRF spectrometers supported	ARL 9800 and ARL 9900 XRF series with WinXRF and OXSAS Analytical Software		
Sample weight	Max. 900 grams		
Production sample forms	Shape:	Powder	Pellets in steel rings, fused beads on metallic support
		Metal	Lollypop single and dual thickness without thin part, spemis, disks, cylindrical or conical (max. 3° cone angle) with parallel surfaces following preparation
	Dimension:	Within ± 1 mm	
	Height:	8-25 mm (after preparation)	
Setting-up, control, conditioning samples and type standards	Shape:	Disks, steel rings with pellet, fused beads on metallic support, cylindrical or conical (max. 3° cone angle)	
	Dimension:	32-50 mm in diameter	
	Height:	8-25 mm	
Magazine for setting-up, control, conditioning samples & type standards	Capacity of 45 samples:	9 positions each with 25 mm high samples (extended capacity available as an option)	
Sample preparation system	For ferrous samples:	Dual belt grinding. Cup wheel and belt grindind. Milling.	
	Options:	Sample introduction systems	
	For non-ferrous samples:	Dual milling or cutting and milling	
	Options:	Sample introduction systems	
	For powder samples	Grinding mill, pelletizing press. Fusion machine	
	Options:	Crusher, sample introduction systems	
Sample preparation time and transfer to the SMS-2000			Depends on the type of sample preparation
			For metals: 35-90 sec. For powder: several minutes

Typical production sample manipulation times:

A sample turning device is used as part of the ARL SMS-2000 system when metals samples of variable heights are presented by the preparation machine with the analysis surface down.

	PELLETS IN STEEL RINGS	METAL SAMPLES FUSED BEADS ON HOLDER
- Sample transfer to XRF spectrometer loading position (*)	7 sec	7 sec
- Loading in the spectrometer and preparation for analysis (**)	22 sec	18 sec
- Result calculation and transmission	3 sec	3 sec
- Remaining sample unloading by the spectrometer (done during calculation)	5 sec	5 sec
- Sample filing and robot move to the next sample	8 sec	8 sec
- Sample surface analysis by a vision system (option):	--	2 sec
- Sample labeling (option)	--	8 sec
Sample analysis cadence per hour (assuming excellent quality pellets)	With 30 seconds XRF measurement time (depends on instrument configuration)	
	Up to 48 pellets production samples per hour	
	Up to 44 metals production samples per hour with vision and labeling	

Various

Floor space requirements including SMS-2000	Length [mm]	2405
	Width [mm]	1250
	Max. height [mm]	1350-1600 (with vertical robot arm)

ARL SMS-2000:

Weight	200 kg
Supplies	0.1 m ³ air per hour at 6-10 bar (only for systems with labeling)
Power	230 VAC ± 10 %, 50/60 Hz ± 2 %, earth < 1 Ohm, 1.5 – 2.5 KVA
Operating conditions	Laboratory (except for the sample preparation machine)

(*) This assumes that the same holder will be used on the instrument lift for oxide and metal samples. Otherwise 5 seconds have to be added to change the sample holder before loading the sample.

(**) Pumping time depends on sample type and quality

