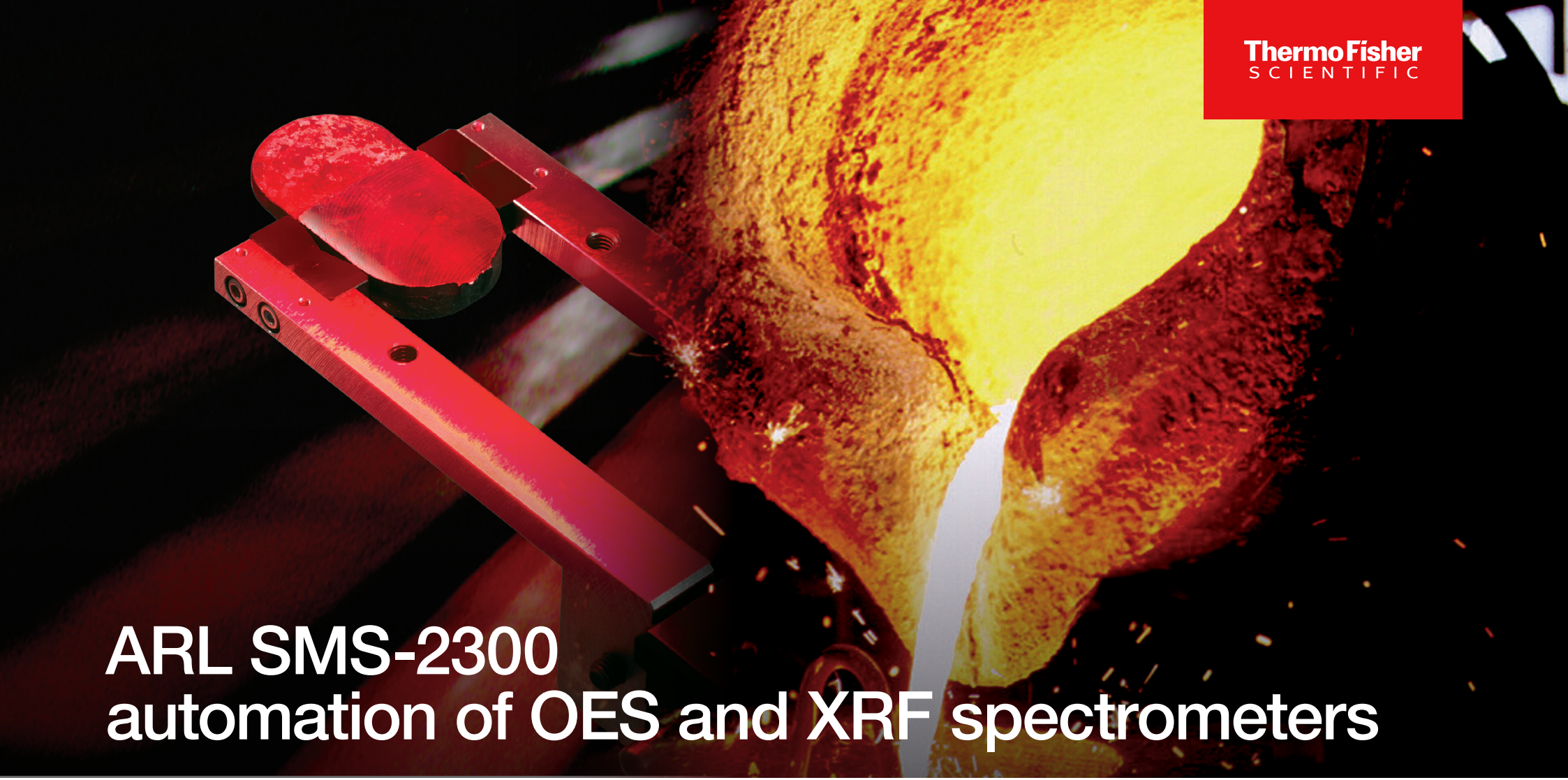


ThermoFisher SCIENTIFIC

ARL SMS-2300 automation of OES and XRF spectrometers

Materials analysis is our job, quality is our strength, and automation is our commitment

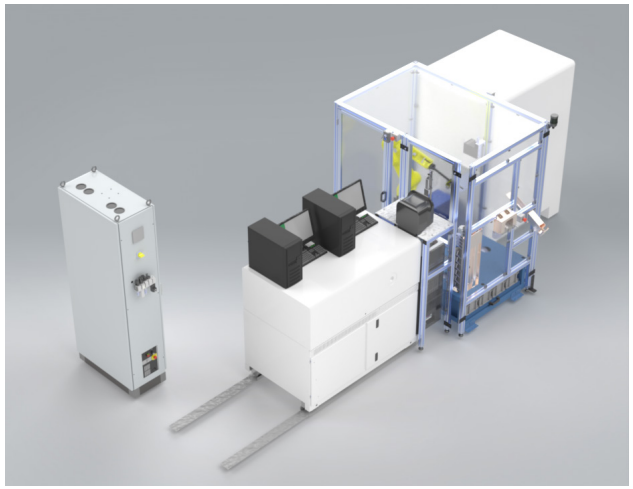
thermo scientific

Automation of OES and XRF Spectrometers

Compact, ultra-fast and easy to install, the Thermo Scientific™ ARL™ SMS-2300 Robotics-Based Automation for OES or XRF implements the latest automation technologies to exceed the expectations of modern metals industry laboratories. The ARL SMS-2300 automated metals system is a true product manufactured and maintained according to ISO 9001 procedures alongside our reputed metals analyzers. As designers of the spectrometers producing the analyses, the only deliverable to the process, we can comprehensively supply and support instrument and laboratory workflow automation solutions.

A proven automation solution with increased performance

The ARL SMS-2300 system is the culmination of 40 years of experience in supplying laboratory workflow automation solutions. It benefits from the feedback of more than 1,000 robotized Thermo Scientific optical emission (OES) and X-ray fluorescence (XRF) spectrometers in metals applications worldwide.



The ARL SMS-2300 system, has established a high standard of performance, reliability and durability in the most demanding metals applications. As a single spectrometer automation solution, it provides further sample turnaround time savings through a tighter integration of sample preparation and new sample processing capabilities.

A real opportunity for the metals industry

Nowadays, metal product specifications are getting progressively more stringent as quality norms become stricter. Therefore, the ability to perform accurate analytical quality control is more crucial than ever.

At the same time, competitive pressures for increased efficiency and lower production costs lead to fundamental reviews of production methods and quality control. Today, the ARL SMS-2300 system is the ideal automation solution to advance your production quality control operation.

Increased efficiency

With the ARL SMS-2300 system, the samples are prepared and analyzed through an automated workflow designed to reduce operator interaction. Operating and analysis costs are cut significantly:

- The results are available much faster to improve production turnover and contribute to eliminating production bottlenecks
- Routine operator workload is reduced

Better analysis dependability and quality

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

Automatic instrument monitoring functions ensure that instrument performance is permanently under control. The most advanced analysis procedures are often difficult to implement with a manual instrument are applied systematically.

A very rapid payback

Faster, more reliable, and less expensive analyses make for a rapid return on investment. With a more repeatable process, less rework and downtime are needed, leading to increased measurement accuracy, which results in increased productivity and ultimately in more metal being produced.

Easy integration into your specific environment

The automated ARL metals system is designed for use in centralized laboratories as well as on the production shop floors.



The ARL QuantoShelter Automated Metals Analyzer.

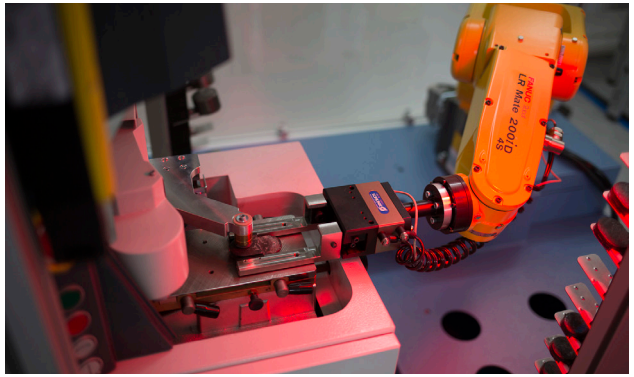
In situ analysis

When analysis must be done on the production floor, our Thermo Scientific ARL QuantoShelter Automated Metals Analyzer is the ideal solution. Also called “the lab in a box”, this container is specially designed for housing the complete system, including the sample preparation. It operates like a process sensor or an on-stream analyzer; the sample transport times are then reduced to a minimum as the laboratory is brought to the samples rather than the other way around.

The ARL QuantoShelter Automated Metals Analyzer is of particular interest when no protected premises are available in production to install the system.

Laboratory applications

Interfacing manual and automated air tubes is easy as all samples are introduced in the ARL SMS-2300 system rather than in the sample preparation machine. Incoming samples can be temporarily stored in the SMS system and processed based on their priority to reduce the complexity of automated air tubes systems. This permits optimizing the performance and costs of large automated laboratories while reducing commissioning times to a strict minimum.



ARL SMS-2300 robot.

Latest robotics technology

The ARL SMS-2300 system is equipped with a robot from FANUC, the number one supplier of industrial robots worldwide. This medium-sized robot has an arm length of 550 mm with a gripper and six moving axes and stands on a chassis linked to the ARL Metals system.

Metallic samples and standards of up to 1.5 kg can be moved at very high speeds with a repeatability of ± 0.03 mm.

Given usual production sample weights, this means less solicitation and reduced wear, increasing reliability and a longer lifetime. Minimum maintenance is required as the ARL SMS-2300 system’s robot uses high-precision, brushless AC-Servo motors, and internal cabling.

A powerful, multi-purpose, and entirely customizable product

The system provides full operational flexibility and the most comprehensive functionality ever built into a standard product. The result is unmatched customization capabilities to cover wide application ranges, avoiding one-off engineered solutions that are often difficult to maintain.

Following installation, the system can easily be adapted to changing or new requirements, which are often difficult to predict and anticipate.

High speed and intelligent sample processing

Multi-tasking to reduce sample turnaround times is at the heart of the automated ARL Metals Analyzer design:

Each component of the system (spectrometer – SMS system – preparation machine) has its own intelligence and works simultaneously and independently of the other. Samples are prepared while other samples are introduced or analyzed. Sample turnaround times are systematically optimized by the ARL automation workstation, or the “brain” of the system.

The spectrometer performs the instrument stand and electrode cleaning in hidden time, independently of the ARL SMS-2300 system’s robot. When the instrument is busy, waiting positions for prepared samples are automatically used to free the preparation machine to process the next sample.

Top class performance and uptime



Temporary storage of incoming samples.

Easy sample registration and introduction

Several options are available to simplify sample registration and introduction. Production samples can be registered manually. Online registration using other computers (process computers, laboratory management systems) is also possible to avoid errors and save time. Samples are always introduced directly in the ARL SMS-2300 system before being prepared to reduce the need for electromechanical sample introduction magazines and transfer systems.

To cope with high cadences, incoming samples can be temporarily stored in a random access, fixed, and universal magazine by the robot.

These samples are automatically processed based on their individual priorities rather than on a first-in, first-out basis. A monitoring shows the production samples waiting for processing.

Open architecture for sample preparation

High quality, reproducible and reliable sample preparation is an essential component of the automated metals analyzer, which contributes directly to the analytical performance and the system uptime. Sample preparation has undergone a significant evolution in recent years, and milling has become the preferred preparation technique for metals application. Fully aware of the market expectation to have a choice of sample preparation solutions and brands, we propose several sample preparation alternatives allowing customers to select the best solution depending on their preferences, needs, and budgets.

Tightly integrated sample preparation

The ARL SMS-2300 system's robot has direct access to most sample preparation machines for sample loading and unloading. Sample turnaround times are reduced, and unnecessary hardware is eliminated. Reduced floor space is necessary for the complete system and short distances between the various components ensure fast operation without compromising on accessibility for service and maintenance. For maintenance, convenient access to the sample preparation machine is maintained, avoiding having to switch off the robotic system.

More reliable, accurate, and reproducible analyses

The global system reliability is no better than that of the line's weakest link. Each component of the automatic system has been selected based on very strict quality criteria and the SMS software is also subject to comprehensive tests before any new release.

- At the heart of the system is the ARL iSpark with its own PC and the OXSAS analytical software. The SMS robot loads the prepared sample directly on the spectrometer stand. The sample is then automatically clamped onto the stand table during measurement.
- The ARL SMS-2300 system's robot shifts the sample between sparks automatically and very precisely.
- Bad sparks are automatically rejected. Bad burns can be detected early during the pre-integration to further reduce processing times for difficult samples.
- The stand table and the electrode are cleaned automatically in hidden time.
- To ensure optimum sample manipulation reliability, every different production, setting-up, control sample and type standard is gripped and handled by the robot as a specific sample.

The analysis results are immediately and automatically transmitted, and the samples are sorted and filed in containers following analysis. Specific samples can also be filed chronologically on a chute for further manual examination (e.g., samples that cannot be analyzed).

Sample surface management

The analysis surface of every standard is managed to perform a maximum number of sparks before having to re-prepare (saving on expensive reference samples and making more time available for the processing of production samples). The spark positions are user-definable for every sample and standard.

Automation to advance quality control capabilities

Instrument performance monitoring

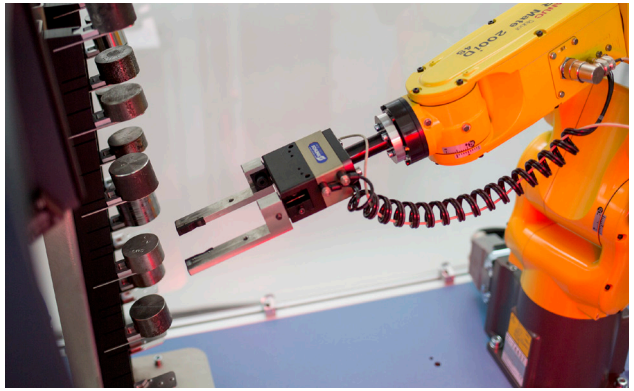
Ensuring that the automated metals analyzer permanently delivers quality results is essential to prevent scrap and rework in production.

Control samples are regularly analyzed and processed by statistical process control (SPC) to detect eventual anomalies. Automatic instrument standardization is triggered by the system when necessary, and alarms are produced when manual interventions are required in exceptional situations.

For certification purposes, the instrument's analytical performance can be permanently recorded and visualized in the form of control charts (SPC-Full options) which can be generated automatically with reduced operator interaction. And these SPC tools can also be applied automatically to the production process for, quick review of the performance in matching product qualities and identifying possible production improvements.

Type standards are supported to correct response differences between instrument calibration and the composition of particular alloys.

Conditioning samples can be measured to remove eventual stand contamination when trace elements must be measured following alloys samples.



ARL SMS-2300 Setting-up Samples, Control samples and Type standardization sample.

The ARL SMS-2300 magazine for setting-up, control samples and type standards is fixed and universal. It can store as many as 11 standards of variable diameter (up to 147 standards as an option). These standards are re-prepared automatically in idle time, immediately before analysis or at the request of an operator. The standards are automatically rotated about 30° before by the SMS robot to avoid any bias in the repreparation over time and prevent any sample inclination problems.

Full compliance with safety regulations and audit trail

The ARL SMS-2300 Automated Metals system's safety enclosure is designed according to the applicable CE conformity standards. The system also complies with robotics applications and electro-magnetic norms and recommendations.

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

To ensure the traceability of the quality control activities, events of interest can be recorded on disk and communicated to other computers.

Three superimposed color lights (red, blue, and green) permanently display the system status (optional).

Specific events can be communicated to external user-supplied devices (lamps, acoustic devices, etc.) via digital signals (optional).



Safety enclosure with access doors.

Focus on production samples and uptime

Direct online user access

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

- Synoptic showing the position of each sample monitoring in the system and the status of each system component
- Registration of manual samples introduced directly in the ARL SMS-2300 Automated Metals system
- Examination of the recorded system activities
- Request to run a control sample or to standardize the instrument
- SPC control charts can be displayed and printed
- Analyses or the latest standardization can be examined

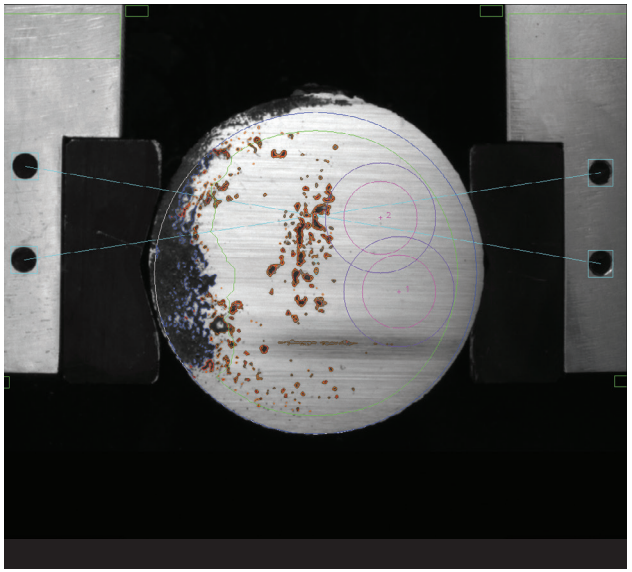
Selective standardization

To reduce the number of samples measured during standardization, only the instrument channels ‘out of control’ can be corrected (selective standardization). If required, production samples can be processed between the analyses of setting up samples to avoid delaying time-critical production samples. Otherwise, production samples will be blocked until the instrument is again under control.

Simplified and efficient maintenance

The distributed automated metals analyzer sample processing architecture also increases the modularity of the software and simplifies testing, diagnostics and maintenance. Only a few modifications are required to automate existing metals analyzers in the field.

The instrument and the sample preparation machine can also be used manually as standalone devices for maintenance or for backup purposes. Many online diagnosis tools enable system and component tests to be performed to identify eventual failures and reduce breakdown times. Log files holding trace mode operation details are then investigated by our specialists to solve the problems.



Sample results.

Sample processing options

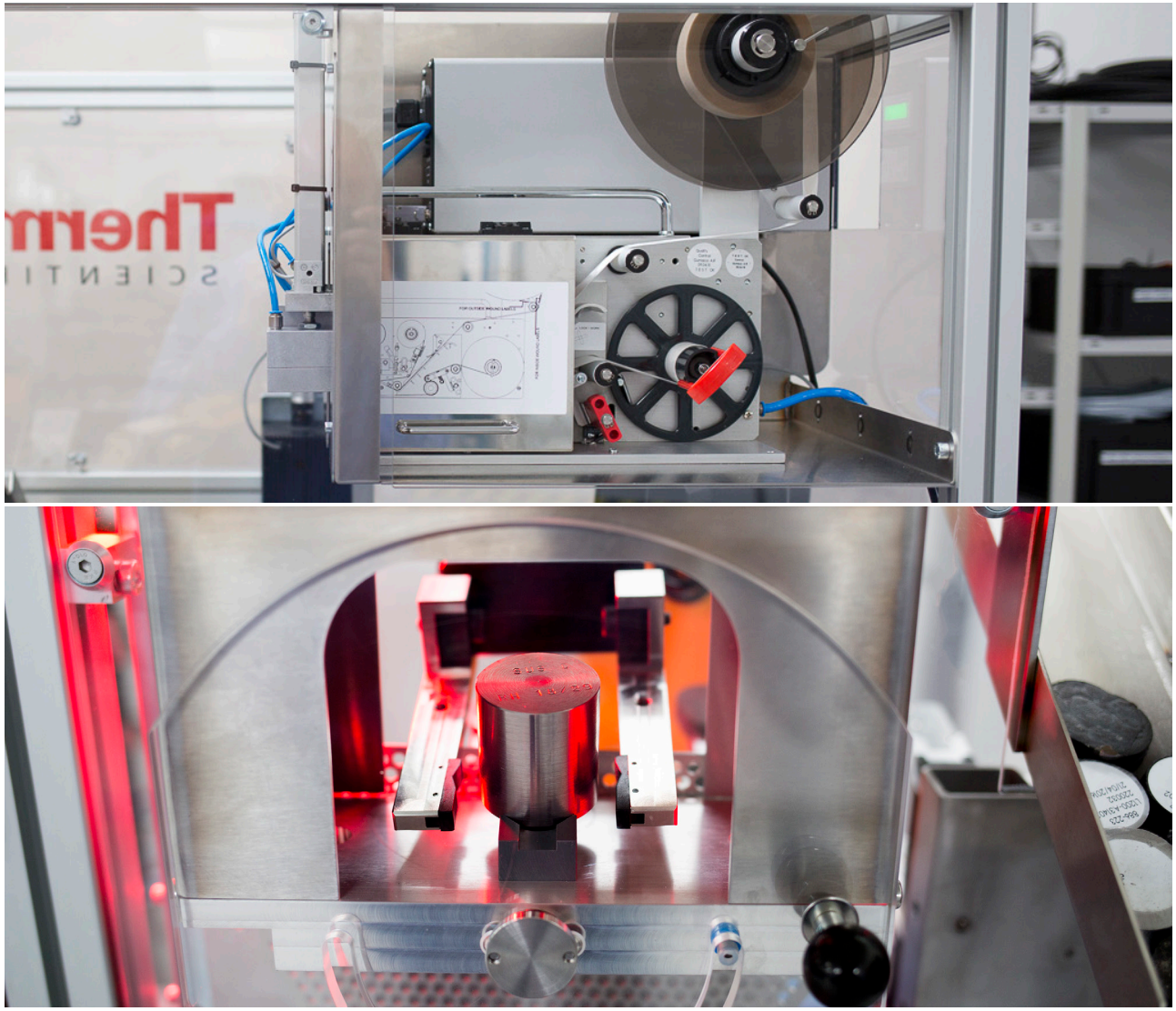
Advanced sample processing options include:

- An ultra-fast vision system that can select the best spark positions in two seconds for difficult samples and reject them without analysis trial when they do not meet the minimum surface quality
- Labeling of production samples on the analysis surface or on their back
- Sample radioactivity detection

Separate product specifications are available describing these options.

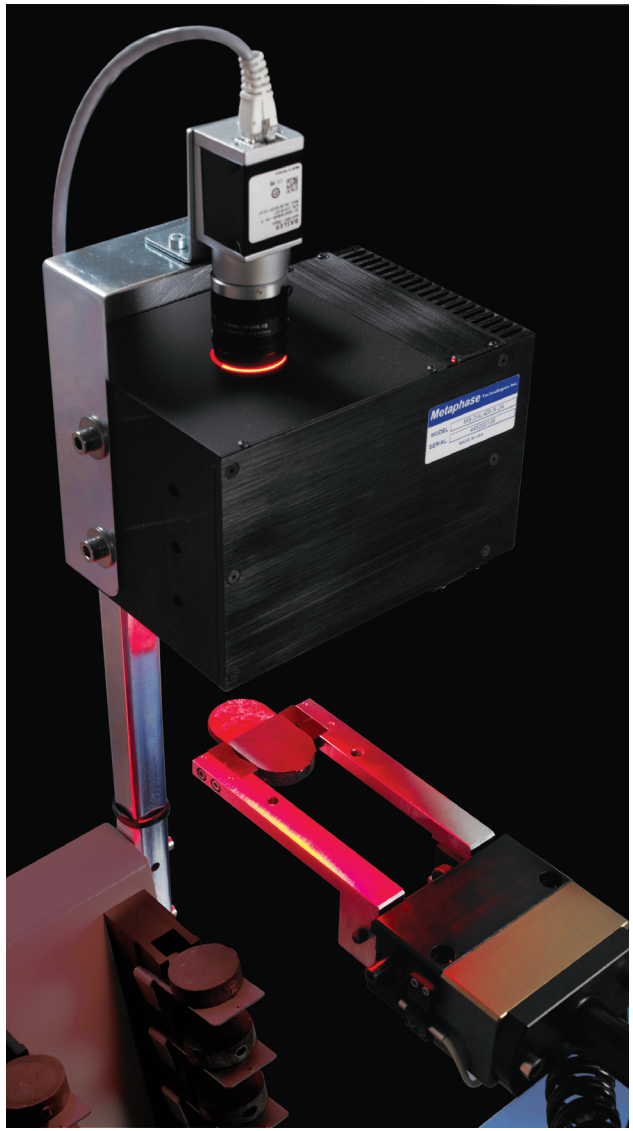
A wide range of options is available to satisfy your individual needs:

- Support of up to five different production sample shapes
- Sample registration via terminal or network
- Bar code readers
- Registration from the list of production samples announced by other computers
- Registration using sample identification parameters recorded on a network disk
- Sample introduction via manual introduction or via a local or remote sample introduction door
- Temporary storage for up to 16 incoming production samples waiting for processing
- Automatic repreparation of metallic samples that cannot be analyzed
- Additional digital signals for communication with external customer devices



Sample labeling (top). Manual sample introduction (bottom).

A unique automation product range



Vision system.

- An additional chute for chronological filing of samples outside the robot work volume
- Extension of the SMS magazine for standards to up to 90 positions
- ARL QuantoShelter for *in situ* analysis
- Weighing of sample to detect bad sample before sample preparation

The ARL SMS-2300 system is not merely limited to optical emission; there is an X-ray fluorescence version to automate the Thermo Scientific ARL 9900 XRF Spectrometers (refer to the separate product specifications).

The following other Thermo Scientific automation products share the same software automation platform:

- The Thermo Scientific ARL SMS-3500 System for the automation of twin OES and/or XRF spectrometers with double preparation machine support – Our top of the range solution
- The Thermo Scientific ARL SMS-3300 System in its single or dual version (for one or two instruments, respectively) allows cost-effective field upgrading between both options
- The XY manipulator based systems for XRF applications (SMS-XY for ARL 9900 XRF, SMSPFX for the ARL PERFORM'X)
- The Thermo Scientific ARL SMS-Omega XRF Instrument for the automation of the ARL OPTIM'X entry level WDXRF spectrometer

The common automation platform maximizes the synergy between all applications and facilitates development, industrialization, and testing, as well as the support of the installed base:

- More than 90% of the ARL SMS automation software code is common to all these systems
- A single software product has to be maintained anytime as opposed to a multitude of one-off systems largely re-engineered for each customer.

Thermo Fisher Scientific is firmly committed to further developing its automation solutions making them completely future-proof. Updates are regularly made available to customers whenever new capabilities are implemented to keep them in pace with the fast technology evolution.

Upgrade paths to the latest automation solutions are available for customers who do not want to replace their complete system. To keep you informed about our latest developments, please visit: **www.thermofisher.com/sms**

Technical specifications		
Metals analyzers supported		Models ARL iSpark Series
Application		Automated metals analysis
Robot payload	Max	4 Kg
Production samples	Ferrous metals shapes	Lollypop round, oval & dual thickness, disks, short & long
	Non-Ferrous metals shapes	ASTM, conical (max. 3° cone angle), mushroom*
		(*) Depending on the sample preparation machine model
	Dimension tolerance	Within ± 1 mm
	Height	8 mm minimum after preparation
Setting-up, control, conditioning samples and type standards	Shapes	Disks, cylindrical or conical (max. 3° cone angle)
	Dimension:	Depends on the sample preparation machine model
	Height	8-60 mm
Magazine for setting-up, control, conditioning samples and type standards	Capacity of 45 samples (Option for 90 samples)	3 sectors of 17, 13 or 9 positions each with respectively up to 30, 40 or 60 mm thick standards
Sample preparation system	Ferrous metals	Milling
		Grinding (cup wheel and belt)
	Non-Ferrous metals	Milling
		Cutting and milling
Sample preparation time	Ferrous metals	27-67 sec (depending on the sample preparation model)
	Non-Ferrous metals	35-67 sec (depending on the sample preparation model)
Typical production sample manipulation times		
Loading in milling machine (from SMS manual sample introduction slide/door)		8 sec
Transfer from the milling machine to the metals analyzer stand or XRF lift		7 sec
Sample shifting for another spark (OES)		5 sec
Sample filing and robot move to the next sample		6 sec
Sample labeling (option)		8 sec
Sample surface analysis by a vision system (option)		2 sec
Stand and electrode cleaning (OES)		The cleaning before or after the sample analysis is done in hidden time (the cleaning operates in parallel and independently of the robot)

Various		
Floor space requirements	ARL iSpark	ARL SMS-2300 (Without sample preparation)
Length	1385 mm	1200 mm
Width	860 mm	995 mm
Height	1200 mm	1900 mm
Weight	~ 500 kg or 1100 lb	~ 295 kg or 590 lb
Power	230 VAC ± 10%, 50/60 Hz ± 2% Earth < 1 Ohm 1 kVA	230 VAC ± 10%, 50/60 Hz ± 2% Earth < 1 Ohm 1.5 – 2.5 kVA
Supplies	See ARL iSpark metals analyzer specifications	Compresserd air: 0.2 m3 per hour at 6-10 bar
Operating conditions	See ARL iSpark metals analyzer specifications	

About Thermo Fisher Scientific

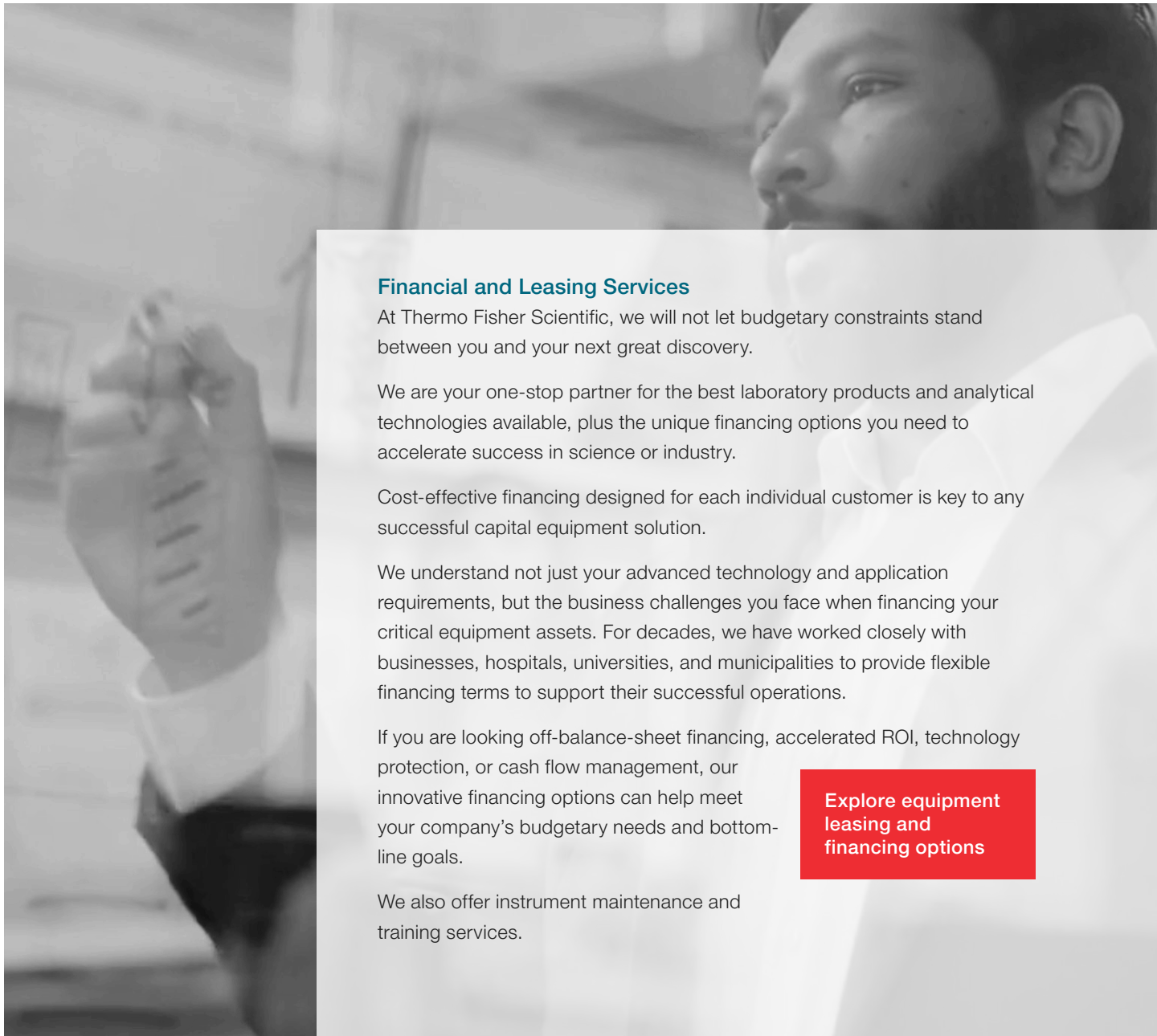
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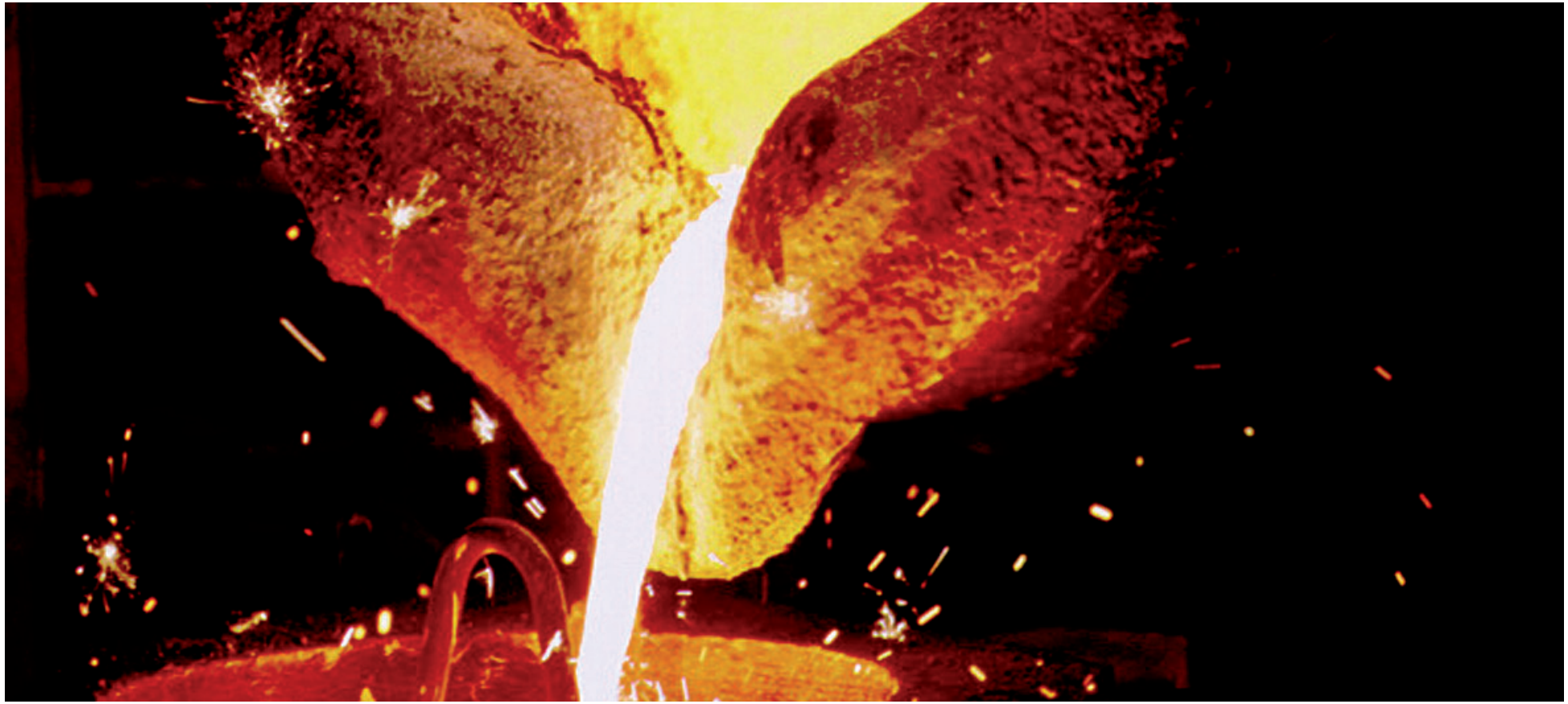
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