



Avanta



**Atomic Absorption
Spectrometer**



*The GBC Avanta is a versatile, modular AAS
tailored to your specific requirements*

GBC—a history of innovation

GBC Scientific Equipment is a world leader in the development and manufacture of atomic absorption spectrometers. Since our inception in 1978 GBC has been at the forefront of developments in AAS.

From Ultra-Pulse background correction and asymmetric modulation for double beam instruments to Automatic Burner Rotation, GBC has brought innovation into your laboratory. We have improved the quality of your data while ensuring that your instrument is not only easier to use but produces meaningful results faster and with less operator intervention.

Our goal has always been to increase the productivity of your laboratory while decreasing your ongoing costs. These benefits are yours now with the high performance Avanta AAS.

The Avanta AAS—versatile, powerful and fast

The Avanta AAS makes use of the latest in atomic absorption spectrometer technology. Developed after exhaustive research into the needs of the analytical community, Avanta has all the power, performance and speed required in today's modern laboratory.

Select the configuration which best suits your analytical requirements

The Avanta atomic absorption spectrometer can be configured to perfectly reflect the analytical requirements of your laboratory. You may need a cost-effective instrument to handle a few samples per week, or a fully automated system capable of handling hundreds of samples per day. The sensitivity of a flame atomization system may suit your application, or you may need the ultra-trace capability of a graphite furnace or hydride system. The speed of analysis may be critical, or you may need to follow strict QC protocols for regulatory compliance. Whatever your application there is an Avanta configuration tailored to your needs and your budget.

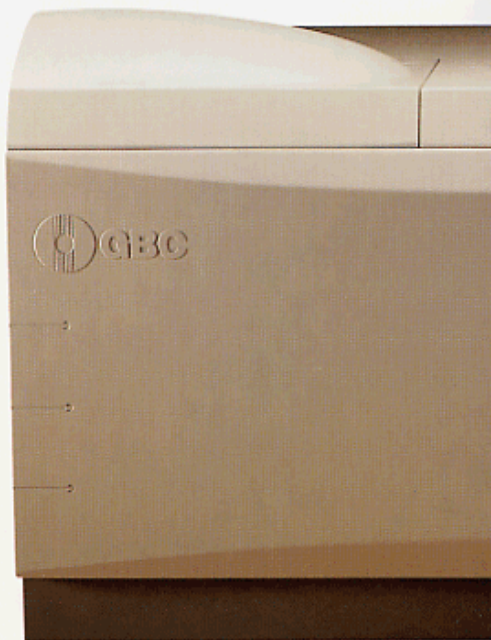
The entry level Avanta is a high performance AAS with:

- Guaranteed world-best sensitivity and precision
- Double beam optics for long term stability
- Ultra-Pulse background correction to ensure accurate results
- Four-lamp turret for rapid element selection
- Automatic wavelength and slit setting for ease of operation
- A flame control system with comprehensive safety interlocks

Choose from a wide range of high performance options

A range of options may be added to this powerful base system to increase the level of automation and further improve your productivity. These options include a motorized eight-lamp turret to allow automated multi-element analysis, a programmable flame control system to ensure optimum conditions for each element and even safer operation, an automatic burner rotation system for fast and accurate measurement of high concentration samples without dilution, and a Super Lamp power supply for even lower detection limits. Or you can choose from the full range of accessories.

The Avanta AAS can be configured for flame or furnace analysis, with a comprehensive range of accessories to make your analytical task simpler, more reliable, more accurate and more productive.



Avanta

Safety and simplicity with advanced
method or fully programmable
flow control

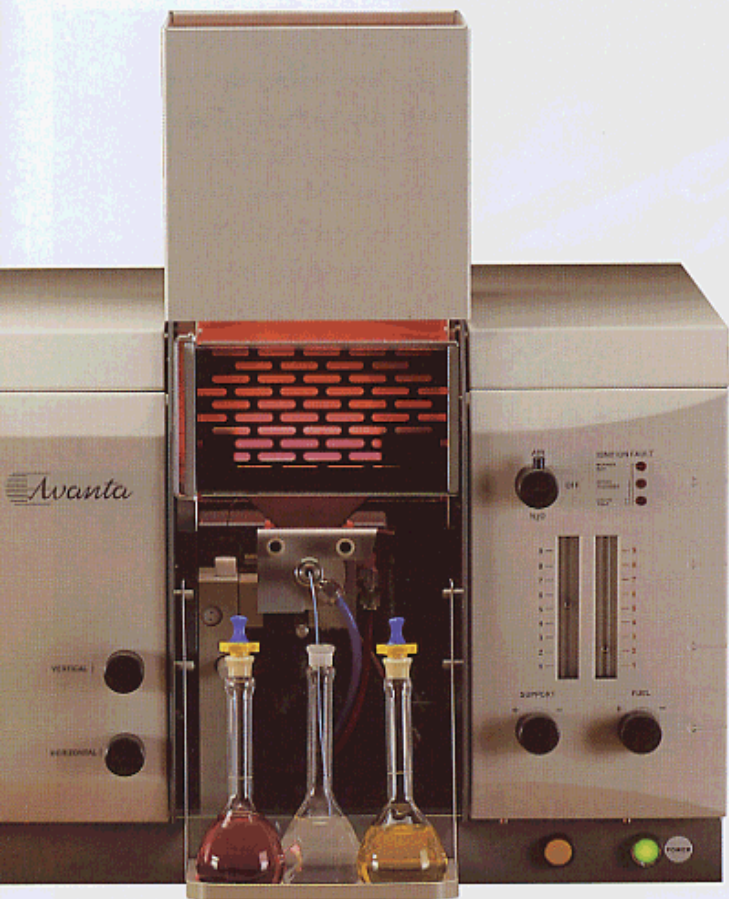
Highly accurate and precise
detection system
Wide range of sample applications
Simple operation and easy
maintenance



ISO 9001 QUALITY ACCREDITATION

GBC has always placed a strong emphasis on quality in all aspects of our operation, from design and manufacture to the provision of service and support to our customers, and we are fully committed to continuous evaluation and improvement in all areas.

The GBC Quality Management System has been accredited to the ISO 9001 quality standard by Lloyd's Register Quality Assurance Limited. This certification is your assurance that the procedures and processes used to produce the goods and services which GBC provides comply with the relevant International Standard, and demonstrates our commitment to meeting the needs and expectations of our customers.

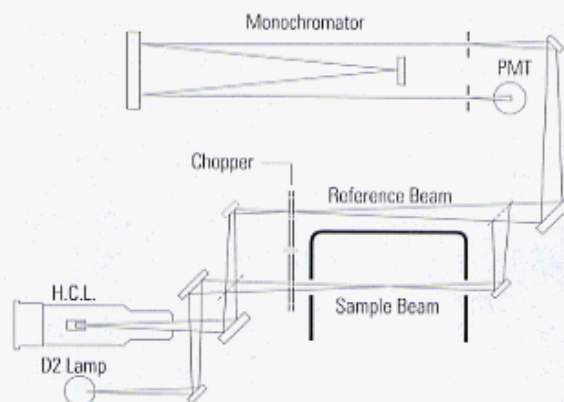


Chromatogram Data Table:

Peak	Time	Area	Height
Peak 1	1.00	2700	1.00
Peak 2	2.00	6475	2.00
Peak 3	3.00	2300	1.00
Peak 4	4.00	2364	1.00
Peak 5	5.00	1474	1.00

Chromatogram Plot: Shows a signal vs. time graph with peaks corresponding to the table data.

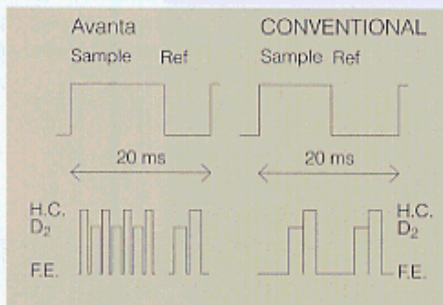
Unmatched optical performance with your choice of manual or automated lamp turret



High performance optics

The optical design is the heart of any spectrometer, and at GBC we have a long history of quality optical systems. The Avanta provides unmatched optical performance, from more efficient all-reflective optics and a minimal optical component count to ensure maximum light throughput, to a monochromator designed for maximum efficiency at all wavelengths. To further improve the performance, Avanta uses the unique Asymmetric Modulation to improve the signal to noise ratio.

Whereas conventional double beam instruments measure the light in both the sample beam and the reference beam for equal durations, with Asymmetric Modulation the light in the sample compartment is measured for twice the duration of the reference beam measurement. As the sample compartment is the area in which all the noise is generated in an AAS, Asymmetric Modulation improves the signal-to-noise ratio by as much as 40%. The result is unmatched performance in terms of both sensitivity and detection limit.



Manual four-lamp turret with automatic second-lamp warm-up provides rapid lamp changeover

With individual lamp peaking and a two-lamp power supply, a second lamp can be warmed up and ready to go for the next analysis. All you need to do is rotate the turret, the instrument will do the rest.



Multi-element analysis is simplified with the optional motorized eight-lamp turret

Automated eight-lamp turret for simplified multi-element analysis

The optional motorized turret makes multi-element analysis without operator intervention a reality. The lamp sequence is pre-programmed, so the next lamp required is automatically warmed up. Simply load the element sequence and begin the analysis.

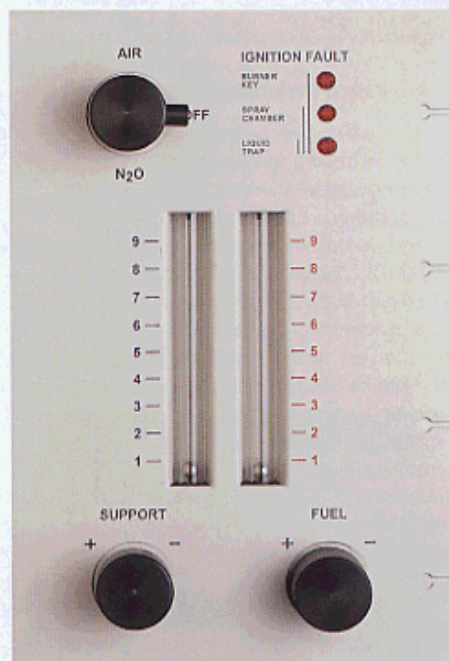


Safety and simplicity with manual or fully programmable flame controls

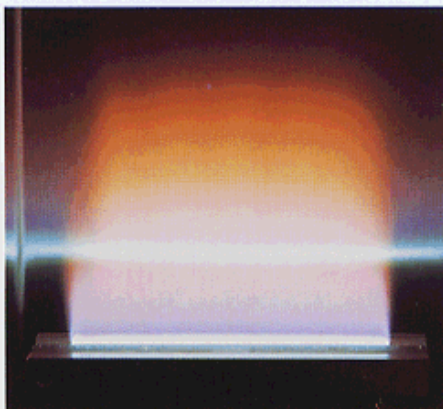
Interlocked flame control for safe and simple operation

Gas flows and burner position are set manually with real time on-screen monitoring of absorbance values for fast optimization.

With interlocks for burner presence, burner type, liquid trap level, nebulizer bung and pressure relief bung, safe operation is assured. The flame will not ignite if any interlock is triggered. If the wrong burner is in place then a nitrous oxide acetylene flame cannot be selected. If a fault is detected, the cause is displayed by an indicator light on the front panel of the instrument.



Interlocked flame control for routine analysis



Optional programmable flame control improves accuracy and ensures optimum gas flows for each element

The optional programmable flame control offers significant productivity improvements as your workload increases. The added safety features are of real benefit for nitrous oxide acetylene analysis, or when inexperienced operators are using the instrument.

Instrument parameters stored with each method ensure that gas flow settings are accurately reproduced every time the method is used, providing greater analytical accuracy, trouble-free operation and time savings.

In addition, gas flow settings may be optimized for each individual element in a multi-element analysis, and are automatically adjusted without further operator intervention as the analysis proceeds. This is particularly useful for analysis close to detection limits.

Flame stability is enhanced because gas flow adjustment is smoothly and continuously variable across the whole operating range. This is achieved by continuously-variable needle valves controlled by micro-stepping motors, eliminating the flame pulsations which can occur in solenoid-operated systems.

Comprehensive flame control interlocks provide a safer laboratory environment

Safety without sacrificing performance is the key to the GBC programmable flame controller.

A full range of safety interlocks ensures trouble-free operation, even with inexperienced operators. Safety interlocks include:

- Ignition of the flame is prevented if no burner is installed, or it is not installed correctly.
- The flame will not change over to a nitrous oxide-acetylene flame if the correct burner is not installed.
- Pressure sensors on the air, acetylene and nitrous oxide gas supplies continually monitor the pressure so that the flame will not ignite if the pressure is too low, or the flame will be shut down if the pressure drops while it is burning.
- The oxidant flow (air or nitrous oxide) is continuously monitored to ensure that the flame can be ignited or shut down in the correct manner if the flow is insufficient. Insufficient oxidant flow can lead to a flashback. GBC is the only company to offer this important safety feature.
- A flame sensor shuts off the gases if the flame is extinguished for any reason. This prevents the laboratory from filling with gas.
- An integral liquid trap with built-in liquid level sensor prevents ignition or shuts down the flame if there is insufficient liquid in the trap.
- Sensors on both the nebulizer bung and pressure relief bung ensure that they are correctly in place. Ignition is prevented or the flame is correctly shut down if either of the bungs is not correctly positioned.
- A mains power sensor shuts down the flame in the correct sequence if the power supplied to the instrument is interrupted.

Avanta

Fast and accurate background correction at all absorbance levels

Background Correction

In many instances background correction is required to correct for the absorbance associated with non-atomic species that can be present when the sample is atomized.

The unique Ultra-Pulse background correction system which is standard on the Avanta provides the best all round background correction capability available.

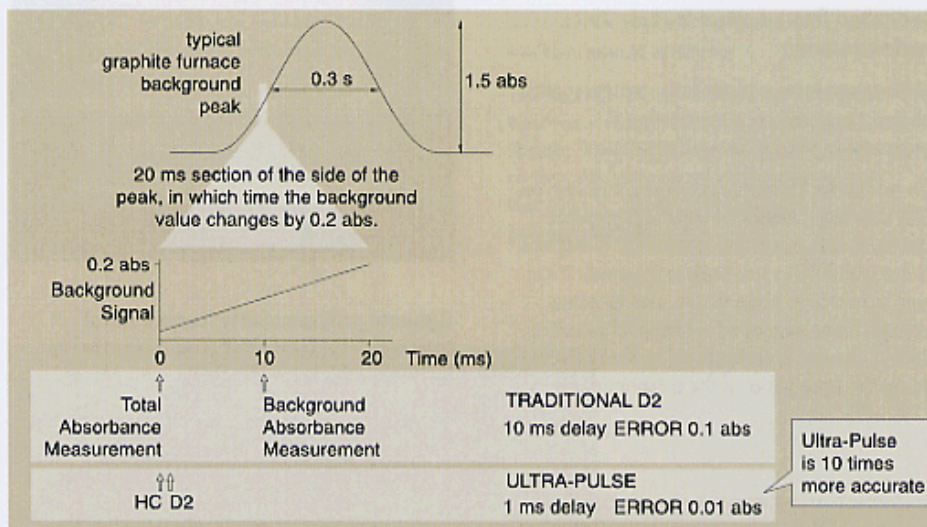
There are a number of requirements of a background correction system, which when met will ensure accurate results.

Firstly, the background correction system needs to be able to correct to high absorbance levels, preferably over two absorbance units.

Secondly, the speed of background correction is critical. There must be a minimal delay between taking the total absorbance measurement and the background absorbance measurement since the magnitude of the background signal can change rapidly with time.

Thirdly, the background corrector must not degrade sensitivity, precision or linearity.

The GBC Ultra-Pulse background corrector is the only system that meets all of these requirements. It is able to correct for signals of up to 2.5 absorbance units, using a combination of high intensity deuterium lamp, high throughput narrow beam geometry optics and rapid electronic modulation.



High Speed and Accuracy

Ultra-Pulse is the fastest background correction available, with a delay of only one milli-second between successive measurements. Other systems can have a delay of as much as ten milli-seconds, increasing the errors associated with the correction by a factor of ten, as the diagram shows.

Guarantee of Performance

GBC has always led the way in performance of atomic absorption spectrometers and has always been prepared to guarantee the performance. This tradition continues with the Avanta. GBC guarantees that, when optimized, the instrument will give an absorbance of at least 0.7 (typically 0.9) for a 5 mg/L copper solution and that on the same measurement the relative standard deviation will be less than 0.5%. This guarantee is unique to GBC. Other manufacturers who offer a guarantee need to optimize for either sensitivity or precision. They do not guarantee sensitivity and precision on the same measurement. Put simply, it means that with a GBC AAS you never need to compromise the performance of the instrument on any measurement.

Improve sensitivity and concentration range with these high performance options

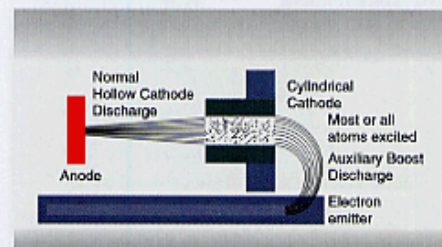
Improve detection limits, sensitivity and linearity with built-in Super Lamp capability

Super Lamps are high intensity hollow cathode lamps, designed to improve the quality of the data obtained from your AAS. They are particularly useful for low intensity elements such as As, Se, Cd, Ni, and Pb, providing improvements in detection limit, sensitivity and linearity.

When used in conjunction with the ABR, the instrument's dynamic range can be extended by more than two orders of magnitude. With the Avanta AAS, an optional one- or four-lamp Super Lamp power supply can be built into the instrument.

A comparison of detection limits for flame analysis between Super Lamps and normal Hollow Cathode Lamps

Element	Standard HCL (µg/mL)	Super Lamp (µg/mL)	Detection Limit Improvement
As	0.5	0.1	5.0
Se	0.4	0.06	6.7
Cd	0.014	0.05	2.7
Pb	0.14	0.05	2.7



Measure high concentrations quickly and accurately without dilution using Automatic Burner Rotation

To further increase the productivity of your laboratory, add GBC's unique Automatic Burner Rotation (ABR) accessory. ABR will extend the measurement range of your instrument, allowing the measurement of higher concentration samples without time consuming and error-prone dilutions. Automatic Burner Rotation increases the measurement range by a factor of forty, in some cases eliminating the need for additional sample preparation. In comparison with automatic on-line dilution systems, ABR is at least twice as accurate and up to ten times faster.

Results for fertilizer and brine samples using Automatic Burner Rotation

Matrix	Element	Actual Conc. (µg/mL)	Measured Conc. (µg/mL)	% Recovery
Fertilizer	Al	550	550.3	100
Fertilizer	Al	550	536.7	97.6
Fertilizer	Cd	40.07	39.05	97.5
Fertilizer	Cd	40.07	39.29	98.1
10% NaCl	Si	890	889.3	99.9
10% NaCl	Si	890	889.3	99.9

Data for iron measurements comparing automatic burner accuracy with manual dilution accuracy

Actual Conc. (µg/mL)	Measured Conc. Using ABR	% Recovery Using ABR	Measured Conc. Using Dilution	% Recovery Using Dilution
10.0	10.01	100.1	10.01	100.1
10.0	9.99	99.9	10.17	101.7
200	200.2	100.1	198.3	99.2
200	200.4	100.2	197.6	98.8
200	200.9	100.5	198.1	99.1

*Powerful AAS software
uses the Windows®95 platform*

Fast and friendly multi-tasking software

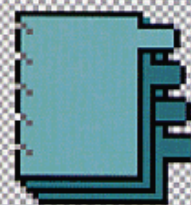
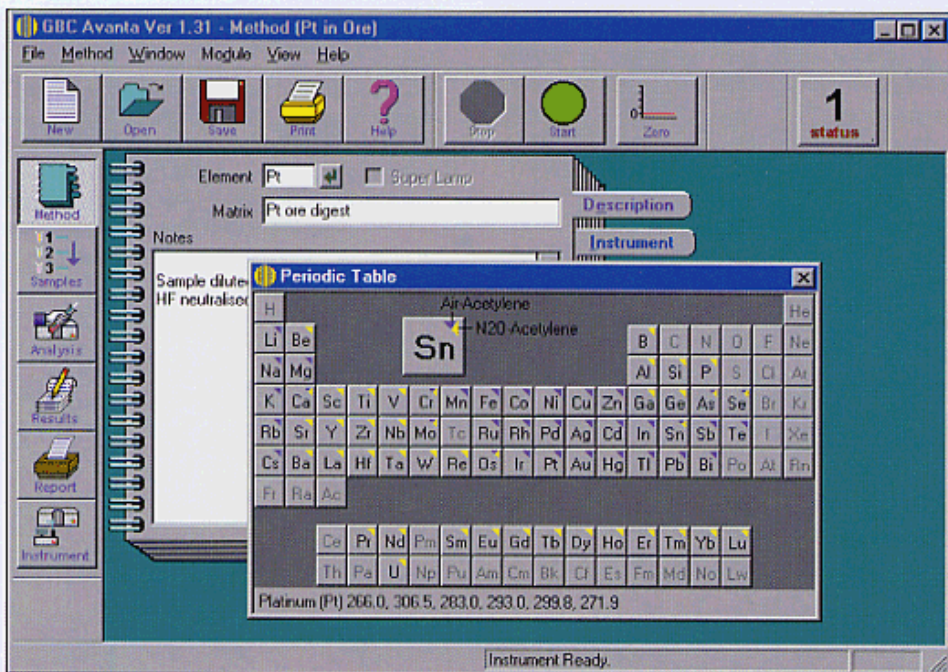
The design of the Avanta software was guided by several requirements expressed by GBC users. High on the list was ease of use, and the graphical environment of Windows®95 was an obvious choice. Good software design ensures that comprehensive and powerful features do not compromise the simplicity of method set-up or sample measurement, and that prompt and appropriate access to help is provided when needed.

The Avanta software addresses these requirements with a complete easy-to-use package. For instance, only one mouse click is required to initiate an analysis. The structure of the program ensures that method, sample identification, analysis, report generation, instrument set-up and results are clearly separated and easily accessible.

Context-sensitive on-line help explains every aspect of hardware setup, operation, maintenance and safety.

Learning to use the instrument is made easy through multi-media tutorials. While running a tutorial or displaying context-sensitive help the operator can work through the Avanta software to build an application, using as much or as little help as may be required.

The Windows® 95 platform offers advantages of speed, power, compatibility with third party software and true 32-bit pre-emptive multi-tasking.



Method



Samples



Analysis



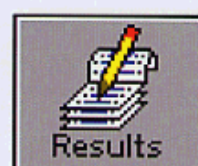
Results



Report



Instrument



Rapid method development

The method module of the software allows the operator to set up and store all parameters associated with an elemental analysis including instrument, quality control, calibration, flame and graphite furnace, sampling and measurement parameters.

As all the parameters are within one module it is a simple task to develop a method. Once an element is selected from the periodic table, and the appropriate wavelength determined, based on the required working range of analysis, recommended conditions are recalled.

Methods can be created or modified, even while the instrument is collecting data.

Password protection can be applied to method files to ensure that unauthorized changes or erasure cannot take place.

Flexible sample handling

The samples module is used to identify the samples and to determine in which order they will be analysed, when and how often spike recoveries, check samples, re-calibrations and re-slopes will be carried out.

Once a sample file has been created it can be saved for later use or modification. Also included with the sample identification are sample weights and dilutions which can be used to calculate the element concentration in the original sample. The weights can be read in directly from an electronic balance with an RS232 port or the information can be imported from other software packages.

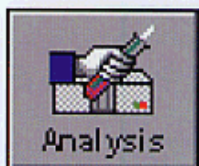
Manual sampling is fast and simple

For rapid manual sampling analysis, accept default sample names and click to start. It's that simple.

Integrity of results is assured

The results section of the software is used to collect, display and process data collected by the instrument. As all the raw data is collected for each standard and sample it is possible to re-calculate results post-run, based on different criteria. For example, results that were collected in peak area mode can be calculated in peak height mode. This can be invaluable for method development, particularly in furnace work.

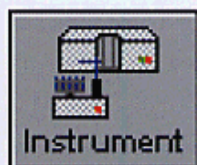
The calibration routine can also be changed post-run to get the best possible fit of the calibration. Even weight and dilution data can be added after the analysis and results re-calculated. Of course, erroneous results can be deleted, meaning that samples or calibrations need not be repeated. The entire results section can be password protected to ensure the integrity of the data.



Simple automated analysis

The analysis mode is used to bring together the method and sample details for the measurements that are to be taken. These may be linked to provide fully automated multi-element analysis using the optional motorized lamp turret and programmable gas controller. This information can be saved as individual files, and single- or multi-element analysis can be initiated with just three mouse clicks.

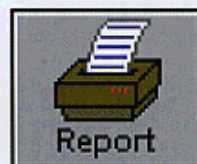
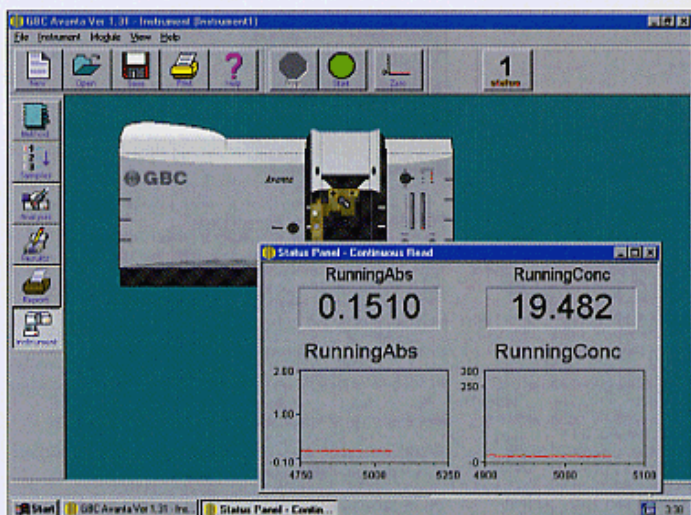




Complete instrument diagnostics

The instrument module independently controls all hardware functions of the instrument, from initial setup to optimization and diagnostics.

It can be an invaluable tool for problem solving, method optimization and trouble shooting, saving valuable time and money for your laboratory.



Customized reports

Comprehensive reports have never been easier to generate and customise in either the single element format or as a combined multi-element report. A single element report can contain any combination of information including replicates, calibration graph, method parameters and weights and volumes.

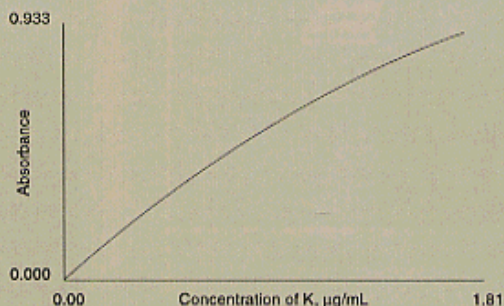
All reports can include page footers and headers, individual margins, separate header file, and all columns and rows of information can be individually sized. In addition a full selection of fonts and font size is available.

Reported data may be easily and automatically exported to third party software packages, either on-line or post-analysis. Direct connectivity to Laboratory Information Management Systems (LIMS) is easily enabled without additional software.

Combine graphs,
data and
customizable
headers or footers
in the report.

Analysis: Batch 47, Riverina District, Schedule 12
Method: Available Soil Potassium, HCl extractable
Sample preparation and instrument conditions as per test specification,
Available Soil Potassium, Soils 003

Sample Type	Conc. µg/mL	%RSD	Mean Abs.	Replicates		
				1	2	3
Cal Blank	-----	HIGH	0.000	0.000	0.001	0.001
Standard 1	0.300	0.35	0.202	0.203	0.202	0.201
Standard 2	0.700	0.27	0.425	0.425	0.425	0.425
Standard 3	1.500	0.27	0.771	0.770	0.770	0.774

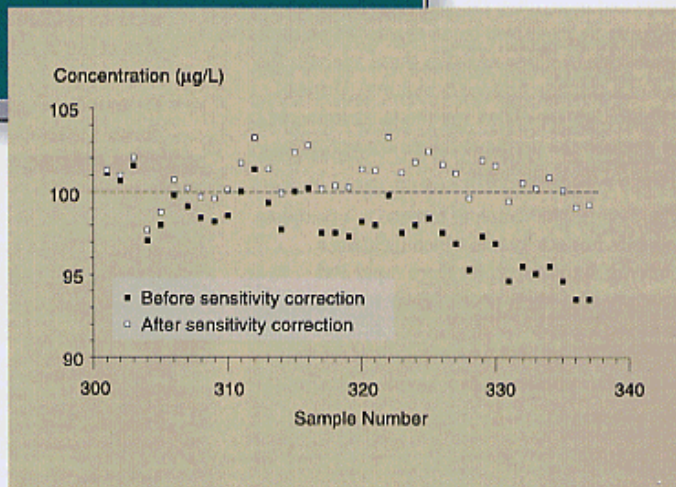
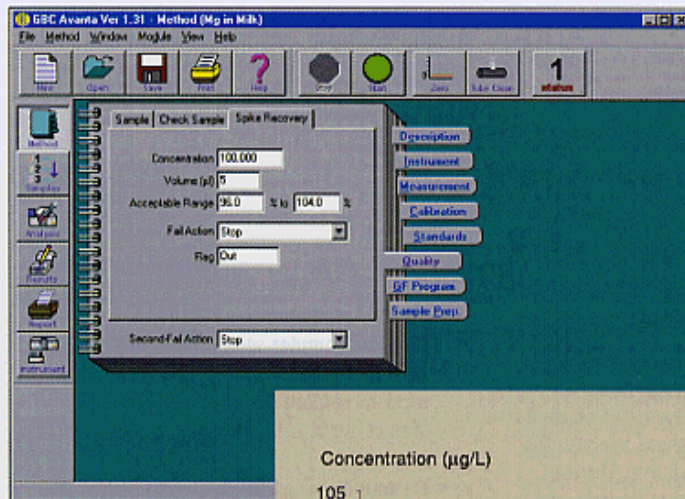


Sample Type	Conc µg/mL	%RSD	Mean Abs.	Replicates			Dilution Factor
				1	2	3	
EK43	868	0.06	0.509	0.509	0.508	0.508	1000
EK29	1291	0.07	0.691	0.691	0.692	0.691	1000
EK8	1060	0.05	0.596	0.596	0.595	0.596	1000
NorthS1	681	0.06	0.417	0.417	0.417	0.417	1000
NorthS3(run off)	164	0.34	0.114	0.115	0.114	0.114	1000
NorthS4	680	0.36	0.416	0.415	0.416	0.418	1000
TalW2	327	0.16	0.218	0.219	0.219	0.218	1000
TalW3	511	0.35	0.326	0.324	0.327	0.326	1000
ShepO5	1073	0.26	0.601	0.601	0.603	0.600	1000
ShepN3	855	0.04	0.503	0.503	0.503	0.503	1000
Murch1	505	0.22	0.322	0.323	0.322	0.322	1000
Murch2	1264	0.12	0.680	0.680	0.681	0.680	1000

Quality control for Good Laboratory Practice

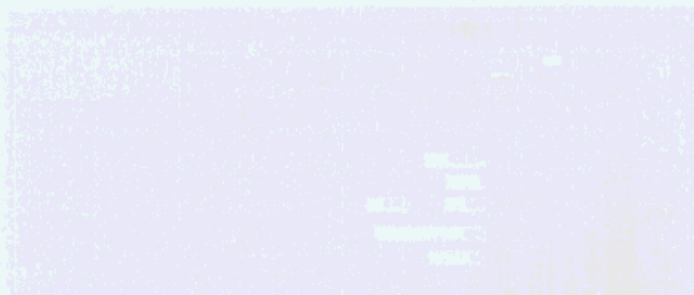
At GBC we realise how important it is for your laboratory to be able to assure the quality of the data it produces. To this end, GBC has incorporated extensive quality control protocols into the software. They include:

- Upper and lower limits for quality assurance of samples, ideal for situations where your lab is running samples that have to fall within a pre-determined range. Samples outside the specified range will be flagged.
- Check sample analysis. Once a check sample of known concentration has been analysed, further analysis is dependent on the result of the check sample. If the check sample falls within an operator-selected range then the analysis will proceed as normal. If the check sample should fall outside the selected range then the analysis will follow a pre-selected action. Possible actions include: stop, continue and flag, re-slope and continue, re-calibrate and continue, re-slope and repeat all the affected samples or re-calibrate and repeat all the affected samples.
- Spike recovery samples allow for sample measurement followed by the analysis of a spiked sample as a check for possible interferences. If the spike fails a pre-determined recovery range then the analysis will proceed according to the procedure specified by the operator. The choices available include all those available for check sample error.
- Sample blank is used when the standards and samples have different matrices and so may require separate blanks.



- Automatic Sensitivity Correction (ASC) is a unique GBC feature which provides automatic compensation for sample results affected by changes in conditions during an analytical run (for example, aging of a graphite furnace tube). It means that samples need not be re-analysed and that re-calibrations only need to be performed when required. The productivity improvements and savings on consumables using ASC can make a significant difference to your profitability.
- Calibration fit gives the operator the option of pausing if the calibration has failed an operator-determined curve fit criteria.
- Automatic re-slope rate can be set either as a function of time or of the number of samples being analysed, thus further ensuring data quality.
- Automatic re-calibration rate can also be set either as a function of time or of the number of samples that have been analysed.

The selective use of quality control protocols enables compliance with almost any regulatory requirement and ensures that your laboratory maintains good laboratory practice.

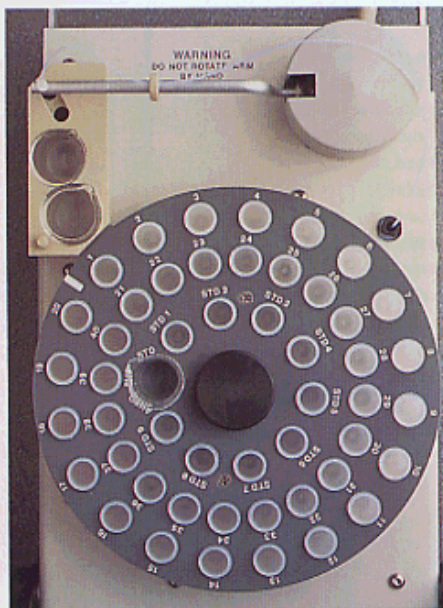


Fully automated high performance System 3000 Graphite Furnace

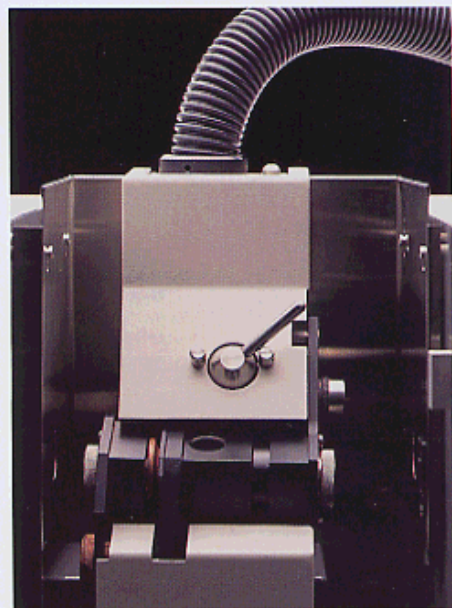
More and more often the analyst is required to measure at levels well below the detection limits achievable by flame AAS. For these analyses the use of a graphite furnace is required. Using a graphite furnace allows routine measurements to be made in the parts-per-billion concentration range for most elements.

The System 3000 graphite furnace is a complete graphite furnace system which includes a powerful autosampler for more rapid and accurate analysis, a power supply unit and workhead. The entire system is controlled by the Avanta software which provides all of the features required for rapid, simple and accurate analysis.

- Flexible temperature program allows for even the most complex samples.
- High performance furnace tubes with raised sections contain the sample within a small area of the tube to eliminate temperature gradients.
- Programmable gas selection switches gases during the temperature program, allowing for different ashing techniques.
- Total pyrolytic graphite platform enhances sensitivity and ensures that samples are atomized into a hot atmosphere, reducing or eliminating interferences.
- Un-matched sensitivities are achieved for over fifty elements, a selection of which is shown in the table.
- Chemical modifiers are dispensed automatically. With two modifiers available almost all manual sample pre-treatment is eliminated.
- Variable injection speed can be particularly useful with viscous samples such as oils, or when using the hot injection technique.
- Hot injection for faster analyses means greater productivity for your laboratory.
- Unique set-up and storage of probe coordinates through the computer keyboard saves time and effort, simplifying autosampler set-up.
- Multiple injections allow automatic pre-concentration. For especially low concentration work the autosampler will deposit the sample, the furnace will then dry and ash it before the cycle is repeated as many as fifty times, totally eliminating messy and time consuming extraction or pre-concentration techniques.

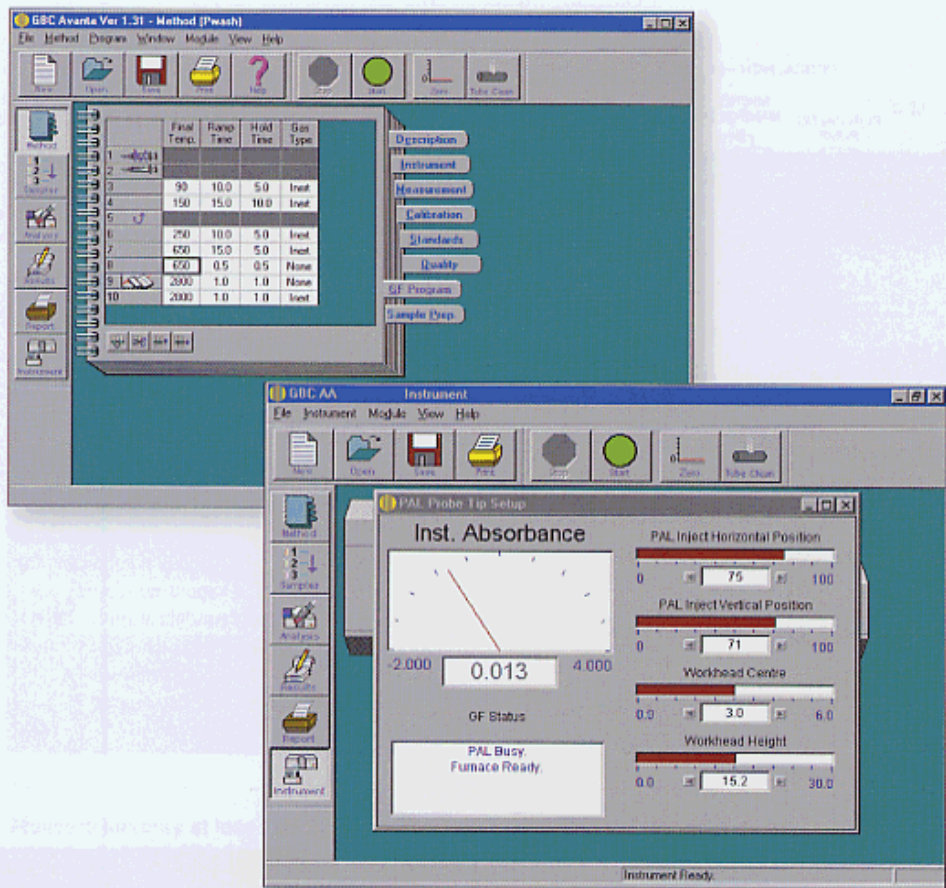


The PAL3000 Programmable Auto Loader provides automatic calibration with up to 10 standards and automatic analysis of up to 40 samples. Sample volumes between 1 and 100 μ L may be selected.



Avanta

Fully automated
Graphite Furnace system



The ultimate in graphite furnace sensitivity

The System 3000 is designed to achieve state-of-the-art sensitivities and detection limits. Approximately 50 elements can be determined, most at sub part-per-billion concentrations. The typical characteristic mass for some of the elements is shown in the following table. Characteristic mass is the mass of an element required to give an absorbance change of 0.0044.

Element	Characteristic Mass (pg)	Element	Characteristic Mass (pg)
Ag	0.9	Fe	1.5
Al	5	Mn	0.7
As	6	Mo	8
Au	4	Ni	5
Ba	12	Pb	2.5
Cd	0.25	Se	20
Co	4	Ti	45
Cr	1.5	V	20
Cu	2.5		



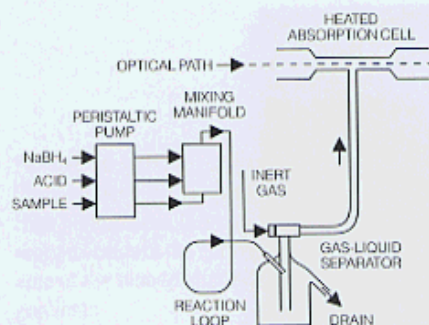
Continuous flow HG3000 Hydride Generator for best results

The HG3000 is an automatic continuous flow hydride generator for the analysis of the hydride forming elements such as arsenic, selenium, antimony and bismuth at parts per billion concentration level. The same system can be used to measure mercury at parts per billion concentration utilizing the cold vapour technique.

As the system is a continuous flow system, signals can be integrated, thus filtering noise and reducing the detection limits when compared to hydride generation systems that produce transient signals. To achieve the same sensitivity with flow injection systems, much larger sample volumes are required, meaning longer set up and analysis times.

The continuous flow process also means faster analysis when following good analytical procedures and measuring more than one replicate.

Typical sample throughput is 60 samples per hour, measuring three replicates on each sample. Other systems only allow 30 to 40 samples to be measured each hour when measuring three replicates on each sample. The HG3000 will increase the productivity of your laboratory.



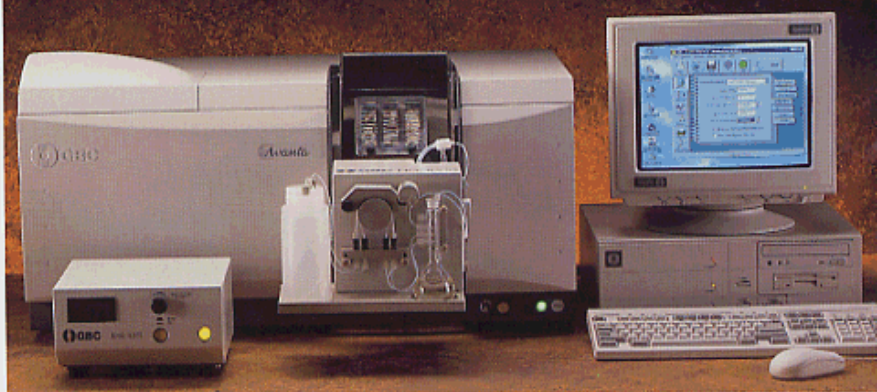
Improve hydride results with the EHG3000 Electrically Heated Hydride Cell

The EHG3000 is used to electrically heat the quartz cell used in hydride generation analysis, as an alternative to flame-heating of the cell. The advantages of using an electrically heated cell include: more accurate temperature control, more stable temperatures, less noise as the flame is not present, and improved sensitivities and detection limits for most elements.

As the EHG3000 does not require a flame, hydride analyses can be carried out unattended or even overnight, saving the laboratory time and money. In addition, the EHG3000 can be used for warming the cell for cold vapour mercury analysis, eliminating any condensation in the quartz tube. The electrical heating blanket can also be used with the graphite furnace-only version of the Avanta AAS, enhancing its analytical capability.



Element	Characteristic Concentration (µg/L)	Detection Limit (µg/L)
Antimony (Sb)	0.1	0.08
Arsenic (As)	0.05	0.05
Bismuth (Bi)	0.1	0.04
Mercury (Hg)	0.3	0.05
Selenium (Se)	0.13	0.04
Tellurium (Te)	0.2	0.13
Tin (Sn)	0.4	0.20



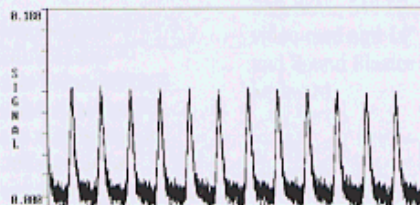
Mercury Concentration for trace level analysis



Measure mercury at less than 10 ppt with the MC3000 Mercury Concentrator

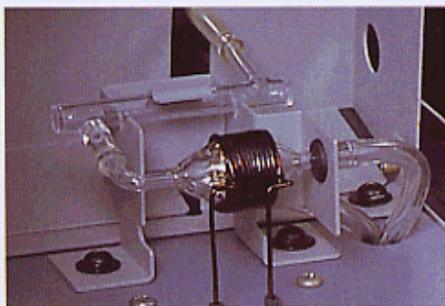
Regulations for mercury analysis are continually lowering the required detection limits, well below the level achievable using the standard cold vapour technique. The MC3000 mercury concentrator accessory for the HG3000 addresses this problem. By concentrating the mercury vapour on a gold foil, detection limits of 5 parts per trillion can be readily achieved. The MC3000 accessory is fully controlled by the Avanta software and the analysis can be carried out unattended when used in conjunction with the SDS-270 sample delivery system.

The mercury concentration cell is shown in front of the absorption cell located in the light path.



Mercury trace at 20 ppt

SAMPLE	CERTIFIED VALUE	MEASURED VALUE
Water 9645-9647	1.74 ppb	1.76 ppb
Sewage Sludge	3.23 ppb	3.65 ppb



Sampling accessories

High speed SDS-270 Sample Delivery System

The SDS-270 Sample Delivery System is an X-Y autosampler which provides unmatched productivity with full random access capability and a small footprint. Samples are contained in three separate racks, meaning that different tube sizes can be used within a batch. The autosampler is totally controlled by the Avanta software, providing random access as well as micro-sampling capability and standard additions analysis. Check samples and quality control limits are also an integral part of the autosampler operation.

A built-in diaphragm pump provides a continuous stream of clean rinse solution.

PS-270 Preparation Station

The PS-270 is used in combination with the SDS-270 auto-sampler, removing the need for manual standard and sample preparation and sample dilution for flame and hydride applications. The PS-270 is totally controlled through the Avanta software enabling true fully-automated analysis. Simple and reliable automation of standard additions and spike recovery, or sample matrix modification through the addition of up to two chemical modifier solutions provides hands-off operation and versatility. The ability to work in combination with Automatic Burner Rotation (ABR) extends the dynamic range beyond that of other dilution systems.



High Solids Analysis without dilution

Eliminate burner blockage with the HSA3000 High Solids Analyser

The analysis of samples with a high dissolved solids content has always been a problem in flame atomic absorption spectrometry. There is a tendency for salts to crystallize and cause blockages in the nebulizer or burner. Historically, the only way to avoid this problem has been to dilute the sample until the concentration of dissolved solids is less than 2%. The difficulties with this approach are that it is time consuming, it dilutes the analyte concentration and can lead to errors in the analysis. The HSA3000 solves all these problems, allowing the analysis of solutions containing as much as 30% total dissolved solids without blockage to the nebulizer or burner, or compromising the quality of the results.



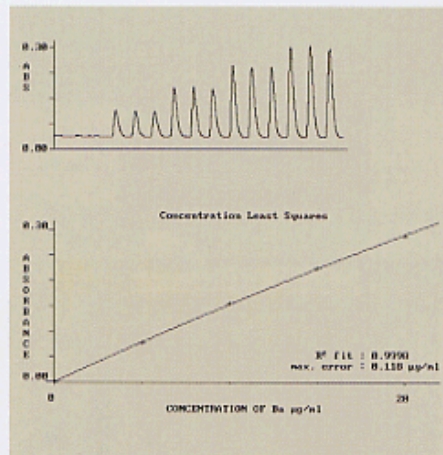
Atom trap for improved sensitivity

Better flame sensitivities with atom trap

Quite often the analyst needs to measure a sample that is at or just below the lower measurement range for flame work. The option is to then pre-concentrate the sample or to analyse the sample by graphite furnace, both options being more difficult and time consuming.

The cost effective and easy alternative is to use the GBC atom trap. The atom trap is a slotted quartz tube positioned on the burner, slowing the passage of atoms through the light path and hence concentrating them.

The resulting improvement in sensitivity means that more analyses can be performed by the faster, less complicated flame technique. When used in conjunction with a Super Lamp, the sensitivity improvement can be as much as 10 times.



Ba standards at 5, 10, 15 and 20 µg/mL
in 30% NaCl solution (peak height mode)

Comparison of
characteristic
concentrations for a
range of elements,
determined with and
without the GBC
atom trap

Element	Characteristic Concentrations (µg/mL)		
	Standard Flame	Atom Trap	Improve- ment Factor
Silver	0.015	0.0075	2.0
Gold	0.05	0.03	1.6
Bismuth	0.10	0.035	2.9
Cadmium	0.0086	0.0025	3.4
Copper	0.022	0.009	2.4
Iron	0.030	0.019	1.6
Mercury	1.3	0.42	3.1
Manganese	0.016	0.005	3.2
Lead	0.06	0.021	2.9
Selenium	0.20	0.06	3.3
Antimony	0.19	0.06	3.1
Tellurium	0.25	0.07	3.6
Zinc	0.005	0.003	1.6

Optics

Double beam with background correction and flame emission capability. Asymmetric modulation with 2:1 sample-to-reference ratio for noise reduction. All-reflective system with quartz overcoating on mirrors. Sealed against dust and vapour.

MONOCHROMATOR

Ebert-Fastie design with 333 mm focal length, 1800 line/mm grating and 185–900 nm wavelength range. Automatic wavelength selection and peaking. Continuously adjustable slits with 0.2 to 2 nm spectral bandwidth. Reduced height for furnace work available with all slit widths. Automatic setting of slit width and height. Automatic wavelength scanning. Selected wide range multi-alkali photomultiplier tube.

MANUAL LAMP TURRET

Four-lamp manual turret with individual lamp peaking

MOTORIZED LAMP TURRET (option M)

Optional eight lamp motorized turret with automatic lamp selection and individual lamp peaking. Automatic optimization in two planes for maximum light throughput. Automatic multi-element operation, with the next lamp in the sequence automatically warmed up. Compatible with standard hollow cathode lamps and Super Lamps.

BACKGROUND CORRECTION

ULTRA-PULSE background corrector takes 200 (50 Hz) or 240 (60 Hz) corrected sample readings per second for correction of fast background peaks. With approximately 1 ms between pulses and interpolation between measurements, best possible accuracy is assured. High intensity, long life deuterium arc lamp provides 185–425 nm correction range. Corrects to 2.5 total absorbance.

Flame Control

INTERLOCKED FLAME CONTROL

Manual setting of flame type and gas flows. Press button ignition. Interlocks monitor burner presence, burner type, liquid trap level, presence of nebulizer bung and pressure relief bung. Ignition is prevented if a fault is detected. Error lights show interlock status.

PROGRAMMABLE FLAME CONTROL (option P)

Automatic setting of flame type and gas flows from stored conditions. Programmed ignition and shutdown sequences. Automatic change of flame conditions during automatic multi-element operation. May be programmed to automatically extinguish the flame at the end of an analysis. Interlocks monitor air, acetylene and nitrous oxide pressure, burner presence, burner type, liquid trap level, presence of nebulizer and pressure relief bung, oxidant flow, flame condition and mains power. Ignition is prevented or flame is shutdown if a fault is detected. Screen display of interlock status.

FULLY AUTOMATED AVANTA (option PM)

Combining programmable flame control and the eight lamp motorized turret for fully automated analysis.

Flame Atomization System

Pre-mix design with solid inert polymer mixing chamber. All-titanium burner construction. The optional nitrous oxide burner is designed to reduce carbon build up. Nebulizer has platinum-iridium capillary and tantalum venturi for resistance to acid attack. Adjustable sample uptake rate with locking mechanism. Inert impact bead. Interlocked nebulizer bung and pressure relief bung. Integral liquid trap with liquid level interlock. Quick-change mounting to enable easy change-over to graphite furnace. Automatic motorized height and horizontal adjustment of the burner and graphite furnace workhead.

AUTOMATIC BURNER ROTATION

Motorized burner rotation allows the burner angle to be set as part of a method. Samples outside the calibration range can be automatically re-measured at a greater angle after a further calibration. Angle is settable to $\pm 0.1^\circ$ with a rotation angle from 0° to 90° .

PERFORMANCE GUARANTEE

Greater than 0.7 abs for 5 mg/L copper solution with an RSD of less than 0.5%.

COMPUTER MINIMUM REQUIREMENTS

An IBM compatible computer incorporating an Intel Pentium™ microprocessor operating at 90 MHz with 8 Mbyte RAM, 1.44 Mbyte floppy disk drive, 540 Mbyte hard drive, one parallel port, two serial ports, SVGA video card and 14" SVGA colour monitor. In addition, a quad speed CD drive and Sound Blaster™ compatible sound card, bus mouse and 101 key keyboard.

General

DIMENSIONS

86 x 55 x 39 cm

WEIGHT

Spectrometer module: Unpacked 71 kg, Packed 110 kg

ELECTRICAL REQUIREMENTS

110/220/240 V AC, 50/60 Hz, 600 VA

Specifications—Software and System 3000 Graphite Furnace

Software

Microsoft Windows® 95 operating platform for true multi-tasking.

Controls AVANTA spectrometer, SDS-270 sample delivery system, PS-270 Preparation Station, GF3000 graphite furnace, PAL3000 furnace autosampler, HSA3000 high solids analyser and MC3000 mercury concentrator.

DATA PROCESSING

Provides analysis by atomic absorption or emission. Absorbance range to 3.0 Abs. Measurement by integration, running mean, peak height or peak area. Mean and RSD of up to 50 replicate readings. Calibration using up to 10 standards. Linear least squares curve correction, linear least squares through zero curve correction, exact fit curve correction, concentration least squares (polynomial) curve correction, standard additions or bracketing standards. Programmable re-slope using a single standard or complete re-calibration, rate settable by either time or frequency of samples. Password protected result editing to remove unwanted readings on either samples or standards. Weight and dilution correction. All editing available either during the run or post run.

GRAPHICS

High resolution colour display of atomic absorbance, background signals, furnace temperature programs, calibration curves, peaking meters and wavelength scans. Graphics can be displayed in a number of different modes including overlaying non-successive peaks. Selectable absorbance scale for traces. Graphics cursor can be used to obtain numerical information from graphics traces. Zoom function allows graphics traces to be expanded.

DATA STORAGE

Storage is provided for all data including the linking of the graphics trace to the result. Also stored are the methods, sample labels, sample sequences, method sequences, weights and dilutions, report headers and footers, calibrations and the results.

REPORT GENERATION

Reports may be printed from all stored results in either single element or multi-element format with results being combined from different runs and different measurement techniques. All operating parameters, calibration graphs, headings, footers, method notes, sample labels, results statistics and weight and dilution factors may be printed. Software supports a full range of printers.

QUALITY CONTROL PROTOCOLS

Complete range of quality control functions available including check samples, spike recovery, upper and lower QC limits, calibration correctness. Checks can be carried at pre-determined intervals based on time or number of samples analysed. Alternately checks can be carried out randomly. All checks have operator settable failure limits and failure actions. Flagging for all failed tests.

System 3000

Automated graphite furnace system. Comprises GF3000 graphite furnace power supply and workhead plus PAL3000 programmable automatic sample loader. Controlled by GBC AVANTA computer.

GF3000 Graphite Furnace

Furnace assembly includes graphite tube (and platform if required) mounted in enclosure with quartz windows. Permanently connected to power supply by umbilical cord carrying gas, cooling water and electrical supplies. Two independent gas supplies. Temperature range ambient to 3000°C. Computer controlled maximum heating rate of 2000°C/sec. Unlimited number of steps, each with ramp and hold, gas selection, graphics display option and read option. Temperature controller monitors current and voltage and uses power feedback to provide accurate control over the full temperature range and during both ramp and hold stages. Interlocked to inert gas and cooling water pressures. Corrects for changes in cooling water temperature.

COOLING WATER REQUIREMENTS

1–2 L/min at 100–200 kPa (15–30 psi).

INERT GAS REQUIREMENTS

Argon or nitrogen at a pressure of 70–200kPa (10–30 psi).

DIMENSIONS

38 x 36 x 29 cm

WEIGHT

Unpacked 35 kg, Packed 45 kg

ELECTRICAL REQUIREMENTS

208/220/240 V AC, 50/60 Hz, Rated current 15 A, surge current 40 A

PAL3000 Furnace Autosampler

Accommodates 40 samples and 10 premixed standards and one stock solution for automatic mixing of up to 10 standards. Container volumes are 2 mL for samples and standards, 5 mL for automix standard, 10 mL for blank and primary modifier. Auxiliary modifier can be placed in any position on the autosampler. Dispensed volume is 1–100 µL, programmable in 1 µL increments. All-PTFE capillary. 1L rinse container. Probe set-up controlled by computer with co-ordinates stored in memory. Program options include automatic mixing of standards, automatic injection of chemical modifier(s), multiple injection, heated injection, automatic re-slope or complete re-calibration, check sample, and spike recovery.

DIMENSIONS

22 x 29 x 14 cm

WEIGHT

Unpacked 7 kg, Packed 10 kg

SDS-270 Sample Delivery System

X-Y-Z autosampler with capacity for up to 270 samples and ten standards. Can be used for flame analysis, hydride generation and mercury cold vapour analysis. Controlled by the AVANTA computer. Programmable measurement time, delay time, rinse time, re-slope and re-calibration rates, number of samples, number of standards and number of replicates. Full random access.

DIMENSIONS
40.5 x 37.5 cm

WEIGHT
Unpacked 13 kg, Packed 16 kg

ELECTRICAL REQUIREMENTS
100–260 V AC, 47–440 Hz, 30 VA

PS-270 Preparation Station

A syringe pump dilution system for flame and hydride applications. Can be used for automated sample dilution, preparation of working standards and standard additions, addition of chemical modifier solutions, automated spike recovery, and can be used in conjunction with Automated Burner Rotation for extended dynamic range.

DIMENSIONS
32 x 14 x 22 cm

WEIGHT
Unpacked 5 kg

ELECTRICAL REQUIREMENTS
85–264 V AC, 47–440 Hz, 30 VA

HG3000 Hydride Generator

Continuous flow hydride generation system for the analysis of the hydride forming elements; arsenic, selenium, bismuth, germanium, antimony, tin, tellurium and mercury by the cold vapour technique. Detection limits of less than 1 ppb are routinely achievable. Typical sample throughput is around 60 samples per hour taking three replicate measurements with typical precision of 1%.

DIMENSIONS
30 x 20 x 26 cm

WEIGHT
Unpacked 6 kg, Packed 10 kg

GAS REQUIREMENTS
High purity argon or nitrogen at 30 mL/min (+120 mL/min for SnCl₂ operation) and an inlet pressure of 150 kPa

ELECTRICAL REQUIREMENTS
110/220/240 V AC, 50/60 Hz

EHG3000 Electrically Heated Cell for the HG3000

Temperature controlled electric heating blanket for heating the quartz cell used in hydride generation AAS. Includes power supply with temperature controller and workhead.

DIMENSIONS
26 x 16 x 29 cm

WEIGHT
Unpacked 7 kg, Packed 10 kg

ELECTRICAL REQUIREMENTS
110/220/240 V, 50/60 Hz

MC3000 Mercury Concentrator

Gold amalgamation mercury trapping accessory for use with the HG3000 to enable ppt analysis of mercury. Consists of a power supply and workhead with built-in gold foil trap and quartz absorption cell. Controlled by the AVANTA computer. Programmable load time, number of replicates, flush time and clean.

DIMENSIONS
26 x 16 x 29 cm

WEIGHT
Unpacked 10.6 kg, Packed 13.6 kg

GAS REQUIREMENTS
High purity argon or nitrogen gas purge, flow rate 30 mL/min and inlet pressure of 150 kPa.

ELECTRICAL REQUIREMENTS
110/220/240 V AC, 50/60 Hz

HSA3000 High Solids Analyzer

Allows analysis of high dissolved solids solutions of up to 30% w/v. Peristaltic pump fills a sample loop before the solution is passed into the spray chamber. Controlled by the AVANTA computer. Programmable initial fill time, replicate fill time, delay time, read time and number of replicates.

DIMENSIONS
30 x 20 x 37 cm

WEIGHT
Unpacked 5 kg, Packed 11 kg

ELECTRICAL REQUIREMENTS
110/220 V AC, 50/60 Hz

Ordering Information

GBC Avanta	99-0329-x3
GBC Avanta P (Programmable gas control)	99-0329-x7
GBC Avanta M (Motorized lamp turret)	99-0329-x9
GBC Avanta PM (Programmable gas control, Motorized lamp turret)	99-0329-x5
Each GBC Avanta is supplied complete with air-acetylene burner, spray chamber, adjustable nebulizer, gas hoses, dust cover, operation manual, flame methods manual and software for operation of the instrument and all accessories.	
GBC Avanta G (Graphite Furnace only)	99-0329-x1
GBC Avanta GM (Graphite Furnace only, Motorized turret)	99-0329-x6

x: varies with location, consult your local agent for correct suffix

Accessories

Nitrous oxide-acetylene burner	99-0273-01
Recommended spares and consumables for two years operation	95-0013-00
Fume extraction system	99-0012-0x
Silent air compressor, 220 V	75-0006-00
Silent air compressor, 110 V	75-0005-00
Gas purification system	99-0284-00
Computer (Pentium™ PC)	99-0335-00
Atom Trap	99-0152-00

Flame Autosampler

SDS-270 Sample Delivery System	99-0326-x1
Supplied complete with test tubes, teflon coated probe, cables, tubing and three 60 position sample racks	
Flame sampler trolley	96-0021-00

Automatic Dilution System

PS-270 Preparation Station	99-3533-00
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Graphite Furnace

System 3000 complete automated graphite furnace system	99-0108-00
Comprises GF3000 power supply and workhead plus PAL3000 automatic sample loader	
Supplied complete with 10 pyrolytically coated graphite furnace tubes, 5 platforms, 500 sample vials, furnace methods manual, beakers, hoses, cables and tubing	
Graphite furnace tubes, pyrolytically coated (pack of ten)	99-0059-00
Graphite furnace tubes, uncoated (pack of ten)	99-0059-01
Total pyrolytic graphite platforms (pack of ten)	99-0060-00
Pair of electrodes	99-0061-00
Sample vials for PAL3000 (pack of 500)	99-0022-00
Recommended spares and consumables for two years operation with System 3000	99-0015-00

Hydride Generation System

HG3000 automatic hydride generator	99-0276-0x
Supplied complete with absorption cell, burner mounting, reagent bottles, gas-liquid separator, operation manual and tubing	
Closed cell for mercury	40-0018-00
Recommended spares and consumables for two years operation with HG3000	95-0016-00
EHG3000 electrically heated hydride cell for use with the HG3000	99-0237-x1
MC3000 mercury concentrator unit for use with the HG3000	99-0245-x1

High Solids Analyzer

HSA3000 High Solids Analyzer	99-0155-x1
Pump tubing and capillary tubing replacement kit	95-0120-00



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notice.

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GBC SCIENTIFIC EQUIPMENT

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HPLC and UV-VIS

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