

Quantima

Inductively Coupled Plasma
Optical Emission Spectrometer





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 commitment to meeting the needs and expectations of our customers.

Since 1978 GBC has been at the forefront of scientific technological development, manufacturing and marketing a wide range of award winning, quality scientific instruments.

GBC's Product Lines



Visionary Technology

GBC Scientific Equipment will advance people's knowledge and their capacity to enhance the quality of life for all humankind.



Compact Benchtop Design Excellence in design



Quantima is also available with an optional bench

The Quantima is at the forefront of a long tradition of excellence in design and engineering.

It is the culmination of feedback on a worldwide basis from both distributors and end users of ICP-OES. The Quantima is the result of team development of the highest interactivity. Its robustness is only superseded by its reliability and compactness.

It is simple to operate, maintain and service. This instrument raises the standards for truly affordable ICP.

No matter what your application, the Quantima will analyse faster, more accurately and more cost effectively than ever before!

The Quantima offers many new innovative features. Plasma Cam™ and PIP™ ensures that the Quantima will update the technology available in your laboratory in one quantum leap.

The 4th Generation Quantima represents a quantum leap in technology in ICP-OES packed with lots of great features to give you the technological edge!

Low operating cost lower argon consumption

The Quantima uses less than 11 L/min for a typical aqueous sample. This is the lowest Argon consumption of any ICP-OES available. With an 11% increase in monochromator speed the Quantima is both faster and consumes less Argon.

Improved torch ignition sequence

The Quantima's torch Ignition Sequence has been greatly improved. The New IIS Intelligent Ignition Startup™ will vary the plasma startup sequence routine depending on how long the plasma has been off. This enables quicker startup routine for a plasma recently turned off.

Routine or Research Analysis Applications

Outstanding features equal outstanding performance

The Quantima is suitable for a diverse range of applications. Method development and analysis is easy. First time users can easily obtain optimal performance regardless of the application. The Quantima's outstanding features provide comprehensive solutions for your elemental analysis. Routine or Research Analysis Applications

- Computer control of over 230 instrument parameters.
- Precise mass flow control of nebuliser, auxiliary* and plasma* gases.

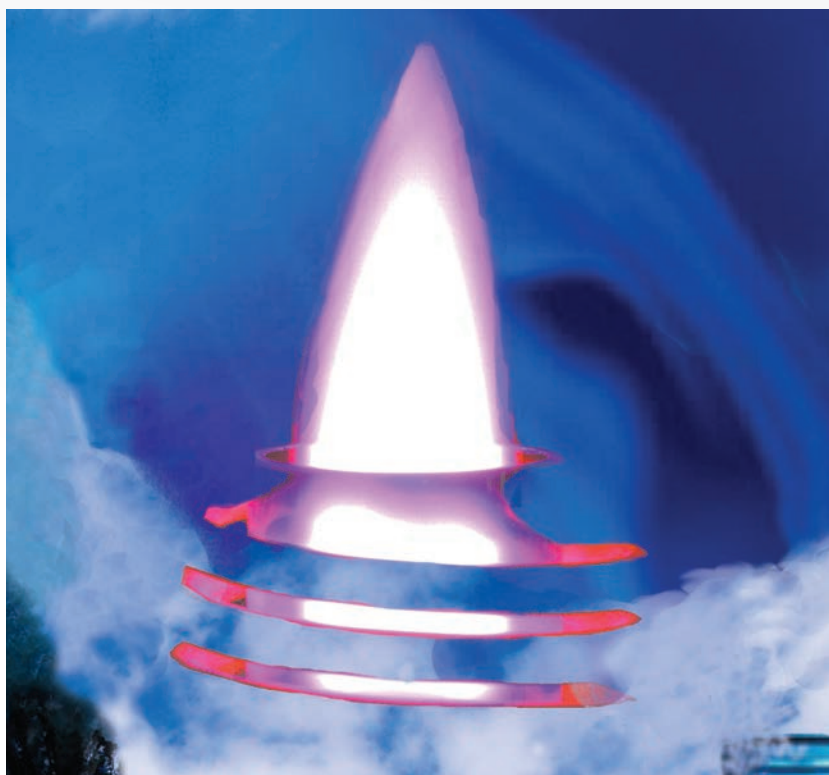
- The Power and Durability of a free-running 40.68 MHz RF generator which offers the highest efficiency of energy transfer to your sample.
- Thermostatted Optics for unparalleled optical stability.
- Choice of gratings* to offer better resolution/sensitivity depending on your application.
- Capability to handle difficult matrices such as 40% dissolved salts using the humidifier* – eliminating the need for dilution and enhancing trace level detectability.

Powerful Multi-tasking Windows® 32 Bit software.

- Sophisticated auto-optimisation software.
- Powerful semi quant facility.
- Plasma Cam™* enables user to view plasma from PC.
- PIP™* – Plasma Integrity Protector significantly decreases chances of a "doughnut" and associated melted torches.
- Inbuilt chiller means no bulky extra chillers required.
- Nitrogen Purged optics – vacuum capability without messy regular maintenance of vacuum pumps.
- Ability to directly analyse organics without any oxygen accessories.

With all of these powerful features, even a first time user can immediately obtain the maximum performance from the Quantima regardless of the application.

The Quantima offers ease of use for method development and analysis which is unmatched by any other ICP.



* Optional extra

Largest Range of Selectable Wavelengths

High performance optics technology

The Quantima optics have been designed to satisfy all the fundamental figures-of-merit critical for spectroscopic instrumentation

- Unlimited wavelength selectivity.
- High sensitivity.
- Highest resolution.
- Unparalleled optical stability.
- High stray light rejection.
- Auto-optimisation of viewing position.
- Optimised dual detector response.
- Widest dynamic range.
- High productivity.
- Unmatched flexibility.

The no compromise design philosophy ensures that you can have full confidence in the integrity of data, regardless of the application.

Largest range of selectable wavelengths

With its comprehensive wavelength database, the Quantima makes wavelength selection simple. Relative sensitivities and all potential spectral interferences are displayed. Choose the most sensitive wavelength for trace determinations or less sensitive wavelengths for high concentrations. You can choose the best possible interference-free wavelengths when the complexity of the spectrum generated by your sample matrix demands it.

The standard Quantima configuration will cover the spectral range of all ICP detectable elements from S, P, B, Hg or Al (Ultra Violet region) right up to Na, Li, Cl and K (Visible region).

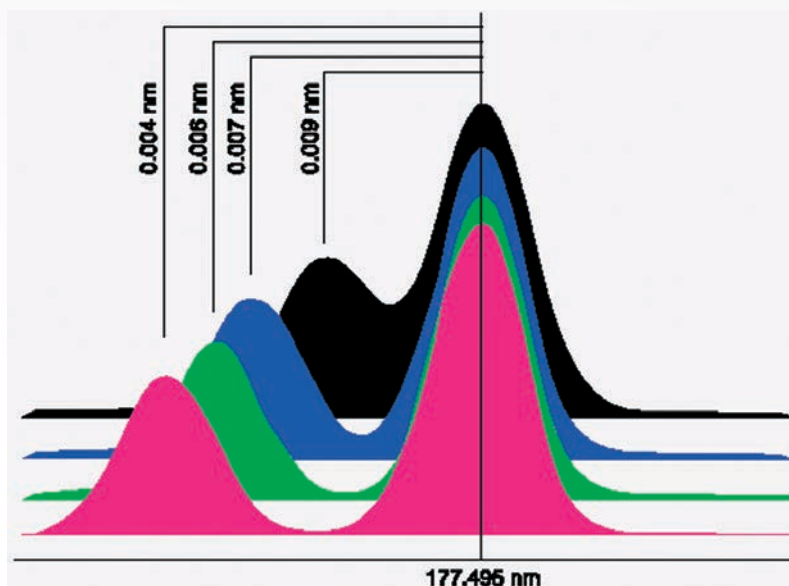
Maximum energy throughput for high sensitivity

By using only efficient all-reflective optics and minimal optical components light loss is minimised and highest sensitivity is assured.

Highest resolving power to 0.004 nm

With a choice of specialized gratings you can choose whether you require wide wavelength coverage or high sensitivity and high resolution to

satisfy your ICP application requirements. The optional 2,400 l/mm holographic grating allows resolution as high as 0.004 nm allowing the Quantima the resolution to perform measurements directly on interference peaks even in the most demanding matrices. The high resolution eliminates the need for complex and time consuming mathematical peak deconvolution software that can only provide poor approximations at separating these interferences.



An example of how the phosphorous line at 177.495 nm can be fully resolved from a copper interference at 177.482 nm using 0.004 nm resolution.

Outstanding Long-term Precision

Mass flow controllers provide accuracy and stability

Quantima – mass flow controllers provide precision, accuracy and stability

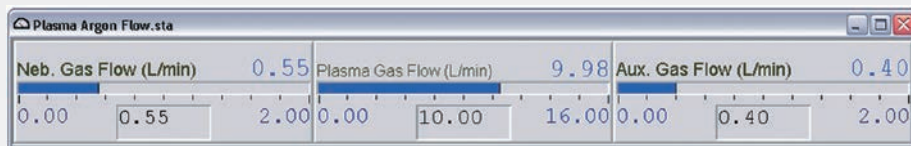
Innovative GBC engineered mass flow controllers, fitted to the nebuliser line and optionally to each of the plasma and auxiliary gas lines, guarantees the highest level of precision and control. This unique feature ensures precision, accuracy and reproducibility of signal measurement, essential since analyte intensities are highly sensitive to fluctuations in gas flows.

With gas flows reproducibly set to within 0.001 L/min together with the high precision concentric nebuliser and efficient cyclonic spray chamber, the Quantima routinely achieves analytical precision better than 0.5%.

Total Argon flow is typically less than 11 L/min for aqueous samples making the Quantima the lowest argon consumption ICP that is available.

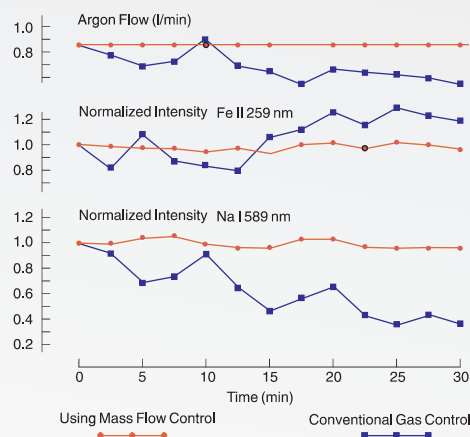
Excellent long-term stability

Direct comparison with conventional gas control systems proves that mass flow controllers achieve the highest degree of gas flow control which results in the best possible precision, long-term stability and outstanding reproducibility.



On screen monitoring of critical parameters

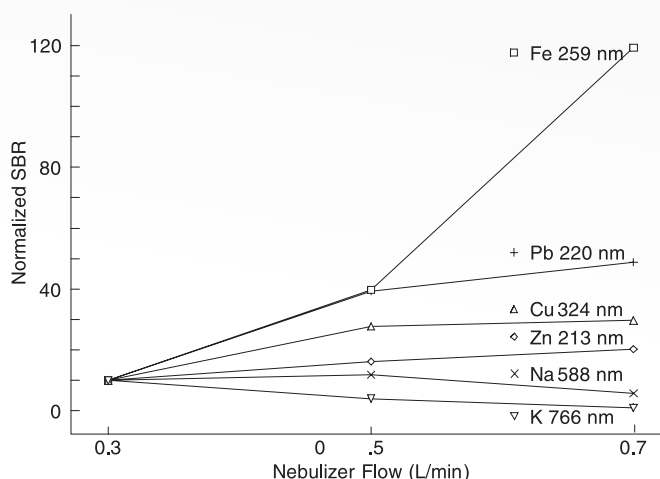
With typically less than 1% drift over a four hour period, the analyst can spend more time analysing new samples and less time repeating calibration standards.



Unparalleled optical stability

The highest possible analytical accuracy and precision are achieved through the precise temperature control of the 0.75 m Czerny-Turner monochromator. The elimination of drift caused by variations in ambient temperature ensures the integrity of analytical data over long and unattended analyses.

Exceptional stability and precision achieved using mass flow control compared to conventional gas control



With sample gas flow optimised for each element, highest sensitivities can be achieved with different matrices

Flexible and Robust Plasma

Flexibility allows best sensitivity regardless of element or matrix

Optimised dual detector system

The Quantima's dual detector system ensures maximum sensitivity across the entire wavelength range. One detector is sensitive below 300 nm and the second detector for elements above 300 nm. The choice of detector is automatic.

Widest linear dynamic range – 8 orders of magnitude

Eight orders of linear response achieved by the dual detector system permits analytical determinations over the widest concentration ranges. Concentrations from high percent to low parts per billion levels can be confidently measured without dilution.

Flexible parameter settings allows best conditions for every element

For ICP determinations every element requires slightly different nebuliser flow and viewing height to obtain the optimum sensitivity. These critical parameters can be accurately set and reproducibly recalled wherever needed.

Robust and reliable high efficiency plasma module

Crucial to the Quantima's power and performance is a robust, reliable and efficient 40.68 MHz free-running 1500 watt RF generator. Utilising the latest in highly accurate fuzzy logic controllers, the GBC designed RF

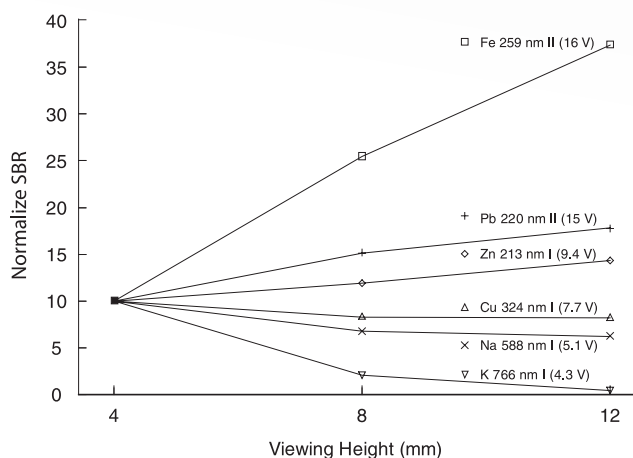
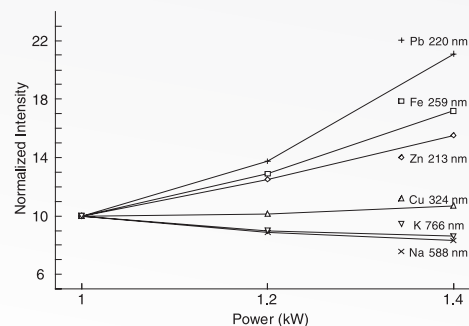
system provides superb stability which translates to unsurpassed analytical performance. This frequency also offers reduced background levels for enhanced signal to noise response.

With power settings controlled in precise 1 W steps, the plasma operating power can be easily configured even for the most difficult sample matrices with each element individually optimised.

The highest energy transfer from plasma to sample

The Mg II 280.270 nm/Mg I 285.213 nm Intensity Ratio provides a true measure of the efficiency of energy transfer from plasma to sample.

Professor J. M. Mermet determined that values greater than 10 are a measure of superior performance. The Quantima's efficient RF generator and precise control of plasma parameters all combine to provide the highest possible energy transfer from plasma to sample. With values typically exceeding 15, the Quantima has the most robust plasma available ensuring maximum sensitivity and minimised matrix effect especially with difficult organic matrices. As well as better sensitivity in aqueous samples, the most volatile organic solvents can be directly aspirated without the need to dilute or use of oxygen accessories.



Graphs showing effect that varying viewing height and nebuliser flow have on various elements.

Direct, Accurate and Fast

Application – direct analysis of milk powder using a slurry method

The traditional method of determining the nutritional composition of milk is to ash it at high temperatures to remove the organic matter followed up by an acid digest. This process can take up to a day to perform.

As well as time costs involved and need for costly equipment and chemicals there is a possibility of either losing volatile elements in the ashing stage or the possibility of contamination in the digestion stage.

As an alternative methodology, GBC chemists devised a 3% slurry technique for milk analysis.

This much simplified technique simply requires weighing a milk powder then adding distilled/deionised water and directly analysing.

Power (w)	1200
Plasma Gas (L/min)	11.00
Auxiliary Gas (L/min)	0.50
Sample Gas (L/min)	0.50
Sample Gas (KPa)	280
Torch Height (mm)	9.0
Pump Speed (mL/min)	1.2
Pump Speed (rpm)	15
PMT (V)	500
Scan Window	0.08 nm 1st order 0.04 nm 2nd order 0.027 nm 3rd order 0.02 nm 4th order
Data Points	40
Integration Time Per Point (s)	0.1
On Peak Integration (s)	2
Replicates	3
Background Correction Mode	Dynamic
Fast Pump between Sample (s)	15
Stabilization (s)	20

Element	Wavelength	Standard 1	Standard 2
Na	589.592	10.00	50.00
K	769.896	25.00	100.0
Ca	422.673	25.00	100.0
Mg	280.270	2.00	10.00
Fe	238.204	0.20	2.00
Zn	213.856	0.20	1.00
Cu	324.754	100.0	500.0
Mn	259.373	20.00	50.00
P	177.495	15.00	30.00

Element	Nestle Reference Powder Expected Result (mg/100g)	Ashed Samples (mg/100g)	3% Slurry Results (mg/100g)
Na	116.9 - 126.4	115, 115.8	120, 120
K	588 - 710	680, 670	672, 675
Ca	273.3 - 284.8	278.3, 276.7	279.3, 278.9
Fe	24.7 - 26.7	25.1, 25.2	25.1, 25.3
Mg	3.9 - 4.15	3.92, 3.95	3.93, 3.95
Zn	1.50 - 1.65	1.52, 1.52	1.62, 1.62
Cu	0.125 - 0.150	0.128, 0.127	0.142, 0.142
Mn	30.6 - 50.1	40.9, 41.8	40.8, 40.9
P	215.8 - 224.3	226.8, 227.3	223.0, 222.8

The Quantima's spacious sample introduction area allows convenient access to all sample introduction components. With quick release gas connections and hoses, changeover of torch, spray chamber and nebuliser is rapid. The new Cool Touch design ensures that the torch box never gets hot, even when running at maximum power for hours, thus allowing physical removal of components quickly without having to wait for them to cool.

Fast Sample Introduction

Wear metal oil analysis

The periodical analysis of engine oil is an important application as fleet companies use this analysis to determine when major servicing is required. An increase in metal concentration in sump oil can pinpoint potential engine trouble. The presence of tin may be caused by bearing wear. The presence of chromium, aluminium or nickel may be because of piston or ring wear. Copper is indicative of coolant leaking into the lubrication system via cracks or poor seals and silicon may suggest dirt or sand intrusion indicating that the air filter needs to be cleaned or replaced.

This analysis is best performed by ICP due to its speed and the ability to analyse elements such as S and P.

The oil samples and organometallic standards are dissolved in kerosene and directly aspirated into the plasma without the need for Oxygen Accessories required by conventional ICPs to avoid carbon build up. The Quantima can perform this function without an accessory and in addition a pump speed of 60 rpm can be used pumping kerosene between samples to speed up sample introduction without the plasma turning off.

Element	Wavelength (nm)	Detection Limit (ppb)
I - Atomic Line		
II - Ionic Line		
Ag I	328.068	2.0
Al	167.081	2.0
As I	188.979	10.0
Bi	249.773	2.0
Ba II	455.403	0.1
Ca II	317.933	2.0
Cd II	214.438	0.8
Cr II	283.563	2.0
Cu I	324.754	2.0
Fe	259.94	1.5
Hg I	184.95	8.0
Mg I	279.553	0.1
Mn II	257.610	0.3
Mo II	202.030	5.0
Na I	588.95	10.0
Ni II	231.064	3.0
P I	177.495	8.0
Pb II	220.353	10.0

Viewing Height Individually Optimised	3 – 20 nm
Power	1300 W
Nebuliser Flow	
Optimised for Pb	0.4 L/min (160 kPa)
Plasma Gas Flow	12 L/min
Auxiliary Gas Flow	1.0 L/min
Sample Uptake Rate	1.0 mL/min
	8 rpm
PMT Voltage	
individually optimised from 340 – 600 V	
depending on concentration level	

Measurement conditions for sample analysis measurement

Integration Time	
On Peak (s)	2
Replicates (s)	3
Background Correction	Dynamic
Scan Windows	0.08 nm 1st Order
	0.04 nm 2nd Order
	0.027 nm 3rd Order
	0.02 nm 4th Order
Data Points	50
Integration Time per Data Point (s)	0.1

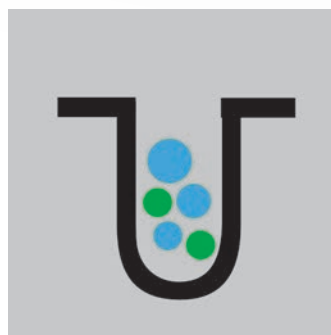
Accessories to Enhance Productivity

Argon humidifier allows up to 40% dissolved solids

An argon humidifier is available as an option to the Quantima. When fitted in series with the sample gas line and the standard nebuliser, the argon humidifier increases the tolerance of the sample introduction system to blockages due to high dissolved salts. This is achieved by bubbling argon through water to add a small amount of humidity to the argon gas supply. As the water vapour passes through the nebuliser orifice it removes salt deposits as they occur.



The optional Argon Humidifier

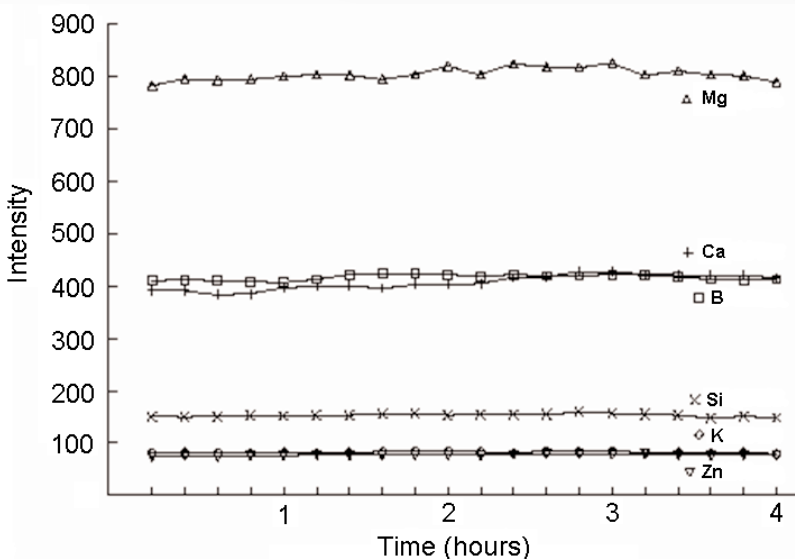


Humidifier Software Icon

Plasma Integrity Protector – PIP™ significantly reduces the occurrence of molten torches. Occasionally, under certain conditions, the plasma can collapse and form what is called a parasitic plasma or doughnut. Here the plasma collapses into the top of the torch and if the power to the RF generator is shut no damage occurs. However, if the doughnut is left, such as would happen in an unattended analysis, the torch would melt within a few seconds. GBC has devised and patented the PIP™ which is an option on the Quantima. The PIP™ immediately shuts power to the RF Generator as soon as it detects a change from a normal plasma to a parasitic plasma. The occurrence of molten torches are significantly reduced.



ICP users often look at the Plasma to determine quickly whether either the sample has reached the plasma or whether the rinse solution has flushed it out. With an optional Plasma Cam™, the end user can now view this and more from the convenience of the computer screen.



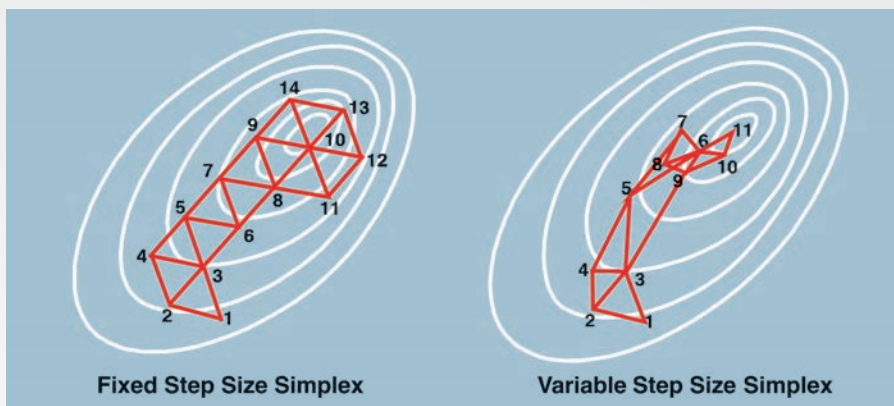
30% NaCl solution excellent reproducibility over 4 hours using standard sample introduction components and Argon Humidifier.

Auto-Optimise Methods

Best performance – every application with automatic optimisation

Powerful, fast, accurate auto-optimisation software

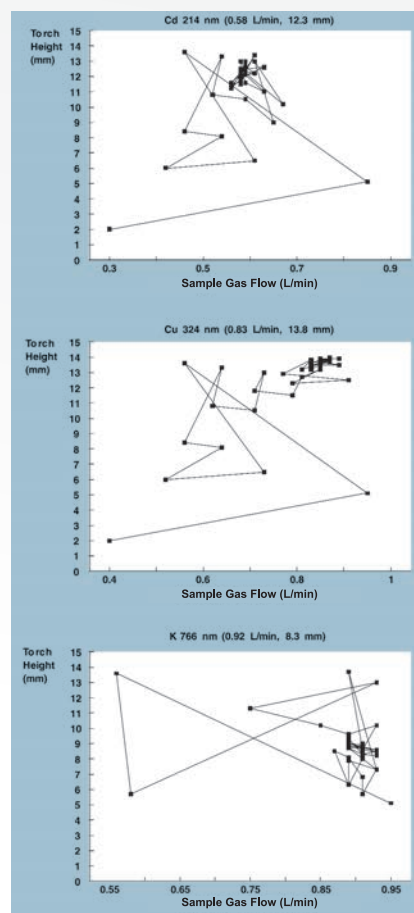
For less experienced users, the Quantima software provides an intelligent auto-optimisation software package that simplifies the complex task of setting up instrument operating parameters optimised for individual applications. Now there is no need to understand the complexity of how all of the operating parameters interact with each other. There is no need to predict the effect on sensitivity on a particular wavelength as the operating conditions are changed. Quantima's auto-optimisation software will perform all the measurements and calculations according to your selected optimisation criteria. A Simplex is a mathematical procedure for determining optimum values for a range of inter-dependent parameters. GBC has modified the traditional fixed step multivariate Simplex to use variable step size as opposed to the traditional fixed step size. This results in a true optimisation value being obtained more quickly and more precisely and accurately.



A variable step size simple algorithm allows faster, more precise and accurate optimisation compared to a fixed step.

User-selectable optimisation criteria

Quantima software achieves optimisation with any number of variables according to user-selected criteria. (Maximum Intensity or SBR or minimum BEC or DL.) Critical parameters such as nebuliser flow, RF power and viewing height, for example, each play an important role in achieving the highest possible analytical precision, accuracy and sensitivity. The Quantima software takes the guesswork out of setting parameters and turns inexperienced operators into expert analysts.



Actual auto-optimisation for 3 different elements. Note that the optimum torch viewing height and nebuliser flows are different.

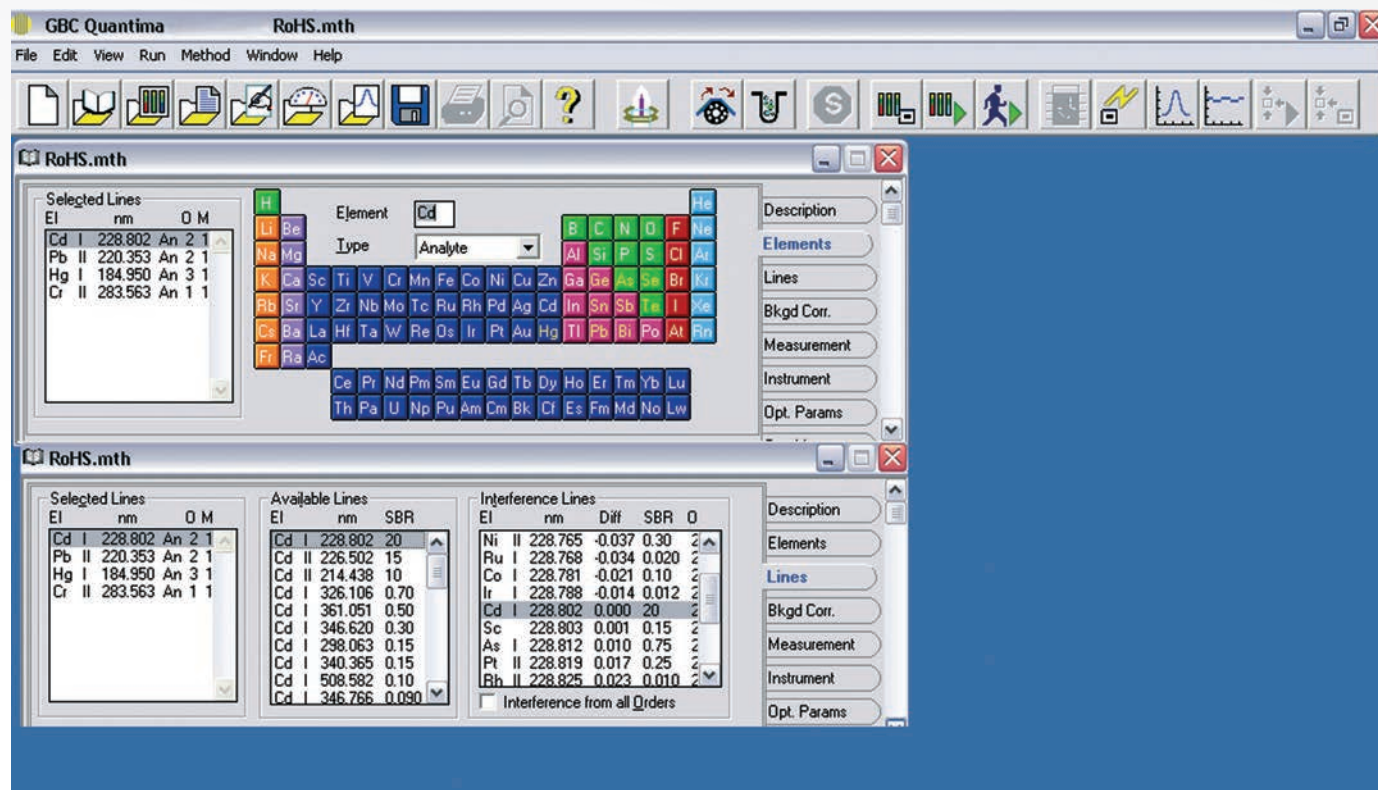
True Multi-Tasking

User friendly, powerful software

Ease of use

The Quantima software, designed for Windows®, is logically organized into clear modules for simplified control of all instrument and analysis functions. Designed for ease of use and flexibility, the software uses a combination of easily recognizable icons, function key controls, simple to edit menus and a notebook style layout to keep you in control and organized.

With User Name and password protection your method and data are now safe from unauthorized users.



To start an analysis can be as simple as a one click operation on the start ICON. While performing sample analysis, old data can be reviewed and printed, user defined critical instruments status panels can be displayed and data can be sent to third party software packages. With context sensitive Help only a click away and error-sensitive prompts ready to respond, the truly multi-tasking software is easy to use.



Data for Future Reference Specifications

Method development made easy

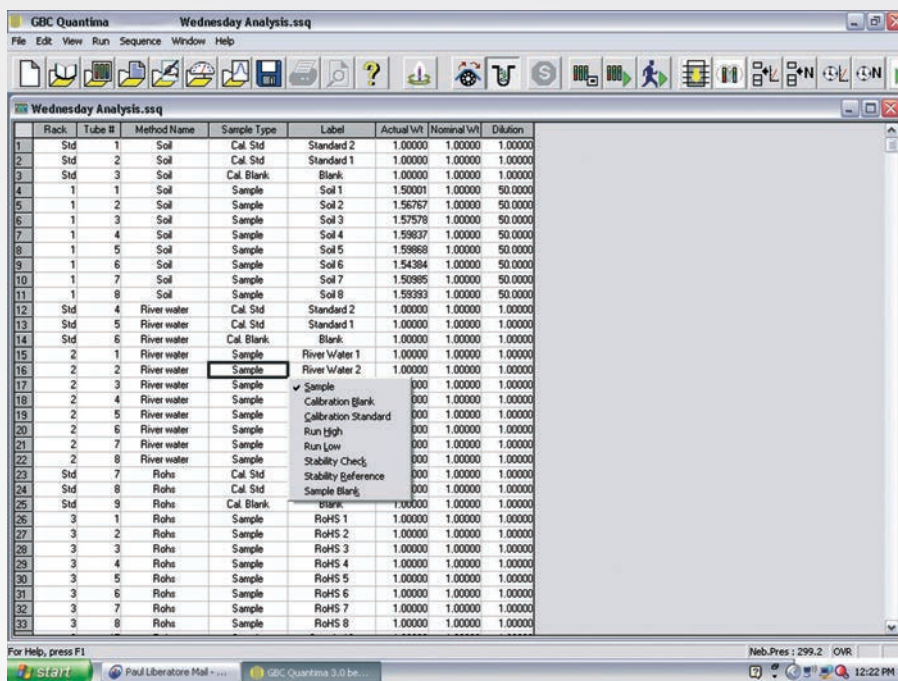
Method parameters are logically grouped on individual pages and accessed via appropriately named tabs on the side of each page. All of the development tools required are located in the Method module.

Powerful graphics module

The powerful graphics module is used to display and overlay wavelength scans for investigating potential interferences, defining background correction positions or for determining the effect on intensity caused by changing gas flows, viewing height, power, wavelength order or many other operating parameters. You can also use the chart recorder facility to investigate performance trends when optimising, to monitor the stability of the instrument or specific parameters, or to determine spray chamber washout times so that you can accurately set and store the appropriate rinse and stabilization times.

Comprehensive wavelength library

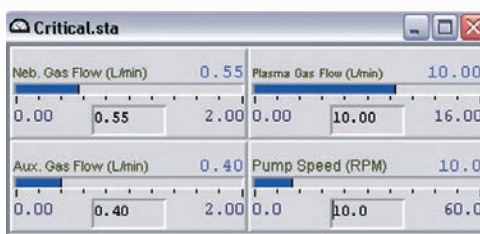
Direct access to the built in wavelength library provides information on relative line sensitivity, background equivalent concentrations and potential interferences about 32,000 wavelengths.



Linking multiple applications maximises the potential of unattended operation.

With graphical display of potential spectral interferences available at all times, wavelength selection becomes very easy, even for complex matrices.

In the unlikely situation where an analyte has an interference and another wavelength cannot be used the Quantima software provides interference corrections to be used.



User customisable status panels. User can choose from over 200 parameters and a range of display or output models.

Extend the Quantima's Capabilities

Accessories

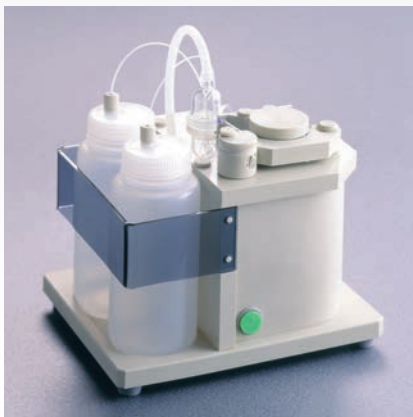
SDS3000 Auto Sampler

The SDS3000 is a precision engineered X-Y-Z auto sampler. Designed and fabricated by GBC Scientific Equipment, this affordable auto sampler provides accurate and fast analysis due to its durable, reliable and sturdy design. Supplied with four sample racks to hold 240 sample vials each of approximately 14 mL and a standards rack to hold 10 standard vials plus a blank each with a volume of approximately 50 mL. PTFE and PEEK material is used to provide a metal free liquid flow path. Variable continuous flow sample probe rinse station with peristaltic pump minimizes sample contamination and carryover. Software controls include rinse time, delay time, number of replicates, rescale rate, recalibration rate, measurement time and analysis order. Full random access capability is standard. Up to 360 samples can be loaded using 7 mL tubes.



HG3000PII Hydride Generator

Use the HG3000PII hydride generator for the determination of sub parts per billion of hydride forming elements such as As, Hg, Sb, Se, Pb, Bi, Sn, Ge and Te. The HG3000PII hydride generator accessory incorporates precision glassware for highly efficient mixing of reactants and gas liquid separation to ensure reproducibility and high sensitivity. This easy to use accessory takes less than a minute to interchange from the Quantima standard set of sample introduction components and is totally made from inert polypropylene material for long lasting performance, essential in highly corrosive environments.



HF-resistant sampling accessories

For samples digested in hydrofluoric acid, a polypropylene spray chamber, used in conjunction with a ceramic nebuliser and torch sample tube, provides an inert environment for sample introduction. This system can also be used for aqueous samples without compromise.

Programmable Temperature Spray Chamber

The programmable temperature spray chamber (PTSC) features electronically controlled temperature using an inbuilt peltier device.

The PTSC provides all the benefits of a temperature controlled ICP sample introduction system in a compact, convenient, cost effective package. Any temperature between -10°C and +60°C can be selected to achieve optimum conditions for any application.

For maximum convenience the PTSC can be controlled from a PC either through supplied Bluetooth interface or supplied USB interface. The cyclonic spray chamber is encapsulated in a special heat conducting polymer which provides excellent sensitivity and precision with fast washout.



Enhance Productivity and Sensitivity

Accessories



- The temperature can be set as low as -10°C and $+60^{\circ}\text{C}$ can be selected to achieve optimum conditions for any application.
- By holding the spray chamber at a stable temperature, the long term stability is improved.
- The sensitivity of many analyses is enhanced by running the spray chamber at elevated temperatures, particularly important for samples with limited volume.

Ultrasonic Nebuliser

The combination of high nebulisation efficiency and subsequent desolvation by the ultrasonic nebuliser results in sensitivities typically 5 to 20 fold greater than those achieved by conventional pneumatic type nebulisers.

Setup is rapid, taking less than one minute to interchange from the Quantima's standard set of sample introduction components and operation is simplified with automatic temperature control of the heating and cooling functions. The compact design allows you to conveniently place the ultrasonic nebuliser on Quantima's standard built-in bench, ensuring optimum use of your laboratory space.

An ultrasonic nebuliser is also available for use with organic samples.

Rapid service response

GBC has many factory trained service representatives worldwide so you can be assured of a rapid response to your service requirements.

Remote diagnostics

Easy to install, user friendly software enables GBC to provide you with complete on-line remote instrument diagnostics and trouble shooting. With over 200 instrument status items, the user can create customised status panels to monitor over 200 parameters. By using the "log to file" facility, any parameters can be logged to a file and emailed to GBC.

Quantima Specifications

Part Number: 99-0552-00

RF Generator

Free running, air cooled generator. Auto start from switch or keyboard.
Operating Frequency 40.68 MHz.

Grating

1,800 l/mm holographic grating allows wide analysis range from 160 – 800 nm and up to 6 pm resolution.
Optional 2400 l/mm grating allows analysis range from 160 – 640 nm with up to 4 pm resolution.

Mass Flow Control

Nebuliser Gas flow regulated using mass flow controller.
Optional mass flow control available on Plasma and Auxiliary flows.

RF Power

Computer controlled from 500 W to 1,500 W with auto tuning.

Safety Interlocks

Interlocks on plasma compartment door, gas pressure, low/high mains voltage, plasma failure.

EMC Standards

Meets the following EMC standards:
EN61326-1:2013

Operating Voltage

200-240 V AC $\pm 10\%$, 3.5 kVA, 20A.

Frequency

50/60 Hz

Dimensions

1520 mm (W) x 850 mm (H) x 730 mm (D)

Weight

245 kg

Accessories

99-0697-00 SDS3000 Auto Sampler

99-0126-03 Hydride Generator

40-0254-00 Programmable Temperature Spray Chamber

99-0322-00 Ultrasonic Nebuliser, 220 V

99-0323-00 Ultrasonic Nebuliser, 110 V

99-0566-00 Ultrasonic Nebuliser with Desolvator, 220 V

99-0567-00 Ultrasonic Nebuliser with Desolvator, 110 V

97-3764-00 Humidifier

97-3718-00 Plasma Cam™

97-3719-00 PIP™

40-0182-00 2,400 l/mm High Resolution/Sensitivity Grating

97-3750-00 3 Channel Mass Flow Controller

97-1929-00 4 Channel Peristaltic Pump

97-3753-00 HF Sample Introduction Kit

95-0035-00 Organic Samples Kit

99-0562-00 Quantima Bench includes Storage Shelves and Wheels

Designed and manufactured by GBC Scientific Equipment Pty Ltd
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GBC SCIENTIFIC EQUIPMENT
Manufacturer of world-class scientific instruments and accessories
— AAS, HPLC, ICP-OES, ICP-TOFMS, UV-Vis and XRD

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