# SPECTRO ARCOS – SOP (130[160]-770 nm)

Automatic, simultaneous measuring optical emission spectrometer with inductively coupled plasma excitation source and semiconductor detector system for the quantitative and/or semi quantitative, spectrochemical, elemental analysis of liquids.

Side-On Plasma Interface (SPI) for added linear range, accuracy and precision for higher concentrations and major component determination in metals, high TDS, organics or slurries.

The optimized laminar, low flow purge ensures an oxygen free light path and minimizes UV wavelength absorbance. This allows the easy-maintenance entrance optic to remain free of contamination, providing excellent stability and extraordinary sensitivity for emission lines in the spectral region between 130 (160)1 and 190 nm.

The SPECTRO ARCOS consists of the following components:

* Polychromator
* Detectors
* UV-System
* Generator
* Standard sample introduction system
* Spectrometer control
* Data processing system
* Software

Note: All items marked “\*” are optional. Please refer to the quoted items page to see whether the option is included. The items marked “1” refer to the ARCOS 160

# SPECTRO ARCOS – DSOI (130[160]-770 nm)

Automatic, simultaneous measuring optical emission spectrometer with inductively coupled plasma excitation source and semiconductor detector system for the quantitative and/or semi quantitative, spectrochemical, elemental analysis of liquids.

Dual-Side-On Plasma Interface (DSOI) with added sensitivity plus high matrix compatibility linear range, accuracy and precision. This unique interface makes the SPECTRO ARCOS suitable for applications with trace analytical requirements, but also for higher concentrations and major component determinations as well as metals, high TDS, organics or slurries.

The optimized laminar, low flow purge ensures an oxygen free light path and minimizes UV wavelength absorbance. This allows the easy-maintenance entrance optic to remain free of contamination, providing excellent stability and extraordinary sensitivity for emission lines in the spectral region between 130 (160)1 and 190 nm.

The SPECTRO ARCOS consists of the following components:

* Polychromator
* Detectors
* UV-System
* Generator
* Standard sample introduction system
* Spectrometer control
* Data processing system
* Software

Note: All items marked “\*” are optional. Please refer to the quoted items page to see whether the option is included. The items marked “1” refer to the ARCOS 160

# SPECTRO ARCOS – MV (130[160]-770 nm)

Automatic simultaneous measuring optical emission spectrometer with inductively coupled plasma excitation source and semiconductor detector system for the quantitative and/or semi quantitative spectrochemical elemental analysis of liquids.

The SPECTRO MultiView (MV) option offers true radial (single and dual side on) and true axial plasma observation in a single instrument. By an effortless turn of the load coil, the orientation of the plasma can be changed. In typically less than 90 seconds the plasma view can be switched from dedicated radial to dedicated axial, which delivers analytical performance without any compromise.

SPECTRO’s Air Cooled Optical Plasma Interface (OPIAir) combines the sensitivity of axial viewing with the freedom from matrix interferences.

Providing an average factor 5 improved sensitivity compared to single radial plasma observation, the OPI’s cone shape achieves this by piercing through the recombination zone, deflecting it radially away from the optical path keeping the degree of removal independent from the matrix.

The Side-On Plasma Interface (SPI) provides added linear range, accuracy and precision for higher concentrations and major component determination in metals, high TDS, organics or slurries.

Dual-Side-On Plasma Interface (DSOI) with added sensitivity plus high matrix compatibility linear range, accuracy and precision. This unique interface makes the SPECTRO ARCOS suitable for applications with trace analytical requirements, but also for higher concentrations and major component determinations as well as metals, high TDS, organics or slurries.

For the ARCOS MultiView the interfaces can be configured as required, - also be purchased at any later point in time.

The optimized, laminar, low flow purge ensures an oxygen free light path and minimizes UV wavelength absorbance. This allows the easy-maintenance entrance optic to remain free of contamination, providing excellent stability and extraordinary sensitivity for emission lines in the spectral region between 130 (160)1 and 190 nm.

The SPECTRO ARCOS consists of the following components:

* Polychromator
* Detectors
* UV-System
* Generator
* Standard sample introduction system
* Spectrometer control
* Data processing system
* Software

Note: All items marked “\*” are optional. Please refer to the quoted items page to see whether the option is included. The items marked “1” refer to the ARCOS 160.

# System Configuration

## Polychromator

* Thermally stabilized to +15%°C ± 0.5°C
* Hollow section design in triple Paschen-Runge mounting
* 750 mm focal length
* Holographic concave master grating: 2 x 3600 grooves/mm, 1 x 1800 g/mm
* Grating material Zerodur
* MgF2 optical components
* Full 1st order wavelength coverage
* Wavelength range: 130 (160)1 - 770 nm
* Entrance slits width: 15 µm

## Detector

* 32(29)1 Hamamatsu linear CMOS arrays, fitted in continuous order, selected and optimized according to the wavelength range
* 4096 pixels per array
* Optical resolution: 130(160)1-340 nm 8.5 pm, >340 nm 16-23 pm
* Thermally stabilized optical system (+15°C ± 0.5°C)
* Parallel readout architecture
* On board digital signal processor for each array
* Intelligent data acquisition and data reduction system
* Dynamic range up to 9 orders of magnitude
* Shortest integration time 0.1 ms
* Shortest measurement time for one analysis: 2 sec (includes measurement and evaluation of the complete spectrum)
* Integration time automatically optimized for each pixel according to signal height
* Full spectrum access
* Automatic dark current correction
* Automatic profile standardization
* TCP/IP interface to data processing system

## UV System

* UV-PLUS System
* Gas (Argon) filled hollow section, sealed, no consumable purge gas required
* Dual Window entrance optics, easy to maintain
* Automatic gas purifying system
* Lifetime of the purifying cartridge: 24 months

## RF-Generator

* LDMOS solid state design
* Frequency: 27.12 MHz, free running type
* RF power output: 0.5 to 2.0 kW
* Power stability <0.1%
* Automatic plasma ignition
* Stand-by mode (low power, low argon)
* Fully computer controlled
* Air cooled (No external cooling required)

## \* Side-On Plasma Interface (SPI)

* Argon purged light path
* Argon flow rate: 0.5-0.8 l/min
* TDS tolerance: up to 30%
* \*UV protection option

## \* Dual Side-On Interface (DSOI)

SPECTRO's unique DSOI represents a brand-new approach to the critical question of plasma view design. DSOI uses two optical interfaces to capture emitted light from *both* sides of a vertical plasma, with only a single extra reflection. It provides *twice* the sensitivity of conventional radial-plasma-view instruments and equals the sensitivity of vertical-torch dual-view systems — while avoiding their complexity and disadvantages like contamination and thermal stress.

* Argon purged light path
* Argon flow rate: 0.5-0.8 l/min per Interface
* TDS tolerance: up to 30%
* \*UV protection option

## \* Optical Plasma Interface (OPIAir)

SPECTRO's unique "Optical Plasma Interface" (OPIAir) in combination with axial plasma viewing improves the sensitivity in average up to a factor of 5 compared to radial plasma observation, while drastically reducing matrix interferences typically associated with axial viewing. The novel forced air cooling system completely eliminates the requirement for external liquid cooling.

* Argon purged light path
* Argon flow rate: 0.5-0.8 l/min
* TDS tolerance: up to 20%
* \*UV protection option

## \* MultiView (MV)

MultiView (MV) combines true radial (single and dual side on) and true axial plasma observation in a single instrument. By an effortless change of the load coil direction, the orientation of the plasma can be changed. In less than 90 seconds the instrument can be turned from a dedicated radial into a dedicated axial instrument, which delivers analytical performance without any compromise.

* Use of the direct light path without additional deflections of the light beam
* Effortless change of the interface and the load coil direction

Note: At least one interface must be included. Additional interfaces may be purchased at any later point in time

## Sample Introduction System and Torch Unit

* Bayonet, single turn mount component holder
* Gas connections included in the torch body
* Thermostatically insulated sample introduction area
* Gas flows/parameters under full computer control
	+ Plasma gas : 0 – 20 l/min in 0.1 l/min increments
	+ Auxiliary gas : 0 – 3 l/min in 0.01 l/min increments
	+ Nebulizer gas : 0 – 1.5 l/min in 0.01 l/min increments
	+ Nebulizer pressure : 0- 8 bar (display only)
	+ Light path flow : 0 – 3 l/min in 0.1 l/min increments
* **\*** Additional control for Additional gas
* **\*** Additional control for Auxiliary gas, e.g. Oxygen
* \* Standard sample introduction system, consisting of:
	+ Fixed Plasma Torch
	+ Crossflow nebulizer
	+ Miniature Scott (double pass) spray chamber for fast washout
	+ \*Argon humidifier for high TDS applications

Note: Additional sample introduction systems can be selected from a wide range of systems available (see accessory items).

* \*Plasma Camera
* Integrated 70-speed, 4 channel cassette, 12 roller, computer controlled peristaltic pump
* Fast pre-flush and fast rinse function
* Peristaltic pump drain

## Data Processing System (PC)\* (minimum configuration)

* Intel® Core™ i5-9500
* 8 GByte RAM
* 500 GB SSD
* DVD +/- RW Drive
* CD RW Software
* Graphic adapter
* Keyboard
* Scrolling Mouse
* USB ports
* Audio sound card
* 2 Network adapter
* Windows 10™ 64 Bit Professional Operating System
* Color HD Monitor (≥22”)
* Ink Jet printer

Note: Due to the rapid technical progress, please inquire with your sales partner regarding the current model supplied.

## ICP Analyzer Pro Software

a. General

* Windows 10, 64 Bit Professional Operating System
* Future proof, State of the Art “Material Design” concept
* Clear, organized structure, intuitive operation
	+ Workflow oriented, master-detail user interface
	+ Excellent usability
		- Where information is contained and where interaction is expected is intuitively perceived
	+ Ergonomically organized structure
		- Only information needed is displayed
	+ Modular architecture, functions not needed can disabled
		- Nine customizable modules 🡺 Customizable user interface
* Powerful multilevel user/permission management
* Advanced data integrity and security system
* User, data management compatible to US FDA 21 CFR Part 11
* Clear text audit trail compatible to US FDA 21 CFR Part 11
* Fully traceable data reprocessing for any sample
* Fast flat file data management
* “Spectra Calibration” –Automatic wavelength standardization.
	+ Individual pixel, full spectrum standardization of the wavelength scale
		- Enables the use of factory methods
		- Enables full method transfer between individual instruments
		- Automatic drift control during the measurement process
		- Continuous system and traceability control using the history function
* Easy to use sequence list
	+ Sequence definition using drag and drop – WYSIWYG display
* Multi-client operation – work simultaneously from different locations on the same platform
* Data Archive/Restore of methods and results
* Disaster Archive/Restore function

b. Manual Measurement

* Versatile analysis view
- Simultaneous display of several samples
- Simultaneous replicate/average view
- Simultaneous display of analysis, spectra, generator and autosampler view
* Entry of “unlimited” identification terms per sample
* Pre-defined dilution calculation
* Calculation of pseudo-elements (e.g. element bonds) by user-defined formulas
* Blank correction
* Automatic interference correction
* Simultaneous background correction
* Real time internal standardization with free selection of reference element and line
* Automatic standardization
* Automatic nebulizer optimization
* Automatic control sample test
- output of results
- comparison to pre-set limits
- high-lighting of values out of tolerance
* EPA/CLP compliant sample logic
* Specification control
* Transient measurement mode
* Sampling frequency up to 10 Hz
* Trigger interface for external devices\*
* Output of measurement results per element line in any concentration unit
* Output of measurements in any calculation step between intensity and concentration
* Output of statistical data (average of individual measurements with absolute and relative standard deviation)
* Automatic data output of sample Ids, individual measurements, averages, standard deviations, raw data (parameters can be pre-set for each individual method) using:
- Template based report generation (template designer included)
- Report Export function (PDF, printer
- printer (page fit or single result per page)
- data storage
* Export of analytical results and raw data to ASCII delimited, XML and/or EXCEL
* Full cut and paste clipboard support
* Automatic selection and switching between spectral lines depending on the defined concentration ranges.
* Recording of complete spectrum or region of interest (with data storage) during sample/standard measurement
* Spectra export to ASCII function (single and average spectra)
* Fully traceable spectrum re-processing for any sample measured
* Fully traceable data reprocessing
* Storage of the complete spectrum for every measurement
* Post measurement editing of all line parameters
	+ Analysis of new elements / lines for measured samples
	+ Analysis with modified peak(area) and/or background settings
	+ New or modified internal references
	+ New or changed calibration models for data evaluation
	+ Previous calibrations and/or standardizations
	+ Retrospective Analysis of previously measured samples

c. Method Development

* Workflow guided method development
* Extensive global editable lines library (NIST)
* Automatic recommended line section
* Global units library
* Standard samples: freely definable units per element and/or sample
* Line specific selection of excitation parameters, if required
* Line specification using peak or peak area
* Automatic selection and switching between spectral lines depending on the defined calibration ranges
* Calculation of user defined Formulas (e.g. Pseudo elements, element bonds)
* Automatic Smart Spectra interference and background correction
* Additional automatic interference correction
* Numerical and graphical output of any number of interelement corrections
* Simultaneous online and/or offline background correction
- Linear or quadric models
- Smart background correction
- Interactive selection with pre-view
- Measuring range freely definable
* Method import/export function
* Calibration curve calculation using polynomial or rational regression models
* Regression of "any" number of samples
* Standard Addition Calibration
* Simultaneous display of calibration function sample list and coefficients for each analytical line
* Various sample weighing models
* Full version control for method and regression
* Restoration of any previous version
* Undo Function

d. Quick Quantitative Analysis

* Measure or view stored spectra function
* Quick-Quant Function
	+ Automatic single sample based quick quantitative analysis of unknown sample
	+ Display of the results
	+ Printing and export of the result
* Automatic line identification
	+ Complete lines library (NIST)
	+ Recommended lines library
	+ Interference identification
	+ Zoom function

e. Sequence Mode

* Easy to use WYSIWYG list mode for the automatic (via autosampler) or manual processing of samples
	+ Workflow oriented structure – several sequences can be linked to a batch
	+ Automation tasks include:
		- Automation sample list supports the following functions:
		- Automatic event-controlled plasma start
* Automatic generator standby function
* Automatic end rinse and generator switch off
* Method Rinse
* Intelligent Move
* On-screen autosampler tray layout design and control
* “Unlimited” number of samples per sequence/batch
* Full Cut/Copy and Paste to Clipboard support
* Time and/or event controlled automatic standardization, control sample measurement, blank correction, calibration, standard addition calibration, conditional/scheduled dilution
* Programmable, automatic event handling e.g. standardization if control sample out of specification
* Duplicate sample function
* Dynamic measurement correction
* Bracketing
* Full Auto Dilutor support for the automatic conditional dilution of over ranging samples or scheduled dilution of samples
* Priority sample function
* Process control according to US EPA norms

f. Result Management

* Management and recalculation of results
	+ Display of:
		- General sample data
		- Sample name
		- Method name
		- Measurement date and time
		- Sample type (None, Grade, Control)
		- Check status
		- Sample identification fields (Sample IDs)
			* Names, values…
* Display of sample results
	+ Element concentrations
	+ Replicates
	+ Statistical values (mean-, reported value, SD, RSD, calibration range, acceptance range, warning range)
	+ Spectra
	+ Regression
	+ Time versus concentration graph
* Management of results using virtual folders
	+ Manual addition
	+ Automatic addition using selection criteria
* Filtering and sorting
	+ Filter settings can be saved and re-loaded
* Element concentrations can be:
	+ Displayed
	+ Printed
	+ Exported (ASCII, Excel,XML)
	+ Template based printing and data export
* Results files can be copied and deleted
* Recalculation of results
	+ Modification of all line parameters
	+ Modification of all standard parameters
	+ Modification of all regressions parameters
	+ Full traceability since all method and result versions are part of the result

## \* Bracketing Plugin

* Automated bracketing according to ISO 11494 and 11495 to achieve high the precision and accuracy as e.g. required for the analysis of precious metals or other major compounds
	+ Definition of bracketing cycles as part of an automation sequence
	+ Automated analysis
	+ Fully traceable measurement and calculation of results
	+ Recalculation of results
		- Modification of all line parameters
		- Modification of all standard parameters
		- Full traceability since all method and result versions are part of the result

## \* Dynamic Measurement Correction Plugin

* Dynamic, post analytical correction of drift over time by recording of the drift, calculation of a correction function and application to samples analyzed
	+ Correction using different model and functions
	+ Fully traceable measurement and calculation of results
	+ Recalculation of the correction

## \* Sample Preparation Correction Plugin

* Correction of the calibration standard-, control sample-, unknown sample- and internal standard bias (correction to nominal samples weights) in case weight-based dilution is applied for the preparation of the samples

## \* Trigger Interface

* Software plugin to trigger (Start/Stop) external devices for the synchronization of the measurement process using Smart Analyzer Vision
* Software Module includes NI USB 6008 data acquisition device
	+ 8 analog inputs at 12 or 14 bits, up to 48 kS/s
	+ 2 analog outputs at 12 bits, software-timed
	+ 12 TTL/CMOS digital I/O lines
	+ One 32-bit, 5 MHz counter
	+ Digital triggering
	+ Bus-powered

## \* Automation Module

* Software developer kit (SDK) for integration of instrument control (TCP IP based) into a master scheduling software used for the operation of online and automation systems.
* Plasma Control Port: output of the plasma status (on/off)

Note: Requires C# programming skills

## \* Transient Module

* Module for the measurement and evaluation of transient signals
* Automatic acquisition of the signals, processing, output (screen, printer, document, file) and storage of data and results
* Acquisition and processing based on defined parameters
	+ Definition of measurement and evaluation parameters stored in transient programs
	+ Definition of the following parameters:
		- Pre-delay, interval times, integrations per interval, sampling frequency and run time
		- Peak start/end
		- Evaluation of peak height or area
		- Base line correction
			* - Average, linear or quadric models
			- Interactive selection with pre-view
			- Measuring range freely definable
		- Background correction (defined in the analytical method)
			* - Linear or quadric models
			- Spline background extrapolation
			- Interactive selection with pre-view
			- Measuring range freely definable
		- Internal standardization
* Display of the time resolved measurement
* Display of analog signals (depending on the trigger device used)
* Definition of calibration standardization and control samples
* Regression function the calculation of calibration functions
	+ Calibration curve calculation using first, second or third degree regression
	+ Regression of "any" number of samples
* Trigger function (Start/Stop) for the synchronization of external devices
* Software includes NI USB 6008 data acquisition device
	+ 8 analog inputs at 12 or 14 bits, up to 48 kS/s
	+ 2 analog outputs at 12 bits, software-timed
	+ 12 TTL/CMOS digital I/O lines
	+ One 32-bit, 5 MHz counter
	+ Digital triggering
	+ Bus-powered
* Sample list for the automatic processing of samples
	+ Automatic calibration and standardization
	+ Control sample measurements
	+ Measurement of unknown samples

## Documentation

* Basic operator manual
* Documentation for external components

## Dimensions

* Spectrometer 1068 x 1582 x 756 mm (HxWxD) (42.1 x 62.3 x 29.8 inch)
* Footprint 1065 x 646 mm (WxD) (41.9 x 25.4 inch)

## Weight

* Spectrometer approx. 249 kg (approx. 549 lbs)

## Environmental Conditions

* Room temperature: 15-35°C (64-95°F)
* Specified instrument performance at 18-25°C 64-77°F)
* Relative Humidity: <80% non-condensing
* Atmosphere: Free of corrosive vapors and high dust pollution
	+ \*An air inlet cover with 100 mm tube adapter for the supply of the instrument with external air is optionally available.

## Exhaust System Requirements

* Capacity: 2 x 300 m3 per h (177 cft/min), separately adjustable between zero and maximum
* Operation without generator extraction:
If the environmental conditions as specified below can be met, the instruments may also be operated without the generator exhaust connected to an external exhaust system. Note that the torch box exhaust must always be connected to an external exhaust system, to avoid any dangers from the sample constituents or plasma generated toxic components. To reach the specified instrument performance, the room temperature should be controlled within a 18-25°C (64-77°F) temperature range, constant within +3°C (+5,4°F). If operated with only the plasma exhaust, the additional heat ingress into the room (approx. 2000W, 6800BTU/h) must be considered. It must be ensured that the heat lost from the generator exhaust into the room does not lead to environmental temperatures or temperature rises outside the specifications.

## Argon Supply Requirements

* Grade: ≥ 4.6 (99.996%)
* Pressure: 6.5 bar (109 psi)
* Consumption: 10-18 l/min

## Electrical Requirements

* 230 VAC ± 5%, 50/60 Hz
* approx. 4.0 kVA power consumption
* 30-32 A instrument required line protection (slow blow fuse)

# ACCESSORY ITEMS

## \* Sample Introduction Systems

\* Standard SOP/DSOI (75560545)

This generic sample introduction system is very well suited for a host of different applications. The combination of the robust and efficient SPECTRO Crossflow nebulizer with a miniature glass Scott double-pass spray chamber allows for good analytical figures of merit for the majority of inorganic samples, also with heavier matrix. The system uses a standard SOP fixed torch with a 1.8 mm bore injector tube and includes the necessary pump and drain tubing, as well as a PEEK capillary for easy sample uptake.

\* Concentric SOP/DSOI (75560546)

This generic sample introduction system is very well suited for a host of different applications. Other than the standard system, a Seaspray nebulizer, with a glass cyclonic spray chamber is used. Of comparable robustness to the Crossflow nebulizer (with a max 2% matrix concentration), this system often allows for improved BECs and a reduced sample washout due to the cyclonic spray chamber’s smaller volume. The system uses a standard SOP fixed torch with a 1.8 mm bore injector tube and includes the necessary pump and drain tubing, as well as a PEEK capillary for easy sample uptake.

\* Standard Oil/Organics SOP/DSOI (75560547)

The analysis of petrochemicals and organic substances for the majority of applications for the SOP requires a setup only slightly different from the aqueous case. To avoid plasma overloading and subsequent extinguishing due to the higher volatility of petrochemical or organic samples, pump tubing with a smaller inner diameter, resulting in a lower sample feed, is used.

Furthermore, this pump tubing is made of a special, organics-resistant material to withstand a quick destruction by the solvent properties of the sample. The combination of the robust and efficient SPECTRO Crossflow nebulizer, a glass Scott double-pass spray chamber and a standard SOP fixed torch with a 1.8 mm bore injector tube, allows for the majority of homogenous organic sample material to be analyzed. The system includes the necessary pump and drain tubing, as well as a PEEK capillary for easy sample uptake

Note: Viton pump tubes are included. Please verify the compatibility with the substance/solvent to be analyzed. Other tubes may be required and need to be ordered in addition.

\* Oils/Organics with Undissolved Solids SOP/DSOI (75560548)

For applications, including wear metals in oils analysis or waste oil toxicity assessment (for halogens and metals), very often due to the slightly inhomogeneous sample composition including small particles, use of the standard sample introduction system for oil/organics would result in problems like clogging and low up-time of the system. To avoid time-consuming and error-prone steps like filtering or even digesting the sample, the sample introduction system Oil/Organics with particles, more robust to sample particulate contamination has been designed.

Using the robust Noordermeer Nebulizer in conjunction with a cyclonic spray chamber gives the system the necessary tolerance against reasonable amounts of particulates in the original sample. Suitable pump tubing made of a special, organics-resistant material to withstand a quick destruction by the solvent properties of the sample is included.

The system includes the necessary pump and drain tubing, as well as a PEEK capillary for easy sample uptake.

Note: Viton pump tubes are included. Please verify the compatibility with the substance/solvent to be analyzed. Other tubes may be required and be ordered in addition.

**ACCESSORY ITEMS (continued)**

\* Gasoline SOP/DSOI (75560542)

To reduce the plasma load, allowing the direct aspiration of gasoline, a low flow nebulizer is required.

Using a Micromist Nebulizer in conjunction with a glass cyclonic spray chamber and a fixed torch with a 1.2 mm injector tube gives the system the necessary capabilities. Suitable pump tubing made of a special, gasoline-resistant material to withstand a quick destruction as well as a PEEK capillary for easy sample uptake is included.

Note: The additional gas option is required for the operation of the nebulizer

\* Volatile Organics SOP/DSOI (75560541)

To suppress volatilization, allowing the direct aspiration of highly volatile solvents such as naphtha, nebulization at lower temperatures is required.

Using a Micromist Nebulizer in conjunction with a Glass Expansion Twister jacketed spray chamber gives the system the necessary capabilities as well as even tolerance against reasonable amounts of particulates in the original sample. Suitable pump tubing made of a special, organics-resistant material to withstand a quick destruction by the solvent properties of the sample is included. The system includes the necessary pump and drain tubing, as well as a PEEK capillary for easy sample uptake. The system includes the necessary pump and drain tubing, as well as a PEEK capillary for easy sample uptake.

Note: Required cooling unit not included

Note: Viton pump tubes are included. Please verify the compatibility with the substance/solvent to be analyzed. Other tubes may be required and need to be ordered in addition.

\* HF-Resistant SOP/DSOI Cyclonic (75560532)

When fluoride salt matrices or hydrofluoric acid digestions have to be analyzed, the use of an HF-resistant sample introduction system is mandatory. Combining the robust and efficient Burgener Nebulizer, an HF-inert PFA cyclonic spray chamber and the standard SOP demountable torch body and a 1.8 mm bore Al2O3 injector tube allows for analytical figures of merit not very different from a standard introduction system for aqueous samples. The system includes the necessary pump and drain tubing, as well as a PEEK capillary for easy sample uptake.

\* High Salt SOP/DSOI <4% (75560540)

With matrix, TDS or salt concentrations of more than 1% but less than 4%, the use of a special high-salt sample introduction system is necessary to avoid clogging of the torch injector. Combining the robust and efficient SPECTRO Crossflow nebulizer, a glass Scott double-pass spray chamber with a standard SOP fixed torch with a 3 mm bore high-salt injector tube and an Ar additional gas adaptor, samples with salt concentrations up to 40g/L can be analyzed. The system includes the necessary pump and drain tubing, as well as a PEEK capillary for easy sample uptake

\* High Salt SOP/DSOI >4% (75560543)

With matrix, TDS or salt concentrations of more than 4%, the use of a special high-salt sample introduction system is necessary to avoid clogging of the torch injector or nebulizer tip. Combining the robust and efficient SPECTRO Crossflow nebulizer, a glass Scott double-pass spray chamber with a standard SOP fixed torch with a 3 mm bore high-salt injector tube, an Ar additional gas adaptor and an Argon humidifier, samples with salt concentrations up to 300g/L can be analyzed. The system includes the necessary pump and drain tubing, as well as a PEEK capillary for easy sample uptake

**ACCESSORY ITEMS (continued)**

\* Slurries SOP/DSOI (75560549)

A very special class of materials is formed by micro particle suspensions, used e.g. for semiconductor wafer polishing or in the context of nanomaterials. Due to their physical and chemical properties, a digestion procedure is nearly impossible. Purity assessment of such materials preferably should use direct sample introduction, which for the case of particle sizes in the 1-25µm range can be done by direct aspiration as a slurry (SPN, slurry pneumatic nebulization).

Other materials might also be analyzed using this method but might require grinding and homogenization to a suitable particle size and size dispersion. Using the robust Burgener nebulizer in conjunction with a Burgener Cyclonic spray chamber allows for an easy implementation of SPN.

The system includes a wide-necked 0.5 L PE flask for sample stirring (to maintain a homogenous slurry and avoid sample precipitation), the necessary pump and drain tubing, as well as a PEEK capillary for easy sample uptake.

\* High Precision SOP (75560544)

This sample introduction system is very well suited for applications where high stability and precision are paramount. The combination of the robust and efficient SPECTRO Crossflow nebulizer with a large glass Scott double-pass spray chamber allows for excellent analytical figures of merit for the precise determination of major components. The system uses a standard SOP fixed torch with a 1.8 mm bore injector tube and includes the necessary pump and drain tubing, as well as a PEEK capillary for easy sample uptake.

**ACCESSORY ITEMS (continued)**

\* Standard EOP (75560521)

This generic sample introduction system is very well suited for a host of different applications. The combination of the robust and efficient SPECTRO Crossflow nebulizer with a miniature glass Scott double-pass spray chamber allows for good analytical figures of merit for the majority of inorganic samples, also with heavier matrix. The system uses a standard EOP fixed torch body and a 2 mm bore injector tube and includes the necessary pump and drain tubing, as well as a PEEK capillary for easy sample uptake.

\* Concentric EOP (75560524)

This generic sample introduction system is very well suited for a host of different applications. Other than the standard system, a Seaspray nebulizer, with a glass cyclonic spray chamber is used. Of comparable robustness to the Crossflow nebulizer (with a max 2% matrix concentration), this system often allows for improved BECs and a reduced sample washout due to the cyclonic spray chamber’s smaller volume. The system uses a standard EOP fixed torch body and a 2 mm bore injector tube and includes the necessary pump and drain tubing, as well as a PEEK capillary for easy sample uptake.

\* Standard Oil/Organics EOP (75560529)

The analysis of petrochemicals and organic substances for the majority of applications for the EOP requires a setup only slightly different from the aqueous case. To avoid plasma overloading and subsequent extinguishing due to the higher volatility of petrochemical or organic samples, pump tubing with a smaller inner diameter, resulting in a lower sample feed, is used.

Furthermore, this pump tubing is made of a special, organics-resistant material to withstand a quick destruction by the solvent properties of the sample. The combination of the robust and efficient SPECTRO Crossflow nebulizer, a glass Scott double-pass spray chamber and a standard EOP fixed torch body with a 1.8 mm bore injector tube, allows for the majority of homogenous organic sample material to be analyzed. The system includes the necessary pump and drain tubing, as well as a PEEK capillary for easy sample uptake

Note: Viton pump tubes are included. Please verify the compatibility with the substance/solvent to be analyzed. Other tubes may be required and need to be ordered in addition.

\* Oils/Organics with Undissolved Solids EOP (75560530)

For applications, including wear metals in oils analysis or waste oil toxicity assessment (for halogens and metals), very often due to the slightly inhomogeneous sample composition including small particles, use of the standard sample introduction system for oil/organics would result in problems like clogging and low up-time of the system. To avoid time-consuming and error-prone steps like filtering or even digesting the sample, the sample introduction system Oil/Organics with particles, more robust to sample particulate contamination has been designed.

Using the robust Noordermeer Nebulizer in conjunction with a cyclonic spray chamber gives the system the necessary tolerance against reasonable amounts of particulates in the original sample. Suitable pump tubing made of a special, organics-resistant material to withstand a quick destruction by the solvent properties of the sample is included.

The system includes the necessary pump and drain tubing, as well as a PEEK capillary for easy sample uptake.

Note: Viton pump tubes are included. Please verify the compatibility with the substance/solvent to be analyzed. Other tubes may be required and be ordered in addition.

**ACCESSORY ITEMS (continued)**

\* Volatile Organics EOP (75560531)

In order to suppress volatilization, allowing the direct aspiration of highly volatile solvents such as naphtha, nebulization at lower temperatures is required.

Using a Micromist Nebulizer in conjunction with a Glass Expansion Twister jacketed spray chamber gives the system the necessary capabilities as well as even tolerance against reasonable amounts of particulates in the original sample. Suitable pump tubing made of a special, organics-resistant material to withstand a quick destruction by the solvent properties of the sample is included. The system includes the necessary pump and drain tubing, as well as a PEEK capillary for easy sample uptake. The system includes the necessary pump and drain tubing, as well as a PEEK capillary for easy sample uptake.

Note: Required cooling unit not included

Note: Viton pump tubes are included. Please verify the compatibility with the substance/solvent to be analyzed. Other tubes may be required and need to be ordered in addition.

\* HF-Resistant EOP Cyclonic (75560528)

When fluoride salt matrices or hydrofluoric acid digestions have to be analyzed, the use of an HF-resistant sample introduction system is mandatory. Combining the robust and efficient Burgener nebulizer, an HF-inert PFA cyclonic spray chamber and the standard EOP demountable torch body with a 2.5 mm bore Al2O3 injector allows for analytical figures of merit not very different from a standard introduction system for aqueous samples. The system includes the necessary pump and drain tubing, as well as a PEEK capillary for easy sample uptake.

\* High Salt EOP <2% (75560523)

With matrix, TDS or salt concentrations of more than 1% but less than 2%, the use of a special high-salt sample introduction system is necessary to avoid clogging of the torch injector. Combining the robust and efficient SPECTRO Crossflow nebulizer, a glass Scott double-pass spray chamber with a standard EOP fixed torch, a of 3 mm bore injector tube and an Ar additional gas adaptor, samples with salt concentrations up to 20g/L can be analyzed. The system includes the necessary pump and drain tubing, as well as a PEEK capillary for easy sample uptake

\* High Salt EOP >2% (75560522)

With matrix, TDS or salt concentrations of more than 2%, the use of a special high-salt sample introduction system is necessary to avoid clogging of the torch injector or nebulizer tip. Combining the robust and efficient SPECTRO Crossflow nebulizer, a glass Scott double-pass spray chamber with a standard EOP fixed torch, a of 3 mm bore injector tube, an Ar additional gas adaptor and an Argon humidifier, samples with salt concentrations up to 200g/L can be analyzed. The system includes the necessary pump and drain tubing, as well as a PEEK capillary for easy sample uptake

**ACCESSORY ITEMS (continued)**

## \*SPECTRO Intelligent Valve System

The SPECTRO Intelligent Valve System (IVS) increases sample throughput for ICP analysis by reducing sample loading, signal stabilization and washout times. Using proven technology, the IVS combines a metal-free, 6-port injection valve and inert, high-speed vacuum pump to rapidly load the sample loop for introduction to the nebulizer. The design of IVS facilitates quickly rinsing the sample loop while simultaneously injecting sample into the ICP nebulizer for analysis. The bubble stream washout effectively cleans liquid flow paths more completely and in less time. The result is additional time dedicated to sample analysis, more effective flow path rinse, and reduced time between samples.

**SPECTRO Intelligent Valve System Specifications**

* Height : 120 mm (4.72”)
* Width : 130 mm (5.12”
* Depth : 200 mm (7.87”) (incl. valve & loop)
* Weight : 1,6 kg (3.53 lbs)
* Hardware Interfaces : POE
* Interface to host PC : TCPIP
* Power : 30 W

**Autosampler Compatibility**

* HTA
* ASX-280
* ASX-560
* OILS 7400
* OILS 7600
* XLR-8

**ACCESSORY ITEMS (continued)**

\*HTA HT 1011I

Utilizing the experience from chromatography autosamplers the HT1000I is a smart, space saving and cost efficient autosampler for spectroscopy applications. While almost all other samplers use XYZ positioning, an encoder-driven carousel is used to move between the different positions of the tray. The sample carousel is organized in six racks, each of which may run different tube sizes. Racks are removable to support off-instrument sample preparation and continuous sample feeding. Furthermore, the racks are coded to enable defined positioning and avoid mismatch.

* **Space Saving Design:** Compact and efficient design, with analysis of up to 80 samples plus 9 calibration/control samples. Small footprint enables placement next to the instrument freeing up valuable bench space.
* **Optimized fluid path:** Since the sample tray is moved instead of the sample probe the transfer tube length is drastically reduced. Shorter uptake and rinse times are the benefit.
	+ Rinse station
	+ Peristaltic pump for rinse station (option)
* **Advanced Electronics**
	+ Compatible with SPECTRO Smart Analyzer as well as SPECTRO ICP Analyzer Pro
	+ Proven technology for reliable performance
* **Flexible Rack Configuration:** Two different rack sizes 16 x 10 ml and 9 x 50 ml.
	+ - Standard configuration: 3 x 10 ml + 3 x 50 ml

**Technical Specifications**

* Height : 38 cm (15”) with sample probe
* Width : 35.5 cm (14”)
* Depth : 56 cm (22”)
* Weight : 8 kg (17.6 lbs)
* Tray capacity : 6 racks
* Available Racks : 16 x 10 ml
 9 x 50 ml
* Computer Interface : USB
* Power Requirements : 100 - 240 VAC +/- 10%, 50/60 Hz, 15 W

**ACCESSORY ITEMS (continued)**

\*ASX-280

More features and improved performance define the next generation of autosampler from CETAC Technologies. The compact ASX-280 Autosampler builds upon the reliability of its predecessors with latest generation electronics, improved accessory interfaces, enhanced pumping capabilities, easier serviceability and a sleek new design. The ASX-280 keeps the durable features of prior Teledyne CETAC autosamplers which have proven their worth in tens of thousands of laboratories and countless hours of operation.

The compact and efficient design of the ASX-280 two-rack autosampler preserves precious laboratory bench space. Ideal for low to medium volume sample applications, this autosampler provides all of the fully automated features of a CETAC autosampler in a compact and easy to use design.

* **Space Saving Design:** Compact and efficient design, with analysis of up to 180 samples. Small footprint enables placement next to the instrument freeing up valuable bench space.
* **Advanced Mechanical Design**
	+ Injection molded parts
		- Better chemical compatibility
		- Improved high resolution applications
	+ Improved pump technology
		- Quieter
		- Easier tubing replacement options
		- Expanded flow capabilities, 0.1 – 80 mL/min (Conserve expensive rinse solution)
	+ Improved serviceability and accessory interfaces
	+ Optional dual rinse station
* **Advanced Electronics**
	+ Improved movement profile
		- Quieter
		- Refined and configurable XYZ movement
		- Expanded movement speed options
	+ Higher resolution positioning
		- Improved accuracy allows for 96-well plates
		- Active resonance control
	+ Electronic home position alignment
	+ Improved firmware and configuration utilities
	+ Backward compatible communications
		- Seamless upgrade path
	+ Proven technology for reliable performance
* **Flexible Rack Configuration:** Five different rack sizes from 90 x 7 ml to 21 x 50 ml are available (2 x 21 Pos and 2 x 60 Pos included). Compatible with other standard market, ready-made sample racks.

**Technical Specifications**

* Height : 62 cm (24.4”) with sample probe
* Width : 35.5 cm (14”)
* Depth : 55 cm (21.6”)
* Weight : 8.1 kg (18.5 lbs)
* Tray capacity : 2 racks
* Available Racks : 90 x 7 ml
 60 x 14 ml

 40 x 20 ml
 24 x 30 ml
 21 x 50 ml

* Computer Interface : USB
* Power Requirements : 100 - 240 VAC +/- 10%, 50/60 Hz

**ACCESSORY ITEMS (continued)**

## \* SDXHPLD (requires ICP ANALYZER Pro)

The CETAC SDXHPLD system combines the proven ASX‑560 autosampler with a novel vortex mixing dilution accessory. The SDX makes use of a high precision syringe pump for both aliquot and diluent, but goes an additional step to vortex mix the resulting dilution prior to sample introduction to the ICP. The SDX employs vortex mixing to promote homogenization of a sample to ensure accurate and precise analysis following dilution.

The CETAC SDXHPLD system redefines “intelligent dilution” with the ability to re-analyze a sample in a single step to fall within range. On the recognition that an analyzed sample falls outside of the calibration range the sample is re-diluted at a new dilution factor that has been calculated by the system so that it falls within the calibration range and will provide a signal of the order of 60% of that of the top calibration standard. Thus, reanalysis is only performed once and not through an incremental dilution process

**Autosampler**

* **Advanced Mechanical Design**
	+ Injection molded parts
		- Better chemical compatibility
		- Improved high resolution applications
	+ Improved pump technology
		- Quieter
		- Easier tubing replacement options
		- Expanded flow capabilities, 0.1 – 80 mL/min (Conserve expensive rinse solution)
	+ Improved serviceability and accessory interfaces
	+ Optional dual rinse station
* **Advanced Electronics**
	+ Improved movement profile
		- Quieter
		- Refined and configurable XYZ movement
		- Expanded movement speed options
	+ Higher resolution positioning
		- Improved accuracy allows for 96-well plates
		- Active resonance control
	+ Electronic home position alignment
	+ Improved firmware and configuration utilities
	+ Backward compatible communications
		- Seamless upgrade path
	+ Proven technology for reliable performance
* **Flexible Rack Configuration:** Five different rack sizes from 90 x 7 ml to 21 x 50 ml are available (3 x 21 Pos and 2 x 60 Pos included). Compatible with other standard market, ready-made sample racks.

# Technical Specifications

* Height : 62 cm (24.4”) with sample probe
* Width : 58 cm (22.5”)
* Depth : 55 cm (21.6”)
* Weight : 11.7 kg (23 lbs)
* Tray capacity : 4 racks

**ACCESSORY ITEMS (continued)**

* Available Racks : 90 x 7 ml
 60 x 14 ml
 40 x 20 ml
 24 x 30 ml
 21 x 50 ml
* Computer Interface : USB
* Power Requirements : 100 - 240 VAC +/- 10%, 50/60 Hz

**SDX High Performance Liquid Dilution System**

* Intelligent Dilution – Re-analysis in one step to fall within range
* Diluted sample homogenization through vortex mixing
* ASXpress plus compatible
* Modular, can be added to an existing ASX-560
* Automated consistency of sample dilution
* Save time and reduce labor costs
* Minimal laboratory footprint
* Known, proven technology
* Syringe pump unit internal leak sensor
* Liquid flow paths and electronics separated within the syringe pump unit
* Promotion of diluted sample homogenization through vortex mixing
* Flexible control of analyte carryover and memory effects

# Technical Specifications

* Height : 25.4 cm (10”)
* Width : 13.2 cm (5.2”)
* Depth : 21.6 cm 8.5”)
* Weight : 4.4 kg (9.7 lbs)
* Computer Interface : USB
* Power Requirements : 100 - 240 VAC, 47/63 Hz, 3.33 A

**ACCESSORY ITEMS (continued)**

## \* ASX-560

More features and improved performance define the next generation of autosampler from CETAC Technologies. The ASX-560 Autosampler builds upon the reliability of the ASX-520 with latest generation electronics, improved accessory interfaces, enhanced pumping capabilities, easier serviceability and a sleek new design. The ASX-560 keeps the durable features of the ASX‑520 before it, which has proven its worth in tens of thousands of laboratories and countless hours of operation.

The ASX-560 Random Access Intelligent Autosampler provides a fully automated sample introduction system and is ideal for medium to high volume sample applications.

* **Advanced Mechanical Design**
	+ Injection molded parts
		- Better chemical compatibility
		- Improved high resolution applications
	+ Improved pump technology
		- Quieter
		- Easier tubing replacement options
		- Expanded flow capabilities, 0.1 – 80 mL/min (Conserve expensive rinse solution)
	+ Improved serviceability and accessory interfaces
	+ Optional dual rinse station
* **Advanced Electronics**
	+ Improved movement profile
		- Quieter
		- Refined and configurable XYZ movement
		- Expanded movement speed options
	+ Higher resolution positioning
		- Improved accuracy allows for 96-well plates
		- Active resonance control
	+ Electronic home position alignment
	+ Improved firmware and configuration utilities
	+ Backward compatible communications
		- Seamless upgrade path
	+ Proven technology for reliable performance
* **Flexible Rack Configuration:** Five different rack sizes from 90 x 7 ml to 21 x 50 ml are available (3 x 21 Pos and 2 x 60 Pos included). Compatible with other standard market, ready-made sample racks.

# Technical Specifications

* Height : 62 cm (24.4”) with sample probe
* Width : 58 cm (22.5”)
* Depth : 55 cm (21.6”)
* Weight : 11.7 kg (23 lbs)
* Tray capacity : 4 racks
* Available Racks : 90 x 7 ml
 60 x 14 ml
 40 x 20 ml
 24 x 30 ml
 21 x 50 ml
* Computer Interface : USB
* Power Requirements : 100 - 240 VAC +/- 10%, 50/60 Hz

**ACCESSORY ITEMS (continued)**

## \*XLR-8-60

The innovative design of the XLR-8-60 with a fixed tray and moveable autosampler increases sample capacity to 720 samples while reducing valuable bench space requirements.

* **Innovative Design:** Fixed tray with moveable autosampler enables analysis of up to 720 samples while reducing valuable bench space requirements.
* **No Supervision:** Automatic analysis of eight sample racks is performed, freeing valuable personnel from time consuming manual sample manipulation.
* **Never Misses a Cup:** Precision engineered automated sample probe arm and stationary sample racks virtually eliminate errors.
* **Auto Zero Feature:** Intelligent sample probe re-homing device dramatically reduces accidental sample intake errors
* **Integrated Rinse Station:** Continuous flow sample probe rinse station minimizes sample contamination and carryover.
* **Advanced Mechanical Design:** Injection molded parts, better chemical compatibility
* **Superior Material Construction:** PTFE and PEEK used to construct a metal-free liquid flow path.
* **Motor Toque:** Robust X, Y, Z axis movement decreases effects of environmental build-up.
* **Easy Set-Up and Operation:** Out-of-the-box set-up allows a fully operational system the day of delivery.
* **Flexible Rack Configuration:** Five different rack sizes from 90 x 7 ml to 21 x 50 ml are available (no racks included). Compatible with other standard market, ready-made sample racks.

**Technical Specifications**

* Height : 66.7 cm (26.25”) with sample probe
* Width : 112 cm (44”)
* Depth : 55 cm (21.6”)
* Weight : 20.45 kg (45 lbs)
* Tray capacity : 8 racks
* Available Racks : 90 x 7 ml
 60 x 14 ml
 40 x 20 ml
 24 x 30 ml
 21 x 50 ml
* Computer Interface : USB
* Power Requirements : 100 - 240 VAC +/- 10%, 50/60 Hz

**ACCESSORY ITEMS (continued)**

## \*Oils-7400

The Oils 7400 Homogenizing Autosampler has been designed to meet the rigorous demands of oils analysis in the rapidly evolving oils testing industry. This automation marries together sample mixing capability with speed and eliminates cross contamination with improved design drip capture.

The Oils 7400 Homogenizing Autosampler offers oils and coolants sample introduction to ICP instrumentation from the same automation. It boasts a sliding dual segregated rinse station fed by two separate peristaltic pumps to change between oils and coolants testing on demand.

Combined speed, mixing capability and improved sample drip capture, deliver robust analysis without compromise

**Sample homogenization**

Used oil samples that require analysis for wear metal elements typically contain particulate material that can settle in a sample tube prior to analysis; this can lead to generation of non‑representative data. The Oils 7400 automation has been designed and developed to resolve this problem on a sample by sample basis in each analytical batch.

Prior to analytical measurement, each sample is automatically homogenized by the autosampler. A stirring paddle mounted next to the sample probe efficiently mixes each sample and, like the sample probe, is subjected to a rinse step at the rinse station. Sample mixing is configurable, via ICP Analyzer Pro

**Rapid**

Faster and smoother XYZ movement saves up to 2 seconds per sample compared to previous generation oils automation.

**Drip Cups**

An improved design incorporated drip cup allows sample drip capture and retention to eliminate cross contamination at faster XYZ movement.

**Integrated rinse station**

A segregated sample probe and stirring paddle rinse station further supports minimized analyte carryover and cross contamination

**Technical Specifications**

Dimensions (H x W x D) : 46 cm x 57 cm x 54 cm (18" x 22" x 21")

Weight : 23 kg (50 lbs)

Computer/Hardware Interfaces : RS-232, USB

Power Requirements : AC 100V-240V 47-63 Hz, 1.9A

Warranty : 2 year limited

**ACCESSORY ITEMS (continued)**

## \*ASXPRESS® Plus

The ASXPRESS Plus Rapid Sample Introduction System increases sample throughput for ICP analysis by reducing sample loading, signal stabilization and washout times. Using proven technology, the ASXPRESS® Plus combines a metal-free, 6-port injection valve and inert, high-speed vacuum pump to rapidly load the sample loop for introduction to the nebulizer. The design of the ASXPRESS® Plus facilitates quickly rinsing the sample loop while simultaneously injecting sample into the ICP nebulizer for analysis. The segmented stream washout technology effectively cleans liquid flow paths more completely and in less time. The result is additional time dedicated to sample analysis, more effective flow path rinse, and reduced time between samples.

**ASXPRESS PLUS Technical Specifications**

Valve/Pump Module Dimensions:

* Height : 12.8 cm (5.0”)
* Width : 5.8 cm (2.3”)
* Depth : 21.7 cm (8.5”)
* Weight : 1.30 kg (2.8 lbs)

Electronics Module Dimensions:

* Height : 25.4 cm (10.0”)
* Width : 8.3 cm (3.3”)
* Depth : 20.0 cm (7.9”)
* Hardware Interfaces : RS-232 to autosampler
* RS-232 and/or USB to host PC
* External pump connector
* Power : 100-240 VAC ~ 47-63 Hz 1.9A

**Autosampler Compatibility**

* ASX-280
* ASX-560
* XLR-8

**ACCESSORY ITEMS (continued)**

## \* CETAC U-5000AT+ Ultrasonic Nebulizer

Nebulizer system for SPECTRO ARCOS ICPs to improve detection limits.

Features:

* AutoTune Power Supply
* Detection Limit improvement up to 10x and greater
* Efficient Desolvation System
* Optimized for use with ICP-OES
* Stable Operation
* Modular Design

AutoTune Power Supply

The AutoTune power supply automatically senses changes in sample composition to ensure uniform and consistent aerosol generation. It permits continuous operation of the nebulizer even in the absence of sample, allowing unattended operation.

Detection Limits

Detection limits are improved by a factor of 5 to 25, depending on the analyte. This improvement allows the transfer of significant amounts of work from Graphite Furnace AA to ICP-OES, taking advantage of ICP’s the higher sample throughput capability. According to the USEPA Method 200 the use of ultrasonic nebulization is approved.

Modular Design

The CETAC U-5000AT+ uses a removable nebulizer/desolvation module. All parts with sample contact are located within this module. Should higher and ultratrace levels need be frequently analyzed, a second (optional) nebulizer/desolvation module can be used to alleviate sample memory problems and nebulizer cleanup. Changeover from one module to another requires less than 5 minutes.

Technical Specifications

* Sample Uptake Rate : 0.5 - 2.5 ml/min
* Nebulizer Gas Flow : 0.5 - 1.5 L/min
* Desolvation Heating Temp : 120ºC - 160ºC (Factory Setting: 140ºC)
* Desolvation Cooling Temp : -20ºC to 10ºC (Factory Setting: 2ºC)
* Power Requirements : 100 - 120 VAC, 50-60 Hz, 4A, 520W or
 : 220 - 240 VAC, 50-60 Hz, 2A, 520W
* Ultrasonic Frequency : 1.4 MHz
* Dimensions : 35.6 cm W x 34.9 cm D x 25.4 cm H (14 x 13.7 x 10 inch)
* Weight : 12.3 kg (27 lbs)
* Shipping Weight : 38.2 kg (84 lbs)

**ACCESSORY ITEMS (continued)**

## \* HGX-200 Hydride Generation and Cold Vapor System

The HGX-200 is a specialized system for the generation of volatile hydride species or the reduction of mercury to Hg(0)(cold vapor). Elements of interest that form volatile hydrides include the difficult to measure metalloids As and Se. Important features of hydride generation/cold vapor and the HGX-200 are listed below:

* Up to 100 fold improvement in sensitivity for As and Se
* Separation of the analytes from potential interferences
* Special U-shaped gas-liquid separator (GLS) with droplet separator for noise reduction
* "Frosted tip" design of GLS for efficient generation of hydride species or Hg(0)
* Additional gas inlet after PTFE membrane filter for optimization of washout time and noise reduction
* Color-coded connection for easy setup and operation

**\* HydraMist- Simultaneous Cold Vapor/Pneumatic Nebulization Spray Chamber**

The Glass Expansion HydraMist is a sensitive, simple-to-use spray chamber for Inductively Coupled Plasma (ICP) that allows simultaneous operation of both conventional pneumatic nebulization and cold-vapor/hydride generation. Cold vapor generation can provide up to 10-fold improvement in sensitivity on ICP for cold vapor forming elements such As, Sb, Se, Tl and Hg. The generation of volatile species of these elements results in increased analyte loading of the analytical plasma giving lower detection limits.

The HydraMist spray chamber features a secondary inlet port that mixes the aerosolized sample and liquid reductant inside the spray chamber for rapid conversion of the As, Sb, Se, Tl and Hg analytes into volatile hydride species. The unique drain design ensures fast, complete removal of waste from the spray chamber, eliminating excess hydrogen build-up that causes sample reflux degrading analytical precision.

The HydraMist spray chamber features:

* Similar short-term analytical precision and washout as other Glass Expansion cyclonic spray chambers
* Fast and complete vapor phase formation of volatile As, Se, Sb, Tl and Hg species for the best detection limits in hydride generation mode
* A unique drain design to eliminate hydrogen build-up and sample reflux that degrades short-term precision

**ACCESSORY ITEMS (continued)**

**\*** **Powervar Security Plus II UPS 6000 VA**

Unique combination of isolation transformer, over current protector and noise filter as an effective power protection solution. Battery backup system as a protection against power failures.

|  |  |  |
| --- | --- | --- |
|  | Model | ABCDEF6000-22, 6kVA  |
|  | Topology | True On-Line, Double-Conversion, IGBT Design, Internal Isolation Transformer |
| Input | INPUT | 200-240 |
|  | Voltage Range (VAC) | 161-264 |
|  | Voltage Tolerance | + 15% ~ -30% before switching to batteries |
|  | Frequency (Hz) | 50/60 |
|  | Frequency Tolerance | 42 Hz to 69 Hz before switching to batteries |
|  | Input PF | > 0.95 |
|  | Input Current THD | < 5.0% |
|  | Input Connection | Hardwired Standard; Line Cord Optional (Consult factory) |
|  | Input Capacity | 6480 VA |
| Output | Capacity | 6000VA/ 5400W |
|  | Voltage (VAC) | 230 |
|  | Voltage Regulation | ± 3.0% Max, ± 1.0% Normal |
|  | Output Voltage THD | < 3.0% |
|  | Power Factor | 0.9 |
|  | Step Load Response | ± 4.0% for 50% step load change |
|  |  | ± 6.0% for 100% step load change |
|  |  | Return to ±3.0% of nominal within 3 cycles |
|  | Crest Factor | 3:1 |
|  | Frequency (Hz) | 50/60 |
|  | Frequency Regulation | ± 0.1Hz |
|  | Overload | 125% for 2 minutes |
|  |  | 150% for 30 seconds |
|  |  | 300% for 500ms |
|  | Efficiency | AC-AC >85.0% |
|  |  | DC-AC >78.0% |
|  | Common Mode Noise | < 0.5 VRMS |
|  | Output Connection | Hardwired Standard; Output Receptacles Optional (Consult factory) |
| Bypass | Input Voltage | 200-240 |
|  | Output Voltage | 230 |
|  | Transformer Voltage Regulation | ± 3.0% |
|  | Overload | 125% for 10 minutes |
|  |  | 150% for 500ms |
|  |  | 1000% for 1 cycle |
|  | Efficiency | > 95.0% |
| Battery | Voltage (VDC) | 96.0, nominal |
|  |  | 109.2, float |
|  | Battery | 12V, 34W flame retardant |
|  |  | High Rate, Sealed |
|  | Quantity | 16 |
|  | Charge Current (ADC) | 3 |
|  | Backup Time (min) | > 5.0 |
|  | Recharge Time | 8 Hours to 90% |
| Environment | Temperature (°C) | 0 to 40, operating |
|  |  | -20 to 60, transit |
|  | Altitude (m) | 2,000, operating |
|  |  | 12,000, transit |
|  | Humidity | 5.0% to 90.0%, non condensing |
|  | Audible (dBA) | 50-55 @ 1m from front of unit |
|  | Heat Dissipation (BTU/hr) | 3252 |
| Standards | EMC | FCC Part 15J Class A |
|  |  | EN 55022 Class A/ CISPR 22 |
|  |  | EN 50091-2 |
|  |  | IEC 61000-3-2 |
|  | Safety Standards | UL1778 4th Ed. |
|  |  | cUL to CSA22.2 No.107.1 |
|  |  | IEC62040, w/CB report and certificate |
|  |  | IEC61000-4-2, Electrostatic Discharge |
|  |  | IEC61000-4-3, Radiated Electromagnetic Field Immunity |
|  |  | IEC61000-4-4, Electrical Fast Transient/ Burst Immunity |
|  |  | IEC61000-4-5, Surge Immunity |
|  |  | IEC61000-4-6, Immunity to Conducted Radio Frequency Disturbances |
|  |  | IEC61000-4-8, Power Frequency Magnetic Field Immunity |
|  |  | IEC61000-4-11, Voltage Dips, Short Interruptions, and Voltage Variations |
|  | RoHS | All units are RoHS compliant |
|  |  |  |
| Other | Communication | RS-232 |
|  |  | USB |
|  |  | DB-9 Dry Contacts |
|  |  | Internal SNMP Adapter (option) |
|  | Unit Weight | 348 lbs. / 157 kg. |
|  | Shipping Weight | 443 lbs. / 200 kg. |
|  | Plug | Delivered with cable, without plug |

**ACCESSORY ITEMS (continued)**

## \* Electrothermal Vaporization System ETV 4000c

Alternative sample introduction system for the direct vaporization of solid and liquid samples. The method offers great advantages especially when the digestion of samples is difficult or if the amount of sample is small. Geological and ceramic samples and high purity metals are well suited. The main characteristics of the ETV 4000c are:

* Requires no time consuming digestion of the samples
* Reduction of preparation based errors
* Improved LODs by up to one order of magnitude compared to liquid ICP analysis
* Multi-element-analysis using the simultaneous ARCOS ICP-OES
* Easy to automate using the optional autosampler

**Principle of Operation**

The method includes the placement of a few milligrams of sample material into a graphite furnace, where it is vaporized, halogenated, transferred to the ICP-OES and introduced into the plasma as a dry aerosol. Except for the weighing of the samples, ETV does not require any further preparation. Without the need for dilution and an almost 100% transfer efficiency into the plasma, the sensitivity compared to a solution based analytical approach is increased even with small sample amounts. Possible sources of preparation based errors like contamination, adsorption to sample containers and analyte loss during the sample digestion process are minimized or impossible. Using an autosampler the technique can be easily automated. After introduction into the graphite furnace, the samples are heated as per the specified temperature program. The Argon carrier gas flow, which is guided across the hot crucible and includes a small amount of reaction gas (SF6, ArH2) decreases the vaporization temperature and transforms the analytes into volatile halogenides or hydrides.

At the exit of the graphite furnace, Argon sheath gas is added through a ring like orifice. The sheath gas prevents condensation on the cool tube walls and transfers the vapor into a saturated dry aerosol. The ETV unit and the ICP are connected through a PTFE tube. The graphite furnace’s outer surface is protected by an Argon inert gas atmosphere. The quick and reproducible heating of the sample allows for a partial fractionation during the vaporization. Drying, ashing and vaporization of compounds with lighter and heavier volatility and the matrix are sequential processes which can be separated in time. The temperature of the furnace can be continuously adjusted between room temperature and 3000°C. During operation the temperature is pyrometrically controlled constantly.

**Technical description**

Compact desktop-instrument with graphite furnace, solid state 400 A power supply, and controllers for the furnace, the pyrometer, the gas flows and the mixer.

* Furnace Controller : Display of program number, temperature, program step or
 temperature-time graph
* Gas control system : Mass Flow controller with LCD display
* Transport gas : Argon, flow rate <1 l/min
* Reaction gas : Cl,F, CCl2F2 or CHClF2, approx. 10 ml/min
* Water cooling : 1 l/min at 3 bar (heat dissipation approx. 2 kW)
* Interface : External trigger port for measurement synchronization
* Power Requirements : 400 VAC +N, 50 Hz, 16A (other voltages on request)
* Dimensions : 45x65x31.5 cm (17.7 x 25.6 x 12.4 inch)
* Weight : approx. 35 kg (77 lbs)

**ACCESSORY ITEMS (continued)**

**Autosampler AD 50-III**

* Automatic handling device for the ETV unit
* Temperature resistant 50 position graphite sample tray
* Tray cover
* Automatic furnace door with pyrometer
* Automatic sample handling tweezers
* Fully integrated into the ETV unit

**ACCESSORY ITEMS (continued)**

## \* Basic spare parts package for SPECTRO ARCOS SOP/DSOI (75270559– Rev. 2)2

|  |  |  |
| --- | --- | --- |
| Part No. | Qty | Description |
| 64063004 | 1 | Window 110 x 90mm |
| 75090021 | 1 | Control-fiber, 1.5m |
| 46905008 | 1 | Load coil, air cooled |
| 77060506 | 1 | Membrane pump 24VDC |
| 75160547 | 1 | Adapter for spray chamber |
| 75030529 | 1 | Reed sensor |
| 64014017 | 1 | Magnet for reed sensor |
| 75030530 | 1 | Torch box interlock |
| 68005371 | 1 | Automatic fuse 25A |
| 68005370 | 1 | Automatic fuse 6A |
| 48301035 | 1 | MgF2 lens for transfer optic SOP |
| 48303012 | 1 | MgF2 window for transfer optic (SOP/DSOI/EOP) |
| 75030078 | 1 | Door interlock |
| 80008152 | 2 | Screw cap |

## \* Basic spare parts package for SPECTRO ARCOS MV(75270563– Rev. 2)2

|  |  |  |
| --- | --- | --- |
| Part No. | Qty | Description |
| 64063004 | 1 | Window 110 x 90mm |
| 75090021 | 1 | Control-fiber, 1.5m |
| 46905008 | 1 | Load coil, air cooled |
| 77060506 | 1 | Membrane pump 24VDC |
| 75160547 | 1 | Adapter for spray chamber |
| 75030529 | 1 | Reed sensor |
| 64014017 | 1 | Magnet for reed sensor |
| 75030530 | 1 | Torch box interlock |
| 68005371 | 1 | Automatic fuse 25A |
| 68005370 | 1 | Automatic fuse 6A |
| 48301034 | 1 | MgF2 lens for transfer optic EOP |
| 48301035 | 1 | MgF2 lens for transfer optic SOP |
| 48303012 | 1 | MgF2 window for transfer optic (SOP/DSOI/EOP) |
| 75030078 | 1 | Door interlock |
| 80008152 | 3 | Screw cap |
| 46901078 | 1 | Sampler OPI |

## \* Extended Spare parts package for SPECTRO ARCOS SOP/DSOI/EOP/MV (75270564– Rev. 2)2

|  |  |  |
| --- | --- | --- |
| Part No. | Qty | Description |
| EK1502-1S | 1 | Host Controller |
| EK1407-2  | 2 | OES Frontend ILX511 |
| EK0014B2  | 1 | Instrument Controller DMB |
| 71000797 | 1 | Peristaltic pump 4-Channel/24VDC |
| EK1502-1S | 1 | Host Controller |

## \* Extended consumable package for SPECTRO ARCOS SOP/DSOI (75270558– Rev. 1)2

|  |  |  |
| --- | --- | --- |
| Part No. |  | Description |
| 48205068 | 1 | Torch fixed SOP |
| 47101003 | 60 | Pump tubing 0.89 mm ID |
| 47101005 | 12 | Pump tubing 1.8 mm ID |
| 47301022 | 10 m | PTFE Tube ID 0.6 |
| 47840036 | 1 | Filter mat |

## \* Extended consumable package for SPECTRO ARCOS MV EOP (75270561– Rev. 1)2

|  |  |  |
| --- | --- | --- |
| Part No. |  | Description |
| 48205077 | 1 | Torch fixed EOP |
| 47101003 | 60 | Pump tubing 0.89 mm ID |
| 47101005 | 12 | Pump tubing 1.8 mm ID |
| 47301022 | 10 m | PTFE Tube ID 0.6 |
| 47840036 | 1 | Filter mat |

## \* Consumable package OILSOP/EOP/MV (75170517 – Rev. 7)2

|  |  |  |
| --- | --- | --- |
| Part No. | Qty | Description |
| 47501002 | 36 | Viton tubes ID 0.89 mm |
| 47101020 | 36 | Viton tubes ID 1.3 mm |
| 47501014 | 2 x 0.06 m | Viton tube AD 3.12/ID 1.42 mm |
| 44702035 | 4 pcs | Connector tube straight ID 1.6 mm |
| 47301004 | 2 m | PTFE tube AD 0.96/ID 0.5 mm |
| 47501015 | 0,08 | Viton tube ID 0.635mm mm |
| 47301011 | 2 m | PTFE tube AD 3/ID 2 mm |

2 Note: Package is subject to technical change. When ordered, the latest revision, valid at the date of shipment, will be supplied.