

## ICP-Optical Emission Spectroscopy

## Avio 500 ICP Optical Emission Spectrometer



The PerkinElmer Avio® 500 is a truly simultaneous, dual view, compact ICP-OES. It utilizes a vertical plasma and is engineered to handle even the most difficult, high-matrix samples without dilution, delivering productivity, performance and faster return on investment.

### Spectrometer Specifications

**Polychromator:** The high-energy (f/6.7) echelle-based Avio 500 ICP-OES polychromator utilizes two SCD detectors covering the spectral range from 163-782 nm. The measured resolution of the system is 0.006 nm at 200 nm. The 80 by 160 mm echelle grating has 79 lines per mm and a blaze angle of 63.4 degrees. The cross-disperser for the UV region is a 374 lines/mm grating, while a 60-degree fused-quartz prism is added as the cross-disperser for the visible region.

The UV disperser on the Avio 500 spectrometer incorporates Schmidt correction to eliminate aberration for the 400-mm radius camera sphere.

**Thermostatted Optics:** The entire optical system is enclosed in a purged and thermostatted optical enclosure. The optical enclosure is mounted on the same large optical bench as the sample-introduction system. The optical bench is shock-mounted to the frame of the instrument so that normal floor vibrations do not affect system performance.

**Plasma Viewing:** The system incorporates a vertically oriented plasma with complete dual-viewing optics under computer and software control. Any wavelength can be used in the radial, axial, or mixed viewing modes in a single method.

With the Dual View capabilities of the Avio 500 system, viewing of the plasma is accomplished by computer control of a mirror located in the optical path and allows selection of axial or radial view and adjustment of the plasma viewing in both the vertical and horizontal planes.

**Shutter and Hg Recalibration System:** The computer-controlled, motor driven shutter automatically opens and closes for each sample, protecting the transfer mirrors from long exposures to the intense UV radiation of the plasma, extending the useful lifetime of the mirrors. A mercury lamp is built into the shutter mechanism and can be viewed at a user-selected frequency to automatically update the system wavelength calibration at the 253 nm mercury emission line.

**Detectors:** Custom-designed, application-specific, patented PerkinElmer Segmented-array Charge-coupled Device (SCD) detectors consist of 235 addressable subarrays covering approximately 6000 wavelengths on a 13 by 19 mm silicon substrate. Typical readout noise is about 13 electrons RMS; dark current is less than 100 electrons/pixel/second; and readout speed is 50  $\mu$ sec/pixel. Correlated double-sampling data-acquisition electronics further reduce electronic noise.

## ICP System Specifications

**RF Generator:** The Avio 500 features a fourth-generation 40 MHz, free-running solid-state RF generator, adjustable from 1000 to 1500 watts, in 1 watt increments. The power efficiency is greater than 79% with < 0.1% variation in output power stability. True Power Control maintains the plasma power at the set point,  $\pm 1$  watt, even when changing sample matrices. The compact RF supply meets all FCC certification requirements for RF emission (Part 18 of FCC rules and regulations).

Its unique Flat Plate™ plasma technology generates and maintains a robust, matrix-tolerant plasma with approximately half the argon consumption of helical load-coil systems.

**Plasma Ignition and Extinction:** Plasma ignition is computer-controlled and totally automated. The software allows the plasma to be ignited automatically at a user-determined time and turned off automatically after an analysis.

**Safety Interlocks:** For user safety and system protection, the system constantly monitors water flow, shear gas pressure, argon pressures, sample-compartment door closure, plasma stability and displays the interlock status on the computer screen as graphic symbols. If an interlock is interrupted, the plasma will immediately and safely shut down.

**Cooling Water:** A water-recirculating cooling system is required, with approximately 4 L/min flow capacity at 310 to 550 kPa and a temperature between 15 °C and 25 °C.

## Gas Flow Controls

**Argon Flow:** Computer-controlled solenoid valves are used to regulate the flow automatically within the range of 0-17 L/min in 1 L/min increments for plasma argon and 0 to 2.0 L/min in 0.1 L/min increments for auxiliary argon. A mass-flow controller is supplied with all systems for the nebulizer argon flow and is variable between 0 and 2.0 L/min in 0.01 L/min increments.

**PlasmaShear™:** A compressed-air shear gas (18-25 L/min) is used to remove the plasma tail from the optical path, minimizing interferences and extending the dynamic range. PlasmaShear provides a maintenance-free and lower-cost approach to removing the cooler plasma zone.

## Sample Introduction System

**Torch/Torch Mount:** A unique, demountable torch design using one-piece quartz tubing for plasma and auxiliary gas flow is supplied. The standard torch includes a 2.0-mm i.d. alumina injector for full corrosion resistance to all acids, including hydrofluoric and aqua regia. A variety of other injectors are available. The externally mounted spray chamber is integrated into an easily removable sample-introduction cassette. The sample-introduction cassette can be adjusted (with the plasma on) for maximum performance in different matrices. No tools are required for torch or sample-introduction cassette removal.

**Spray Chambers:** Instruments can be ordered with a Ryton® HF-resistant Scott-type or a glass cyclonic spray chamber.

**Nebulizers:** The Avio 500 can be ordered with a cross-flow or glass concentric nebulizer. The cross-flow design with GemTips™ is corrosion-resistant (sapphire/ruby tips in a PEEK body). The system can routinely handle 50% (v/v) solutions of HCl, HNO<sub>3</sub>, H<sub>2</sub>SO<sub>4</sub>, H<sub>3</sub>PO<sub>4</sub>, 20% (v/v) HF and 30% (w/v) NaOH. Additional nebulizers are available.

**Peristaltic Pump:** The integrated four-channel, computer-controlled pump has variable speeds from 0.2 to 7 mL/min in 0.1 mL/min increments, using 0.76 mm (0.030 in.) i.d. tubing. Software features include FastPump™ and SmartRinse™, which dramatically improve the sample rinse-out and analysis times.

**Spares Kit:** A spares kit of common replacement items is included.

## Physical Data – Instrument

**Power:** One 200-230 VAC, 20A line, 2800 VA, single-phase, 50/60 Hz ( $\pm 1\%$ )

**Dimensions:** 76 x 87 x 84 cm (W x H x D), 163 kg

**Environmental:** The instrument will operate with a laboratory temperature between 15 and 35 °C (59-95 °F). For optimum instrument performance, the room temperature should be controlled at  $20 \pm 2$  °C.