



## Agilent 4100 MP-AES

### Specifications



#### Runs on air

The Agilent 4100 MP-AES is a compact, bench-top microwave plasma-atomic emission spectrometer based on a robust, magnetically-excited nitrogen plasma. It is suitable for elemental determinations using a solid-state CCD detector.

The Agilent 4100 MP-AES delivers:

- Lowest cost of ownership — the Agilent 4100 MP-AES runs unattended without flammable or expensive gas supply, dramatically reducing your operating costs
- High-performance — magnetically-excited microwave plasma source provides superior detection limits to flame AA
- Ease of use — application-specific software applets plus plug-and-play hardware ensure any user can set up quickly without method development or alignment, and with minimal training
- Improved laboratory safety — in addition to eliminating flammable and oxidizing gases (such as acetylene), the 4100 MP-AES eliminates the need to plumb multiple gases into the laboratory, or manually transport and handle gas cylinders
- Robustness and reliability — ideal for industries such as mining, food and agriculture, chemicals, petrochemicals and manufacturing, and for remote locations

## Instrument hardware

### Sample introduction

Includes a standard one-piece quartz torch optimized for high precision and sensitivity with the recommended power and gas flow settings. The torch features a unique polymer base that automatically makes gas connections and aligns the torch position when inserted using the torch loader.

Includes a high-sensitivity, single-pass glass cyclonic spray chamber and concentric nebulizer as standard. Configurations for other applications (organics, high TDS, HF and high acids) are available.

Fully PC-controlled peristaltic pump with variable speed from 0 to 80 rpm, and three channels for sample, drain and internal standard/ionization buffer. A five-channel pump option is available.

### Gas controls

Computer-controlled solenoid valves are used to automatically enable and regulate the flow. The plasma gas is fixed at 20 L/min and the auxiliary gas is fixed at 1.5 L/min for ease of operation. Nebulizer gas flow is computer-controlled using high-precision pressure control (80 to 240 kPa) providing a nominal flow range of 0.4 to 1.0 L/min.

### Plasma generator

The microwave excitation assembly features a solid-state HV power supply and an industrial-grade, air-cooled magnetron operating at 2450 MHz. Fixed plasma power of 1 kW for ease of operation. Requires no cooling water supply, as the plasma generator is air-cooled. Computer-controlled plasma ignition using a momentary flow of auxiliary argon. Once the plasma is operational, it automatically switches to nitrogen for routine operation.

### Plasma configuration

Vertically-oriented plasma for improved matrix handling with end-on or axial viewing for optimum sensitivity and best detection limits. Computer-controlled plasma viewing position, which may be optimized for each wavelength. A pre-optics protection gas flow of compressed air (25 L/min) is used to divert heat from

the plasma away from the pre-optics. An operator-replaceable pre-optics window ensures excellent performance and easy maintenance.

### Instrument interlocks

Used to monitor critical supplies and conditions to prevent instrument damage. Interlocks monitor:

- Pre-optics window fitted
- Torch loader
- Plasma enable switch
- Gas supply pressures for nitrogen, argon and air
- Pre-optics window temperature
- Operating temperature for HV power supply, magnetron and microwave excitation assembly
- Plasma status

### Optical system

Fast-scanning, high-resolution optical system for fast measurement using a compact design. Czerny-Turner design monochromator with 600 mm focal length and fixed entrance slit for ease of operation. Holographic diffraction grating with 2400 lines/mm is blazed at 250 nm for optimum UV performance. Wavelength range 178–780 nm. The optical system can be purged with air for protection in dusty or corrosive environments, or nitrogen at 10 L/min for sulfur determinations.

### Detector

Hermetically-sealed, UV-sensitive, back-thinned solid-state CCD detector (532 x 128 pixels) designed specially for low-light level detection with > 90% quantum efficiency at peak sensitivity. It is directly cooled to 0 °C using a thermoelectric Peltier device for low dark current and reduced baseline noise. High speed, high capacity binning technology prevents spectral blooming.

The CCD array detector collects the analyte spectra and neighbouring background spectra, allowing simultaneous background correction for enhanced stability and precision.

### Standby and startup

When powered off, there is no standby gas or power consumption.

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With the nitrogen generator, a purge time of five minutes is required from power on, to allow the nitrogen generator to achieve required nitrogen purity.

For optimum performance and stability, a plasma stabilization of 30 minutes is recommended.

## Guaranteed performance

### Signal stability

< 2% RSD over 4 hours without internal standardization or any form of drift correction.

### Resolution

< 0.050 nm (measured as full width at half maximum)

### Detection limits

3 sigma detection limits ( $\mu\text{g/L}$ ) using a 10 second integration time with dewar nitrogen.

Element	Wavelength (nm)	Detection Limit ( $\mu\text{g/L}$ )
Ba	614.171	1.0
Mn	403.076	1.0
Zn	213.857	6.0

## Software

Web-integrated Agilent MP Expert software features:

- Agilent's worksheet concept for ease of use, rapid operator training, and commonality with other Agilent spectroscopy products
- Logical workflow to guide users through method and sequence development
- Method templates, which allow rapid development of new worksheets for commonly-used applications
- Application-specific software applets, which automatically load a preset method so you can start analysis immediately without method development or alignment, and with minimal training

- Computer control of plasma gas flows, plasma viewing position, ignition, safety interlocks and utilities monitoring
- Choice of background correction techniques from traditional off-peak to unique automatic correction
- Fast Linear Interference Correction (FLIC) for real-time spectral modeling and removal of interferences in complex spectra
- Auto-optimization of key instrument parameters (nebulizer pressure and viewing height)
- MultiCal, which assists in extending linear dynamic range and provides automatic validation of results
- Calibration using conventional multi-element calibration and method of standard additions
- Calibration reslopes, which eliminate the need for full recalibration
- Recalibrations that can be programmed at a user-specified rate
- User-customizable Quality Control Protocols (QCPs) designed to meet GLP and other international compliance standards
- Weight/volume/dilution correction factors
- Autosampler rack and tube positions that can be edited for true random access sampling
- Sequence options that include calibration/reslope/QCP error actions and end of analysis actions
- Real-time graphical display of signal spectra, results and calibration graphs
- Post-run retrospective data editing
- Variety of reporting and exporting options with user-defineable settings
- Graphical display of system status and a comprehensive set of instrument diagnostic tools
- A comprehensive help system, including multimedia and video assistance

## Accessories and peripherals

Agilent offers a full range of configurable accessories and peripherals for the 4100 MP-AES, including:

### 4107 Nitrogen Generator

Uses pressure swing absorption technology to produce > 99.5% purity nitrogen for plasma operation. This eliminates on-going gas re-supply requirements providing low cost of ownership. Requires a supply of clean, dry, oil and dust-free compressed air with a flow of 115 L/min at 620 kPa (90 psi) input pressure. Nitrogen output capacity is 25 L/min at > 99.5% purity. At 10 L/min output, nitrogen quality improves to > 99.95% purity, allowing optics purging for sulfur determinations using a second generator.

### SPS 3 Sample Preparation System

High-throughput autosampler, with fast X, Z, theta arm movement for unattended, multi-element operation. Capacity for up to three sample racks and two standard racks. Racks may be exchanged during analysis for unlimited sample capacity. Compatible with a range of commercially-available, autoclavable, laboratory racks.

### Multi-mode Sample Introduction System (MSIS)

Optional MSIS provides simultaneous vapor generation of environmentally-sensitive elements including As, Se and Hg with low ppb detection limits. MSIS uses thin-film technology for significantly better performance than conventional nebulization. The MSIS is easy to set-up and operate. It provides a choice of three operational modes - conventional nebulization, hydride only or simultaneous hydride and conventional nebulization, allowing routine elements to be determined using the same setup as hydride elements.

### Vapor Generation Accessory (VGA 77)

Modular, continuous flow for the determination of Hg, As, Se, Sb, Te, Bi, and Sn at  $\mu\text{g/L}$  and  $\text{ng/L}$  levels. Compatible with the Agilent SPS 3 Sample Preparation System.

### Electronic Gas Control Module (EGCM)

Accurately controls and injects a flow of air into the plasma to prevent carbon deposition and reduce background structure when analyzing organic solvents.

Air injection rate is computer-controlled with four fixed-flow settings covering the flow range 0–1.5 L/min.

Also controls nitrogen flow for purging of the optics for sulfur determinations.

### Optional sample introduction components

Agilent offers a range of torches, nebulizers, spray chambers, tubings and other supplies for routine MP-AES operation. Refer to our website for details.

## Principal installation requirements

### Nitrogen supply

Required for plasma operation. Can be supplied from cylinders, a liquid nitrogen source or a nitrogen generator. Minimum purity 99.5% with a flow rate of up to 22.5 L/min at 500 kPa (72.5 psi). For sulfur determination, a nitrogen purge with minimum purity of 99.95 % is required through the optics at a flow rate of 10 L/min and 450 kPa (65 psi).

### Argon supply

For plasma ignition only. Supplied from an onboard argon bottle or external supply. Requires welding-grade argon (99.0% purity) with a flow rate of 1.5 L/min at 210 kPa (30 psi). Each ignition cycle uses ~ 75 mL of argon.

### Compressed air

Required for pre-optics protection and the optional EGCM. Clean, dry, oil- and dust-free air is required. The pre-optics protection gas requires a flow rate of 25 L/min at 500 kPa (72.5 psi). The EGCM requires a flow rate up to 1.5 L/min at 500 kPa (72.5 psi).

### Cooling

Clean, dry, oil-free, non-corrosive air is required for instrument cooling (chiller not required) drawn in through an air inlet vent at the top, rear of the instrument

### Exhaust system

A minimum flow of 3  $\text{m}^3/\text{min}$  (106 cfm) is required, and must be ducted to an external vent of 150 mm in diameter.

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## Power supply

Single-phase AC 10 A 3-wire system, 200–240 V AC  
±10%, 50/60 Hz

## Dimensions

960 mm (37.8 in) x 660 mm (26.0 in) x 660 mm (26.0 in)

## Weight

73 kg (161 lb)

## System installation

For full details of the 4100 MP-AES or 4107 Nitrogen Generator installation requirements, refer to the 4100 MP-AES Site Preparation Guide.

## Regulatory compliance

### Safety

IEC 61010-1:2001 / EN 61010-1:2001

### EMC

IEC 61326-1:2005 / EN 61326-1:2006, ICES-001:2006,  
AS/NZS CISPR 11:2004

### ISO

Manufactured according to a quality management system certified to ISO 9001

## Support and training

Agilent is renowned for providing expert applications and service support. Agilent has a global network of factory-trained specialists ready to provide support for hardware, software, or applications wherever you are located. Services include:

- Full 12-month warranty support
- Seven (7) year hardware support period from date of last unit manufacture. After this time, parts and supplies will be provided if available.
- Preventive maintenance to deliver consistent operation and minimize downtime
- Troubleshooting, maintenance and repair
- Software support services

- Compliance services including IQ and OQ of hardware and software
- Comprehensive warranty extension and service contracts, including peripherals
- Classroom training and onsite training delivered by experts

### The Agilent service guarantee

Should your instrument require service while covered by an Agilent service agreement, Agilent guarantees repair, or we will replace your instrument for free. No other manufacturer or service provider offers this level of commitment to keeping your laboratory running at maximum productivity.

## Further details

For further information please consult your Agilent office or supplier, or our website at [www.agilent.com](http://www.agilent.com)

**[www.agilent.com/chem](http://www.agilent.com/chem)**

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