



## Agilent 7900 ICP-MS

### Specifications



### **Raise your expectations with the next generation of ICP-MS**

The Agilent 7900 ICP-MS rewrites the rules of ICP-MS. New technologies and a redesigned software platform combine to make the 7900 ICP-MS the world's most powerful, and most automated quadrupole ICP-MS.

Some key components, such as the RF generator and quadrupole mass analyzer, are shared with the field-proven 7700 Series ICP-MS and 8800 ICP-QQQ. However, the Agilent 7900 ICP-MS has been re-engineered from the bench up, with every component optimized for the demands of busy laboratories today, and in the future.



**Agilent Technologies**

## Instrument hardware

### Sample introduction

**Nebulizer:** Concentric nebulizer with low sample flow rate as standard (~0.2 mL/min)

**Spray chamber:** Quartz, low-volume, Scott-type double-pass spray chamber, provides improved removal of larger aerosol droplets, compared to cyclonic or impact-bead designs. Peltier-cooling eliminates the need for a separate external cooling water supply.

- Controlled temperature range: -5 °C to +20 °C (with instrument cooling water at 15–30 °C)

**Peristaltic pump:** Low-pulsation, high-precision, 10-roller peristaltic pump, with three separate channels for precise delivery of sample and internal standard (ISTD), plus spray chamber drain.

**Ultra High Matrix Introduction (UHMI):** Agilent's unique UHMI aerosol dilution technology (option), extends the matrix tolerance of the Agilent 7900 ICP-MS, allowing routine analysis of samples containing tens of % levels of total dissolved solids (TDS), while eliminating the added costs, time and potential errors of conventional liquid dilution.

### Plasma

**RF generator:** High power-transfer efficiency and maintenance-free solid state digital drive 27 MHz RF generator with variable-frequency impedance matching. Provides significantly improved tolerance of changes in sample matrix; even highly volatile organic solvents can be introduced without affecting plasma stability.

- RF power range: 500 W to 1600 W

**Torch:** Easy-mount, one-piece quartz torch with 2.5 mm internal diameter injector. The exceptionally wide torch injector produces a highly robust plasma that efficiently

decomposes the sample matrix, reducing many interferences and minimizing routine interface cleaning.

**Torch position:** Stepper-motor controlled in three axes (horizontal, vertical and sampling depth) in 0.1 mm steps. The torch is automatically realigned with the interface following maintenance.

- Horizontal and vertical position range:  $\pm 2$  mm
- Sampling depth: 3 to 28 mm

**ShieldTorch System:** Agilent's unique ShieldTorch System (STS) precisely controls plasma potential and ion energy — essential to achieve high performance He mode.

**Robust preset plasma conditions:** Plasma conditions on the 7900 ICP-MS are robust and easily reproduced using the pre-set plasma function within MassHunter — no manual tuning is required. Consistent hardware engineering ensures that operating conditions can be precisely set and consistently applied from day to day and with different operators.

Signal suppression for high ionization potential elements such as Be, Zn, As and Cd in 10 vol% HNO<sub>3</sub> matrix is typically less than 10% (Plasma mode: General Purpose).

### Interface

**Sampling cone:** 1 mm diameter orifice, Ni-tipped or Pt-tipped (option) with Cu base. Easy access to the interface region for routine maintenance; no tools are required for removal/refitting of sampling cone. The large cone-retaining ring ensures reliable thermal contact and reproducible fitting, even with different operators, giving dependable long-term performance.

**Skimmer cone:** 0.45 mm diameter orifice, Ni or Pt-tipped (option). Precisely controlled skimmer tip temperature ensures minimal matrix condensation, providing good tolerance to high matrix samples. Small skimmer orifice reduces matrix contamination of the high vacuum region, reducing maintenance.

### Ion Lens

The ion lens provides high ion transmission (> 1GHz/ppm sensitivity at <2.5% CeO/Ce) and low backgrounds to deliver superior detection limits. The ion lens design also ensures that fixed voltages can be used to achieve optimum ion transmission across the mass range.

**Extraction lens:** Positioned behind the skimmer cone, the extraction lens focuses the ions as they enter the intermediate vacuum stage, minimizing space charge effects and reducing mass bias.

**Off-axis Omega lens:** This double deflection lens protects the ORS<sup>4</sup> cell and high vacuum region from contamination, by rejecting neutral species from the ion beam. This contributes to the minimal mass bias and low background noise.

### Octopole Reaction System

The 7900 ICP-MS incorporates a new, 4<sup>th</sup> generation cell, the ORS<sup>4</sup>, which provides fast cell gas switching and the most effective interference removal using kinetic energy discrimination (KED) in He mode.

**Octopole:** The octopole ion guide provides superior ion focusing, minimizing ion scattering and ensuring that high sensitivity is maintained at the high cell pressures required for effective KED.

**He cell mode as standard:** Only the combination of narrow ion energy distribution (due to ShieldTorch) and the 7900 ICP-MS's unique octopole-based cell enables efficient removal of interferences using an inert cell gas (He) and KED. The use of He cell gas also eliminates safety issues related to reactive gases such as H<sub>2</sub>, H<sub>2</sub> mixes or NH<sub>3</sub>.

**Cell gas control:** The 7900 ICP-MS has a single He cell gas controller as standard. A second or third cell gas line can be added to permit the use of reactive cell gases such as H<sub>2</sub>, xenon or ammonia. If multiple cell gases are used in a method, the cell gas is automatically changed with minimal switching time (~5 sec).

### Mass Analyzer

**Quadrupole mass spectrometer:** The 7900 ICP-MS uses a true hyperbolic quadrupole, unique in ICP-MS, operating at high (3 MHz) frequency. A hyperbolic profile quadrupole provides superior ion transmission, resolution and abundance sensitivity at standard settings, so eliminating the need for multiple resolution settings to separate adjacent peaks.

- Mass range: 2–260 amu
- Mass scan speed:
  - Slew rate (Li to U, no intervening peaks): 56.6 million amu/s
  - Scan speed (Li to U, plus data collection at 40 intervening masses): >3,000 amu/s
- Abundance Sensitivity (at Cs):
  - Low Mass side:  $5 \times 10^{-7}$
  - High Mass side:  $1 \times 10^{-7}$

**Orthogonal detector system (ODS):** The ODS delivers higher sensitivity, lower background, and a wider linear dynamic range — up to 11 orders of magnitude from 0.1 cps to 10 Gcps.

Fast measurement of transient signals is provided, due to the use of a proprietary analog amplifier, which operates at the same short integration time (100 µsec) in both pulse and analog mode. There is no settling time between measurements in fast TRA mode.

### **Vacuum system**

Three-stage differential vacuum system using a single, split-flow turbo molecular pump and single external rotary pump for fast pump-down and simple maintenance. Unique Auto recover mode returns the 7900 ICP-MS to standby (pumping) state when electrical power is resumed after a power failure, saving valuable time. No need to manually start the vacuum system following an overnight power failure.

### **Software**

Agilent ICP-MS MassHunter features a dashboard layout with gadgets that guide you through every step of your analysis – hardware configuration, instrument optimization, sample acquisition and data analysis. This user-friendly interface makes learning and using the software easier and more intuitive, without compromising power and flexibility for advanced or research applications.

MassHunter includes:

- An innovative matrix-specific Method Setup Wizard, enabling all users, experienced and new, to consistently obtain high-quality data with confidence
- Batch-at-a Glance data table with real-time update, including all sample data, ISTD/QC signal trend and calibration curves
- Built-in outlier and LabQC checks

### **Optional software**

The power of ICP-MS MassHunter can be extended through a choice of software options:

**User Access Control:** Provides multi-level user logon control for enhanced security and audit, with three levels of access authority, record of user name, Operating System lock and more.

With Agilent's OpenLAB Data Store, ECM, or Spectroscopy Database Administrator (SDA), ICP-MS MassHunter with User Access Control satisfies compliance requirements including US FDA 21 CFR Part 11.

**Chromatographic software:** Fully integrated Agilent LC and GC method setup, instrument control, sequencing, and chromatographic data analysis. Permits automatic sequence recalibrations, retention time and ion ratio updates, Compound Independent Calibration, Snapshot, automated report generation and more.

**Intelligent Sequencing** provides comprehensive, configurable QA/QC functionality for automatic QA/QC checks and actions during unattended operation. Includes templates for QC reports for standard methods such as US EPA 6020 and 200.8. For full details of Agilent ICP-MS MassHunter software for the 7900 ICP-MS, 7700 Series ICP-MS and 8800 ICP-QQQ, see separate ICP-MS MassHunter Specifications.

## Guaranteed performance

For each specification, the actual instrument factory test certificate of Guaranteed Performance is included with every 7900 ICP-MS instrument.

Specification (units)	Element/Ratio	7900 ICP-MS
Sensitivity (Mcps/ppm)	Li (7)	55
	Y (89)	320
	Tl (205)	250
Background (cps)	No gas (9 u)	1
Oxide ratio (%)	CeO/Ce	1.5
	CeO/Ce (HMI-25)	0.5
Doubly-charged ratio (%)	Ce <sup>2+</sup> /Ce	3
No gas mode detection limits (ppt)	Be (9)	0.2
	In (115)	0.05
	Bi (209)	0.08
He mode detection limits (ppt) *	As (75)	20
	Se (78)	40
H <sub>2</sub> mode detection limits (ppt) **	Se (78)	1
Short-term stability (%RSD)	Li, Y, Tl	2
Long-term stability (%RSD)	Li, Y, Tl	3
Isotope ratio precision (%RSD)	Ag (107)/Ag (109)	0.1

\* He mode detection limits for As and Se are performed in a matrix of 1% HNO<sub>3</sub>, 2% HCl and 100 ppm Ca, demonstrating the effective removal of both ArCl and CaCl interferences. All other tests are performed in a matrix of 1% HNO<sub>3</sub>

\*\* Applies when optional H<sub>2</sub> cell gas line is fitted

## Site requirements and safety

### Dimensions

Mainframe	Width	730 mm (main cabinet, excluding peripump)
	Depth	600 mm (main cabinet, excluding power cord)
	Height	595 mm (main cabinet, excluding exhaust chimney)
	Weight	100 kg
Largest shipping container	Width	1,020 mm
	Depth	1,120 mm
	Height	1,000 mm
	Weight	148 kg

### Environmental

Operating temperature	Range	15–30 °C
	Rate of change	<2 °C/hr (max. change 5 °C)
Operating humidity	Range	20% to 80% (non condensing)

### Utilities

Electricity supply	Voltage	Single Phase, 200–240 V, 50/60 Hz
	Current	30 A
Cooling water	Inlet temperature	15–40 °C
	Minimum flow rate	5 L/min
	Inlet pressure	230–400 kPa (33–58 psi)
Argon gas supply	Minimum purity	99.99%
	Maximum flow rate	20 L/min
	Supply pressure	500–700 kPa (71–100 psi)
Cell gas supply	Minimum purity	99.999%
	Maximum flow rate	12 mL/min for He and 10 mL/min for H <sub>2</sub>
	Supply pressure	90–130 kPa (13–18.8 psi) for He and 20–60 kPa (2.9–8.7 psi) for H <sub>2</sub>
Exhaust duct	Vent type	Single vent, 150 mm diameter
	Flow rate	5–7 m <sup>3</sup> /min

## Regulatory compliance

Safety	IEC 61010-1:2001 / EN 61010-1:2001, CAN/CSA C22.2 No.61010-1-04, UL No.61010-1  IEC 61010-2-061:2005, CAN/CSA C22.2 No.61010-2-061-04  IEC 61010-2-081:2001+A1 (2003), CAN/CSA C22.2 No.61010-2-081-04
EMC	IEC 61326-1:2005 / EN 61326-1:2006, ICES-001:2006, AS/NZS CISPR 11: 2011
ISO	Manufactured at an ISO 9001 and ISO 14001 certified facility

Note: Refer to publication 5991-3780EN for 7900 ICP-MS Specifications with option 200 (semiconductor configuration).

## Standard mainframe configuration

Nebulizer (concentric)	MicroMist (borosilicate glass)
Spray chamber (Scott double-pass)	Quartz
Torch (with ShieldTorch System)	Quartz, 2.5 mm ID injector
Ultra High Matrix Introduction (UHMI)	Option
Interface cones	Ni
Plasma Mass Flow Controllers (Ar)	4
Option gas line for alternative carrier or make-up gases such as 20% O <sub>2</sub> /Ar for organics, or He for laser	Option
He (collision) cell gas line	Included
H <sub>2</sub> (reaction) cell gas line	Option
3 <sup>rd</sup> cell gas line (low- or high-flow rate options)	Option

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