C113-E031A

SHIMADZU
Excellence in Science

ICP Mass Spectrometer

ICPMS-2040 Series
ICPMS-2050 Series

DESIGN AWARD 2024

reddot winner 2024

An Era Without Compromise

Exceptional yet Eco Friendly

Proprietary Advanced Mini-Torch System

Redesigned Collision/Reaction Cell

High-Performance Quadrupole Mass Filter

High Throughput with No Additional Cost

"High-Speed Cell Gas Purging" Reduces Measurement Times

"ProActive Rinsing" Efficiently Rinses the Sample Introduction System

Minimal Operation Required

"Extended Rinsing" Automatically Minimizes Carryover

"Dual Valve Unit" Enables Autonomous Operation after Plasma Ignition

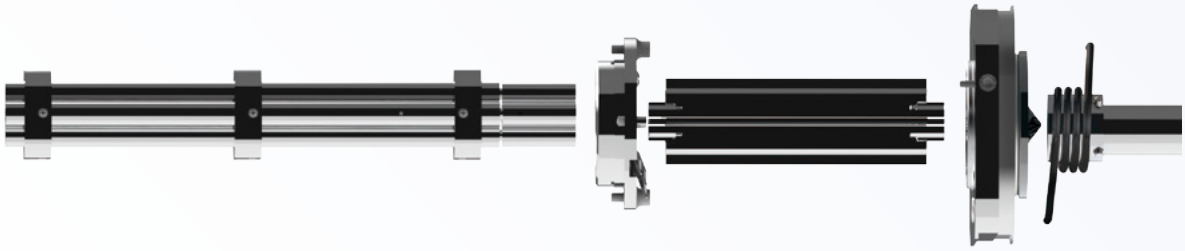
"Preset Methods" Eliminate the Need for Method Development

ICPMS-2040 Series
ICPMS-2050 Series

ICP Mass Spectrometer

Exceptional yet Eco Friendly

An advanced mini-torch design, combined with a redesigned collision/reaction cell, and a high-performance quadrupole mass filter result in an environmentally friendly system with superior analytical performance.

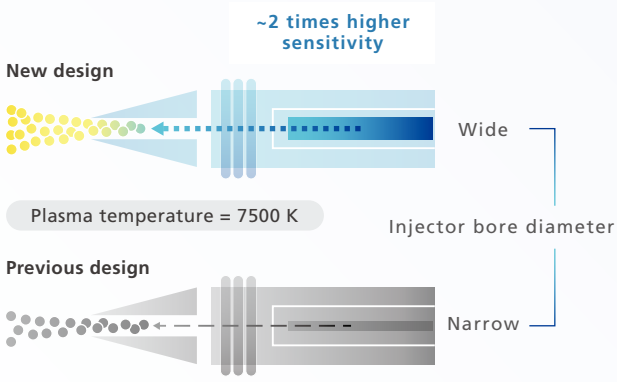


Quadrupole Mass Filter | Collision/Reaction Cell | Mini-Torch System

Proprietary Advanced Mini-Torch System

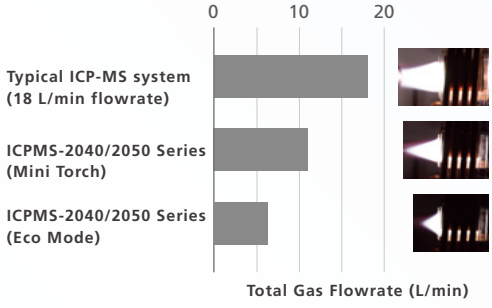
Redeveloped High Sensitivity Mini-Torch

Optimizing the torch design keeps argon gas consumption low and decreases sample flow rate into the plasma, improving sample ionization efficiency. The new design roughly doubles sensitivity compared to previous models while reducing injector clogging issues.



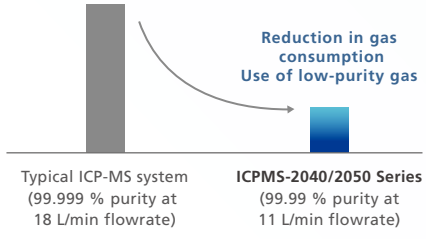
Low Argon Gas Consumption

A major drawback of ICP-MS systems is the large argon gas consumption. Shimadzu's mini-torch system consumes 11 L/min of argon, two-thirds the amount used by typical plasma torches. Continuous operation using a 7 m^3 gas cylinder is up to 10 hours. Utilizing Eco mode (Plasma gas: 5.5 L/min) during standby can further reduce argon gas consumption.



No Need for High-Purity Argon Gas

ICPMS-2040/2050 Series systems have a Shimadzu-made high-frequency power supply that features high-speed matching functionality, allowing for the use of low-cost, low-purity (99.95 %) argon gas to reliably generate a robust plasma.



Argon Gas Cost Reduction

Note: The reduction in cost will vary according to current gas pricing. This calculation assumes the price of 99.999% purity argon is two times higher than the price of 99.99% purity.

Redesigned Collision/Reaction Cell

Product

Collision Mode

Inert helium gas is introduced into the cell to selectively attenuate kinetic energies of polyatomic ions based on their sizes. These low energy ions are removed from the ion beam by applying a bias voltage at the cell exit. Because fewer by-product ions are generated, it can be used for a wide range of applications.

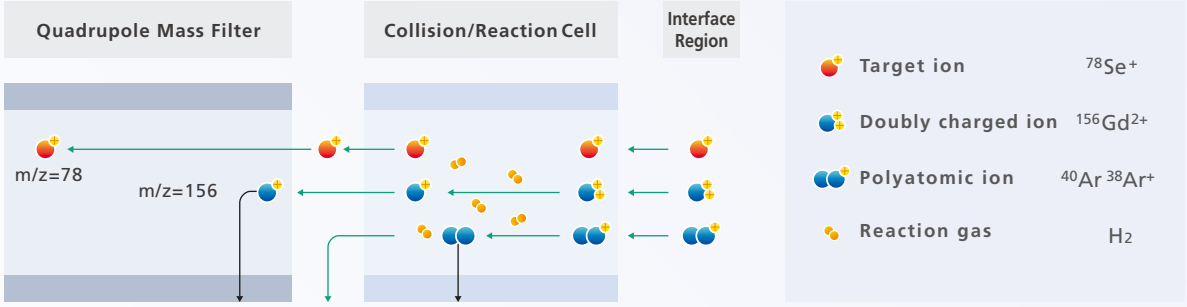
Online Interelement Correction (IEC)

Shimadzu's proprietary online interelement correction (IEC) function is used to correct for spectral interference that cannot be eliminated by the collision mode. By only measuring one standard sample an interference correction is calculated and applied to all samples run subsequently.

Reaction Mode

ICPMS-2050

When a specific gas is introduced into the cell, the reaction of gas with ions is used to reduce interferences. Target ions can be analyzed with high sensitivity, while both doubly charged ions not eliminated by the collision mode and polyatomic ions can be reduced.



Note: Example of how reaction mode can be used. Reaction gas H_2 is used in this example to convert doubly-charged ions to singly-charged ions, and charged polyatomic ions to neutral clusters.

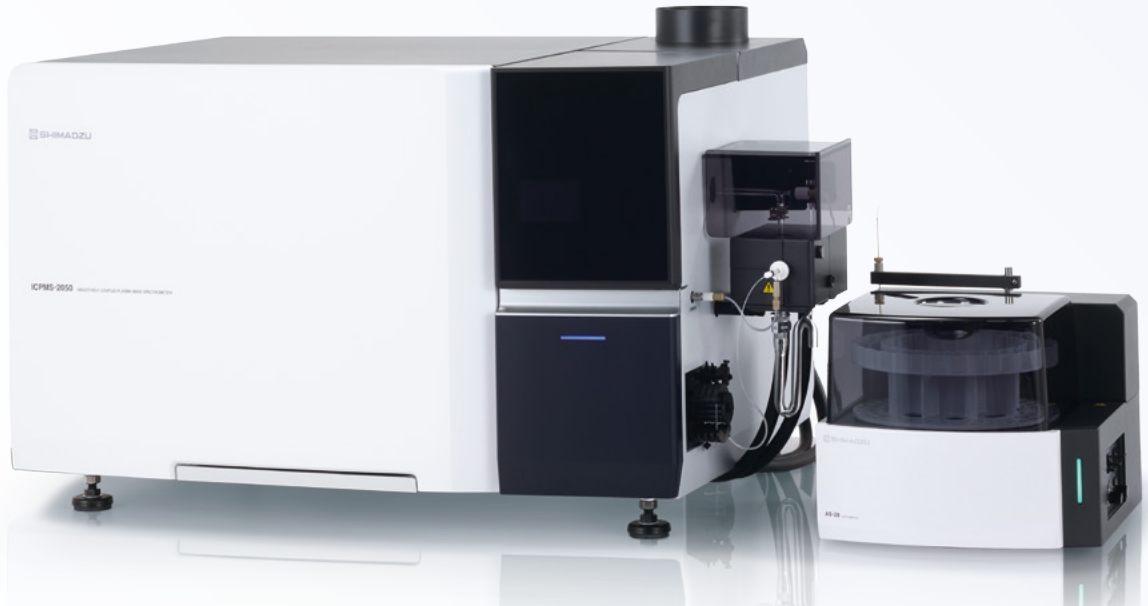
High-Performance Quadrupole Mass Filter

Charge Stabilizer

To mitigate ion charge effects on the mass filter, a pulse voltage is applied between the analysis of each mass to maintain a constant charge level at the electrode surface. This improves the signal stability when analyzing samples for long periods (patent pending).

High-Resolution Mode and Half-Mass Correction

Masses can be analyzed at 0.5 u intervals using high-resolution mode, enabling half-mass correction for doubly charged interferences common in rare earth elements (REEs).



High Throughput with No Additional Cost

The improved gas controller features high-speed cell gas purging. Combined with ProActive Rinsing, measurement times can be significantly shortened without any additional accessories or cost.

Measure a series of 100 samples (example)

Previous model

5 hr and 40 min

Time reduction due to gas purging
23 sec × 100 = 2300 sec

Time reduction due to ProActive Rinsing
40 sec × 99 = 3960 sec

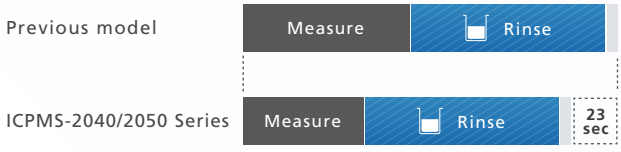
About 1 hr and 44 min Time Reduction

ICPMS-2040/2050 Series
4 hr

High-Speed Cell Gas Purging

The redesigned gas controller shortens cell gas introduction and exhaust times (patent pending).

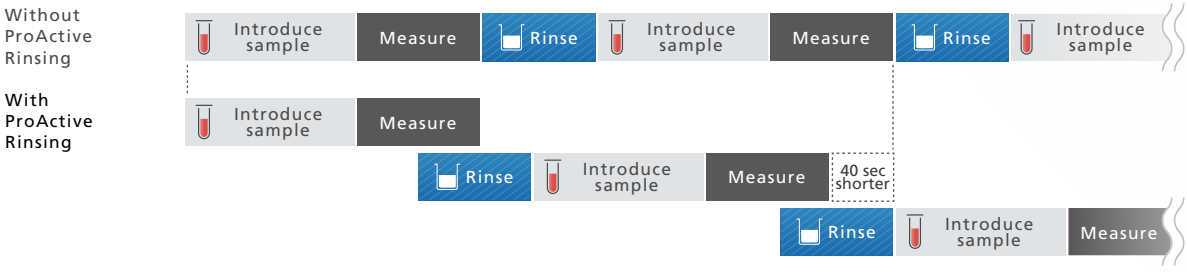
Measurement Time per Sample



ProActive Rinsing

Product

While measuring multiple samples, the rinsing sequence can be started early by sending the autosampler probe to rinse while collecting data using sample already in the suction line. This greatly reduces measurement time and conserves sample.



Note: The reduction in time depends on the measurement conditions. In the example above, the Preset method for Drinking Water in ICPMS-2040 was used.

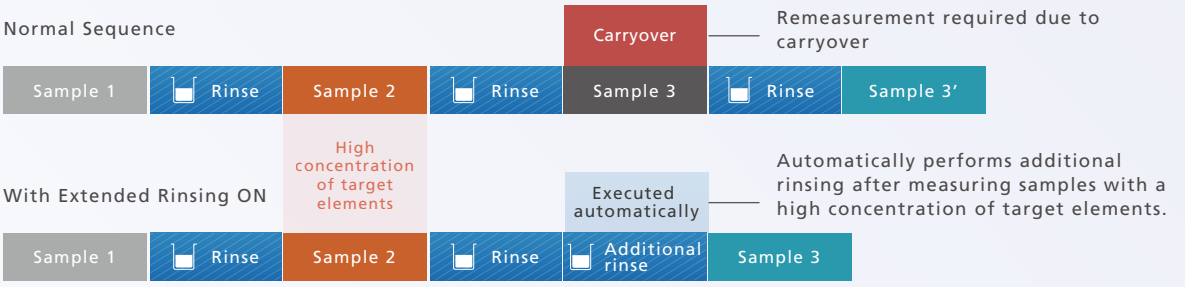
Minimal Operation Required

Using the extended rinsing function with an optional dual valve unit allows the ICPMS-2040/2050 Series systems to run autonomously after plasma ignition.

Product

Extended Rinsing
—Automatically Minimizes Carryover—

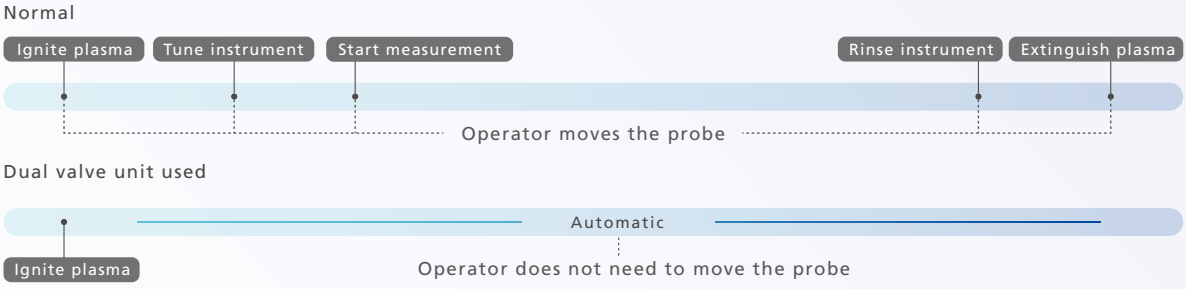
ANALYTICAL INTELLIGENCE



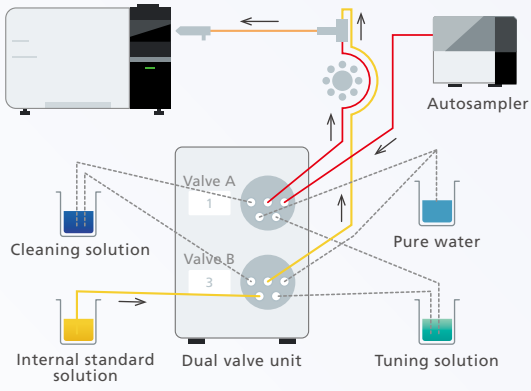
Analyzing samples containing a high concentration of target elements can cause carryover to the next sample, preventing accurate measurements. The extended rinsing function automatically performs an additional rinse sequence when a target element exceeds a predetermined upper limit. A second rinse solution can be used in the additional rinsing sequence to improve rinsing effectiveness. Consequently, carryover is eliminated to ensure high-quality data.

Dual Valve Unit
—Enables Autonomous Operation after Plasma Ignition—

ANALYTICAL INTELLIGENCE



When using an Online Internal Standard Kit (optional), the operator must move the probe before and after data acquisition. The optional Dual Valve Unit allows seamless switching between tuning solution and rinsing solution while also automatically adding internal standard solution to samples. The entire sequence, from instrument tuning, to measurement, to rinsing, and plasma off, are performed automatically.

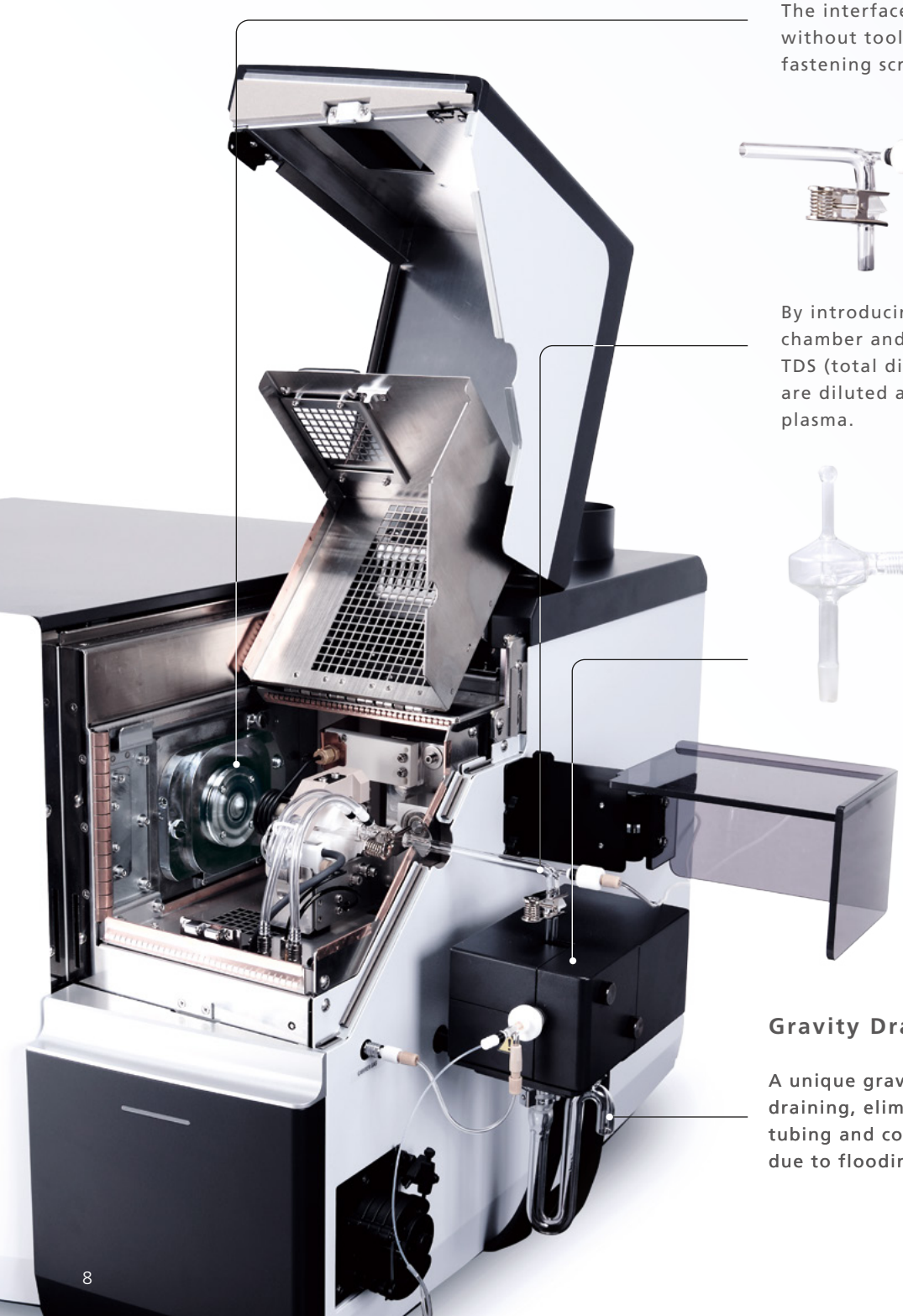


Engineered for Simplicity

Easy-to-Maintain Sample Introduction System

Easy-to-Access Plasma Stand

The large opening plasma stand allows effortless access to the plasma torch and interface.



Easy-to-Remove Interface

The interface can be quickly removed without tools by simply loosening the fastening screw.

Aerosol Dilution System

By introducing argon gas between the chamber and the torch, samples with high TDS (total dissolved solids), such as seawater, are diluted and introduced directly into the plasma.

Peltier Cooled Cyclone Chamber

The system utilizes a high-efficiency coaxial nebulizer and electronically-cooled cyclone chamber for minimizing memory effects and increasing sample throughput.

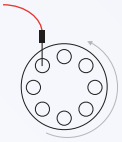
Gravity Drain

A unique gravity drain design ensures proper draining, eliminating the need for pump tubing and concerns about plasma interruption due to flooding.

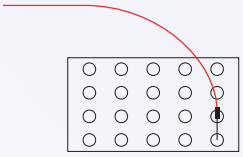
AS-20 Autosampler

Rotary Design Reduces Tubing Length

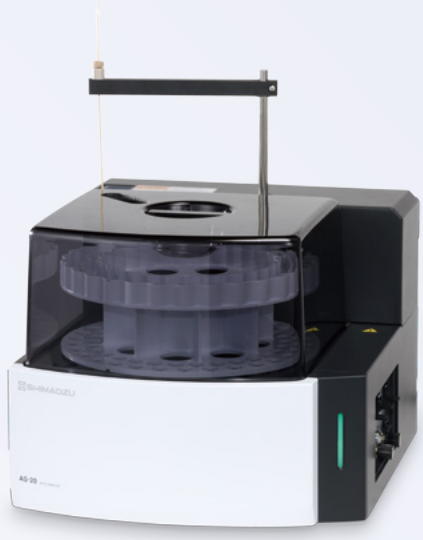
The autosampler has 60 15-mL and 8 50-mL vial positions. The rotary design allows for shorter sample introduction times and can reduce memory effects.



Rotary Type
(Minimizes probe tube length)



XY-Table Type
(A longer tube length is required to reach the furthest vial)



Dual Rinse Port with Overflow Function

The overflow-type rinse system includes both a standard and auxiliary port to reduce contamination between samples. An optional rinse station* can be added for organic solvents.

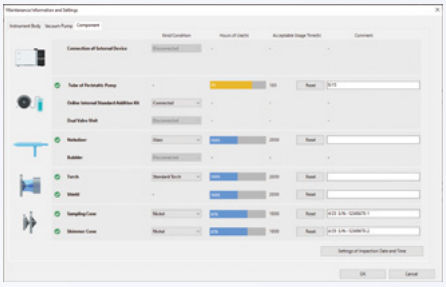
* The organic solvent rinse station does not include overflow functionality.

Rinse port

Simple and Descriptive Maintenance Window

ANALYTICAL INTELLIGENCE

The maintenance information/setting window in new LabSolutions™ ICPMS software clearly indicates operation times of key components and automatically alerts users when it is time to maintain and/or replace parts, taking the guesswork out of maintenance.



Preset Methods

Applications

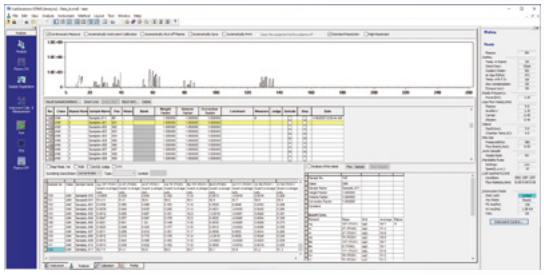
Preset analytical methods come configured with optimized settings, such as plasma conditions, target elements, mass information, and internal standards, for common ICPMS applications. The ICPMS-2040/2050 Series systems can therefore be used immediately after installation with minimal training.

Environmental testing	A method for analyzing drinking/tap water and a method for analyzing high matrix samples, such as waste water, are included.
Foods	A method for analyzing food samples with low TDS and a method for food samples with high TDS are included.
Pharmaceuticals	Methods are included, respectively for ICH Q3D analysis of oral, parenteral, inhalation and cutaneous drugs.

Software

New LabSolutions™ ICPMS Software

The new version of LabSolutions ICPMS software displays all necessary information in a single window, simplifying operation for new users. Experienced users can utilize advanced configurable settings for challenging applications, in-depth research and all analyses in between.

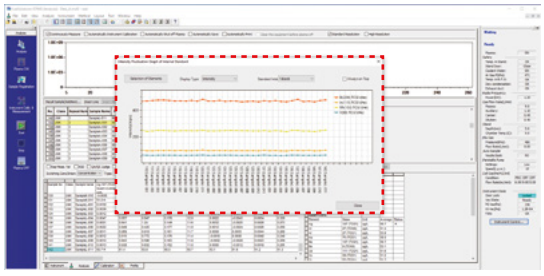


Analysis Window

The customizable analysis window can simultaneously display the current sample profile, registered samples, analytical results, errors, and instrument status. The analysis progress can be monitored at a glance. Windows can be configured and customized based on the user's preference. The assistant bar along the left side guides the users through every step of analysis in the correct order.

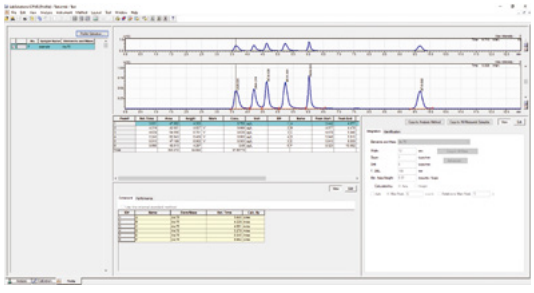
Instrument Status Window

The instrument status window displays information about the instrument and accessories in a comprehensive and easy-to-understand layout.
A warning indicator is displayed if an error occurs or if a part is due for maintenance or replacement.



Automatic Internal Standard Monitoring

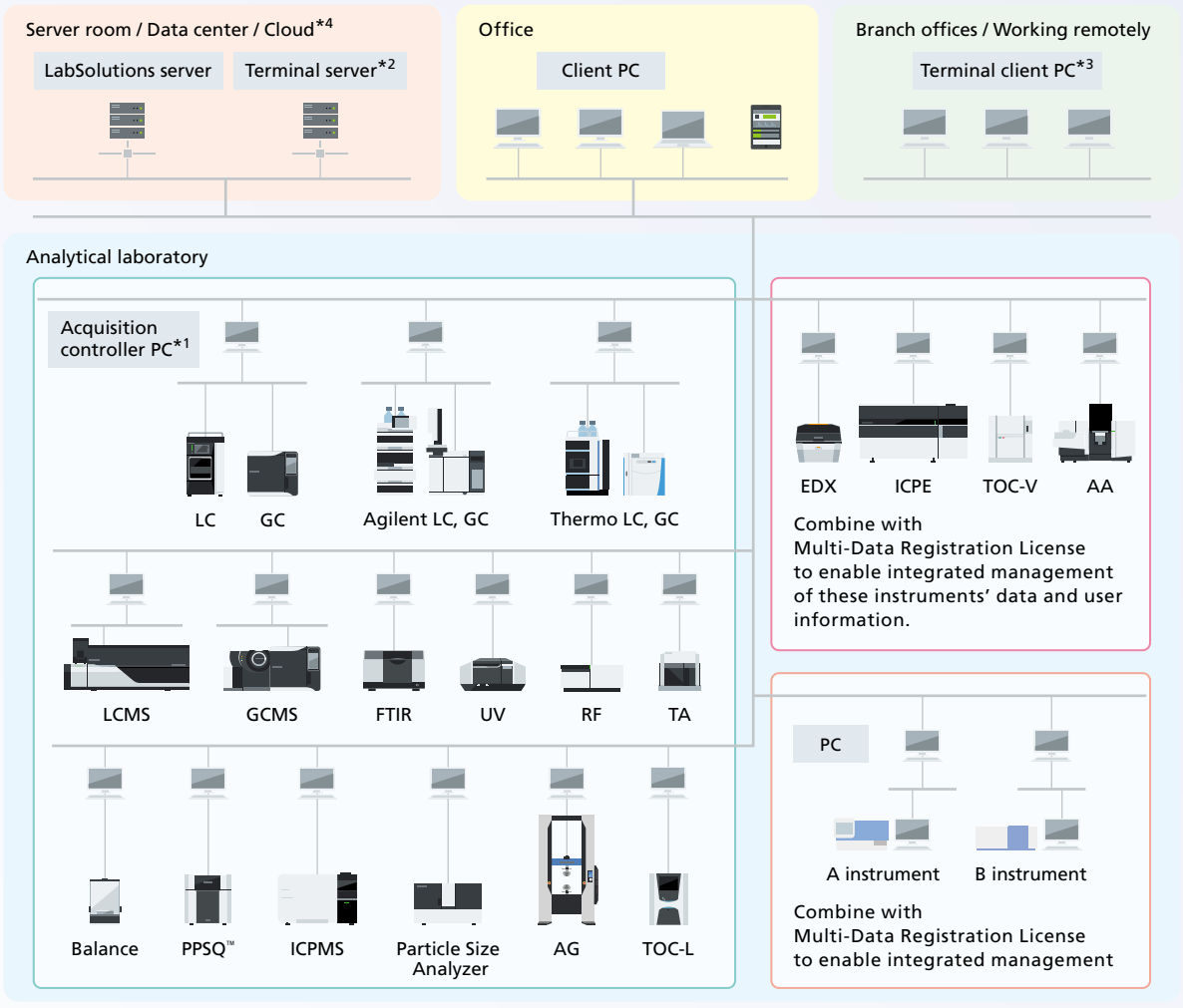
Internal standard fluctuation can be displayed as a graph for the entire analysis time, as either intensity or intensity ratio with respect to a reference sample. This helps quickly identify complications that occur due to sample matrix effects.



LabSolutions™ ICPMS TRM (Optional)

Shimadzu LC-ICP-MS systems combined with LabSolutions ICPMS TRM software can be used to speciate arsenic, mercury, and other elements. The software controls and configures both LC and ICPMS systems in one simple platform.

LabSolutions™ CS Supports Laboratory Networking



*1 The acquisition controller PC controls analytical instruments.

*2 A terminal server is a server for using terminal services. Users can view data reports and perform electronic signature operations through terminal services. It is ideal for remote connections because of the low network load. Only LC, GC, LCMS, and GCMS support analysis and postrun operations through terminal services.

*3 If a terminal service is used, LabSolutions software does not need to be installed on client PCs or tablets.

*4 Servers can be built on various clouds (IaaS). AWS (Amazon Web Services), Microsoft® Azure®, GCP™ (Google Cloud Platform™)

Adding a LabSolutions™ DB/CS connection kit (optional) enables compliance with electronic record-keeping and electronic signature regulations, such as requirements specified in FDA 21 CFR Part 11. Select either a standalone (LabSolutions DB) or networked (LabSolutions CS) system that is best for the given application. LabSolutions CS manages all analytical data in a database on a network server, so that the data can be loaded and postrun analysis can be performed on any computer connected to the network.

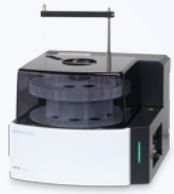
Note: An additional software license is required for loading data onto a computer not connected to an ICPMS-2040/2050 Series system.

Software Required for Connecting to LabSolutions

Name	P/N	Remarks
LabSolutions DB Connection Kit for ICPMS	211-49204-92	Standalone system
LabSolutions CS Connection Kit for ICPMS	211-49241-92	Network system
Second License for LabSolutions ICPMS	211-49245-91	Required for installing LabSolutions ICPMS on a computer other than the control computer

Peripheral Equipment

AS-20 Autosampler (P/N 211-97400-58)



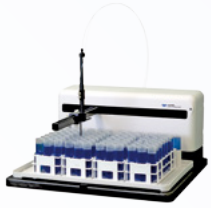
The rotary-type autosampler has 60 15-mL and 8 50-mL vial positions.

Dimensions	W290 × D508 × H300 mm (excluding arm)
Power supply	Single-phase 100-240 V, 50/60 Hz, 50 VA
Weight	11 kg (main unit)

Note: Requires a separate power cord.

Note: An additional rinsing port is optional
Rinse Port Additional Kit for AS-20 (P/N 211-97460-41).

ASX-560 Autosampler (P/N 211-94230-01)



ASX-560 holds 240 14-mL vials and 10 50-mL vials for standards. By replacing the standard rack with a rack sold separately, 160 20-mL vials or 84 50-mL vials can be held.

Dimensions	W580 × D550 × H620 mm (including sample probe)
Power supply	100–240 V AC, 50/60 Hz, 200 VA
Weight	12 kg (main unit)

Note: Requires a separate ASX connection kit for ICPMS (P/N 211-94476-41).

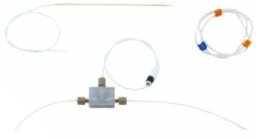
ASX-280 Autosampler (P/N 211-94412)

ASX-280 holds 120 14-mL vials and 10 50-mL vials for standards. By replacing the standard rack with a rack sold separately, 80 20-mL vials or 42 50-mL vials can be held.

Dimensions	W360 × D550 × H660 mm (including sample probe)
Power supply	100-240V AC, 50/60Hz, 200 VA
Weight	8.1 kg (main unit)

Note: Requires a separate ASX connection kit for ICPMS (P/N 211-94476-41).

Online Internal Standard Kit (P/N 211-95010-41)



This kit is used for in-line mixing of sample and internal standard solution and introducing the mixture into the nebulizer.

Dual Valve Unit (P/N 211-97472-41)

This is used to automatically switch between multiple solutions, such as pure water, instrument tuning solution, internal standard solution and cleaning solution.

Dimensions	W95 × D170 × H145 mm
Power supply	100-240 V AC, 200 VA
Weight	1.8 kg (main unit)

Note: Requires a separate AC adapter and power cord.

HFS-6 Hydrofluoric Acid Sample Injection System (P/N 211-93828-42)

This system is used to directly introduce samples that contain hydrofluoric acid. Fluoropolymer materials are used in the nebulizer, chamber, and drain system, whereas alumina is used in the injector unit on the torch.

Organic Solvent Injection System (P/N 211-97019-41)

For analysis of organic solvents, a gas mixture of 70% argon and 30% oxygen is introduced into the torch to prevent precipitation of carbon (C) from organic solvents. This system includes a gas controller for mixed gases, a quadruple torch for organic solvents, and pump tubing for organic solvents (for ethanol/methanol/IPA).

Cyclone Chamber, Quartz (P/N 211-95849)

This chamber is used to analyze trace boron, which is challenging to analyze using a standard borosilicate glass chamber.

Standard Torch Kit (P/N 211-97222-41)

This kit includes a torch with a 1.8 mm injector bore diameter that supports a 1.6 kW high-frequency output as well as a compatible shield screen, bonnet, and adapter.

3rd Gas Introduction Unit (P/N 211-96095-41)

This gas controller unit is for using a 10 % ammonia and 90 % helium gas mixture as the reaction gas in an ICPMS-2050 system.

Water Bubbler (P/N 204-19281)

This is used to humidify argon gas and prevent clogging of the torch and nebulizer when analyzing high TDS samples.

LC Connection Kit (P/N 211-96650-41)

This connection kit is required for configuring an LC-ICP-MS system that combines an ICPMS-2040/2050 Series system with a Nexera inert series or Prominence inert analysis system. For information about compatible LC systems, contact Shimadzu.

LabSolutions ICPMS TRM (P/N 211-49200-92)

This software is for controlling Shimadzu LC and ICPMS-2040/2050 Series systems and analyzing chromatography data.

Vacuum Pump

A rotary or dry pump is required for backing the turbomolecular pump and evacuating the interface unit. Power is supplied to the pump from the ICPMS main unit.

Rotary Pump, PFPE (P/N 211-90070-42)

This pump is lubricated with a PFPE oil that allows the pump to be used for applications ranging from regular analysis to LC-ICP-MS analysis.

Dimensions	W496 × D295 × H325 mm
Weight	Approx. 50 kg

Dry Pump (P/N 211-96382-91)

This oil-free dry pump has low maintenance requirements.

Dimensions	W494 × D217 × H301 mm
Weight	Approx. 30 kg

Name	P/N	Remarks
Caster	225-27850-05	Rotary pump stand with caster wheels
Noise Absorbing Box, Large	225-27850-07	Requires a separate rotary pump noise reduction box kit (P/N 211-93825-41).
Vacuum Hose Elbow Connection	211-96090-41	Required for placing the pump under the support stand
Long Vacuum Hose, 4 m	211-97232-42	For extending the rotary pump exhaust hose
RP Power Cable, 3 m	211-95576-41	For extending the exhaust hose

Cooling Water Circulator

Used to cool the main unit. Select one of the following.

Standard Model Cooling Water Circulator, SMC (P/N 211-97273-41)

Dimensions	W377 × D500 × H615 mm
Power supply	Single-phase 200 to 230 V, 50/60 Hz, 1.2 kVA
Weight	43 kg

Note: Requires a separate chiller connection kit, SMC (P/N 211-93827-43).

Non-Freon Model Cooling Water Circulator, Apiste (P/N 211-97274-41)

Dimensions	W400 × D600 × H697 mm
Power supply	Three-phase 200 V 50/60 Hz, 1.2 kVA
Weight	58 kg

Note: Requires a separate chiller connection kit, Apiste (P/N 211-93827-42).

Accessories

Sample Introduction System

	Standard Set	For Organic Solvents	For Hydrofluoric Acid Resistance
Examples of Samples	Environmental water, effluent water, solutions with dissolved pharmaceutical or food substances, or other acid decomposition solutions	Organic solvents	Solution containing hydrofluoric acid
Torch	Mini Torch, 1.5 (P/N 211-96077)	Organic Solvent Torch (P/N 211-94021-41)	Mini Torch, HF (P/N 211-95846) 
	Shield Screen, Mini (P/N 211-93819) 	Shield Screen, Standard (P/N 211-93820) 	Shield Screen, Mini (P/N 211-93819) 
	Bonnet, Mini (P/N 211-95998) 	Bonnet, Standard (P/N 211-94047) 	Bonnet, Mini (P/N 211-95998) 
	Torch Adapter, Mini (P/N 211-93779-42) 	Torch Adapter, Standard (P/N 211-93780-42)	Torch Adapter, Mini (P/N 211-93779-42) 
Extension Pipe	Extension Pipe (P/N 211-95574)		Extension Pipe, HF (P/N 211-95847)
	Dilution Gas Tube (P/N 211-95989) 		
Chamber	Cyclone Chamber (P/N 211-96078)		Cyclone Chamber, HF (P/N 211-95848) 
	Helix CT Locking Screw with Seal (P/N 046-00093-95)		
Nebulizer	Nebulizer, DC04 (P/N 211-95988) 		Nebulizer, HF (P/N 211-95845)
	Carrier Gas Tube (P/N 046-00092-53) 	Suction Tube, NFT-050 (P/N 211-97567-41)	
Drain	Drain Trap (P/N 211-93814-01) 		Drain Trap, HF (P/N 046-00093-06) 
Peristaltic Pump Tube	Pump Tube, 0.76-BLK3B-95-F (P/N 018-31558-44)	Pump Tube, 0.76-BLK3B-95-SF-F (P/N 018-31558-61)*1 Pump Tube, 0.64-OW-MH-95-F (P/N 018-31558-32)*2 Pump Tube, PUR-T,381-2232F (P/N 016-46043-01)*3	Pump Tube, 0.76-BLK3B-95-F (P/N 018-31558-44)

*1: For ethanol/methanol/IPA *2: For DMF/NMP *3: For xylene/kerosene

Interface

	Standard Set	Option	
Sampling Cone	Nickel Sampling Cone (P/N 211-97283-03)	Platinum Sampling Cone (P/N 211-97283-04)	-
Skimmer Cone	Nickel Skimmer Cone, Small (P/N 211-90200-43) Used in combination with spacer for small skimmer (P/N 211-95342-01).	Platinum Skimmer Cone (P/N 211-90194-02)	Copper Skimmer Cone (P/N 211-90200-41)

Installation

Installation Information

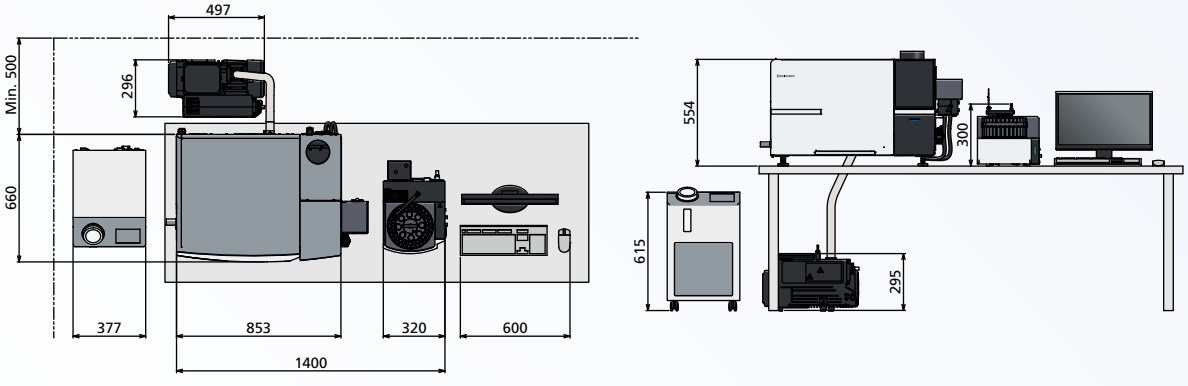
1. Installation Site Environment	Temperature within 18 to 28 °C (max. 2 °C/hour change)		
	Humidity within 20 to 70 %RH (with no condensation)		
	Avoid using the system in locations with significant vibration or dust.		
2. Power Supply	Main unit	Single-phase	200 to 240 V ± 10 %, 50/60 Hz,6 kVA
	Data processing	Single-phase	100 V ± 10 %, 50/60 Hz, 110 VA
	Cooling water circulator	Single-phase	200 to 230 V, 50/60 Hz, 1.2 kVA (standard type)
		Three-phase	200 V, 50/60 Hz, 1.2 kVA (non-CFC type)
3. Grounding	Should be grounded with a maximum resistance of 100 Ω.		
4. Gas Supply	Type	Argon gas	Min. 99.95 % purity Pressure: 500 ± 10 kPa
		Helium gas	Min. 99.999 % purity Pressure: 200 ± 20 kPa
		Hydrogen gas*1	Min. 99.999 % purity Pressure: 200 ± 20 kPa
		3rd gas*2 (gas mixture of 10 % ammonia and 90 % helium)	Min. 99.999 % purity Pressure: 200 ± 20 kPa
		Oxygen-argon mixture gas*3 (70 % argon and 30 % oxygen)	Pressure: 450 ± 10 kPa
5. Cooling Water	Use a dedicated cooling water circulator.		
6. Exhaust Duct	Exhaust flowrate of 2.4 to 3.3 m³/min at exhaust outlet (install a damper).		
7. Dimensions	W853 × D660 × H554 mm (excluding the plasma stand exhaust duct and other protrusions)		
8. Weight	144 kg		

Note: Refer to the pre-installation requirements for more details.
*1: ICPMS-2050 Series systems only. Hydrogen gas generators can also be used.
*2: When ICPMS-2050 Series systems are equipped with an optional 3rd gas system
*3: When an optional organic solvent injection system is installed

For more detailed system specifications, refer to the specifications sheet.

Example of External Dimensions and Installation Configuration

unit: mm



ANALYTICAL INTELLIGENCE

- Automated support functions utilizing digital technologies, such as M2M, IoT, and Artificial Intelligence (AI), that enable higher productivity and maximum reliability.
- Allows a system to monitor and diagnose itself, handle any issues during data acquisition without user input, and automatically behave as if it were operated by an expert.
- Supports the acquisition of high quality, reproducible data regardless of an operator's skill level for both routine and demanding applications.

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