



TELEDYNE CETAC TECHNOLOGIES
Everywhere you look™

Reinventing All Phases of Sample Introduction
Automation • Laser Ablation • Nebulizers • Sample Prep



Products and Parts Catalog

2nd Edition

Teledyne CETAC products and services are used in every industry where rapid and accurate determination of elemental trace levels are required. Major industrial and academic segments include environmental and clinical analysis, mining, semiconductors, petrochemicals, and geology.

Our advanced products and services include:

- Automated Sample Handling Systems for increasing productivity in the analytical laboratory.
- Laser Ablation Introduction Systems for the analysis of solids without sample dissolution.
- Nebulizers and Liquid Sample Introduction Systems for sensitivity enhancement, reduction of spectral interferences, and low-volume (< 1 mL) samples.
- Sample Preparation Supplies for the general enhancement of qualitative and quantitative analytical determination in the laboratory.

We are continually developing new products to meet the needs of our customers. For the most up-to-date selection of products, or to place an order, visit www.teledynecetac.com.

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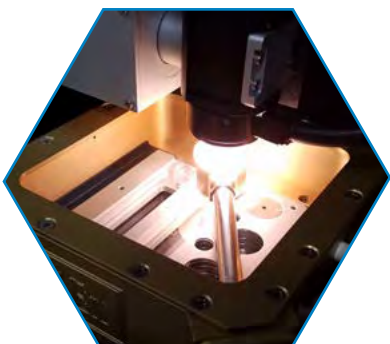
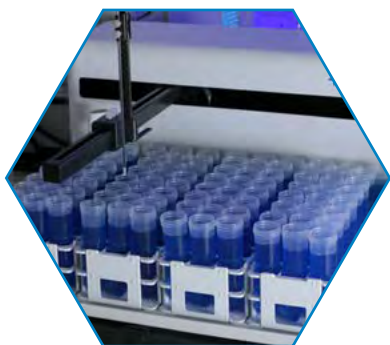


TELEDYNE CETAC TECHNOLOGIES

Everywhereyoulook™

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See what's new!

Aridus3

Desolvating Nebulizer System for ICP-MS



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SimPrep

Automated Liquid Handling Station



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Femtosecond Laser Ablation System



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High Energy Excimer Laser Ablation System



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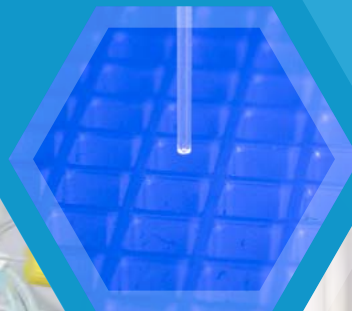
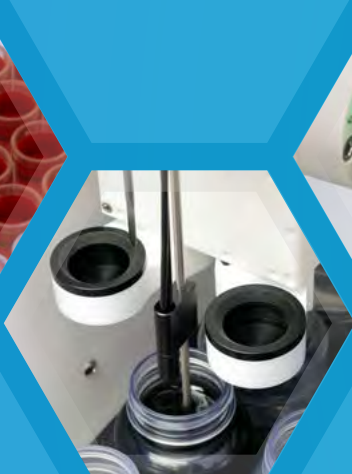
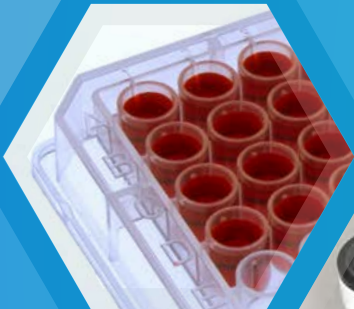
AUTOMATION

Since 1993, CETAC Technologies has provided the industry's highest quality autosamplers to meet the needs of its customers. CETAC Technologies Automation division emerged in response to the growing requests of customers for automation products that varied in size, speed and capabilities.

The underlying technology of CETAC Automation products has evolved since then with continuous hardware and firmware improvements. Based on this technology, CETAC Automation has consistently provided customers with reliable and well-supported products.

CETAC Automation delivers immediate solutions to the various challenges typical in laboratory environments with a variety of products and accessories including:

- Low to high volume autosamplers
- Micro-autosamplers
- Autodilutors
- Liquid handling stations
- Anti-contamination enclosures



ASX-560 Autosampler Series



More features and improved performance define the latest generation of autosampler from Teledyne CETAC Technologies. The ASX-560 family of autosamplers build upon the reliable mechanics of their predecessors with latest generation electronics, improved accessory interfaces, enhanced pumping capabilities, easier serviceability and a sleek new design!

Constructed with Inert Materials

- Plastic cover, base and tray
- Carbon fiber arm and Z-drive
- No exposed metal parts
- Ensures a clean sample environment

Robust Mechanics

- Lead-screw driven XY movement, just like its predecessors
- Select XYZ acceleration and speeds to match your application
- High resolution positioning

Improved Pumping and Rinsing

- Configurable rinse flow rates to meet your application (range of 0.1 – 80 mL/min)
- Virtually noiseless operation
- Optional dual rinse station

A Wide Range of Applications

- Environmental: 200.7, 200.8, 6010, 6020
- Pharmaceuticals
- Clinical
- Mining
- Wear Metals and Oils
- Semiconductor
- Soils

ASX-560 4-Rack Autosampler

Includes (unless otherwise noted):

- 4 each 60 position sample racks with full set of 15 mL vials
- 10 standard locations with 50 mL vials
- 0.5 mm I.D. carbon fiber supported sample probe
- Interface connect cables (DB9 and USB)
- Miscellaneous tubing for hookup
- Power supply with US, UK and European plugs

Technical Specifications

ASX-560 Dimensions

Height (w/ probe)	62 cm (24.4")
Width	58 cm (22.5")
Depth	55 cm (21.6")
X-Axis	42.0 cm (16.54")
Y-Axis	30.0 cm (11.81")
Z-Axis	15.5 cm (6.10")
Weight	11.7 kg (26 lb)

Speed

Axis	Min	Max
X	100 mm/sec	330 mm/sec
Y	73 mm/sec	411 mm/sec
Z	164 mm/sec	476 mm/sec

Pump

0 – 80 mL/min

Communication Interface

2 Serial (RS-232) ports
USB (virtual COM port)

Utilities

Autosampler Configuration tool to set XYZ and pump speed
Firmware Update Utility
IQ/OQ and Log Extractor Utilities

Power Requirements

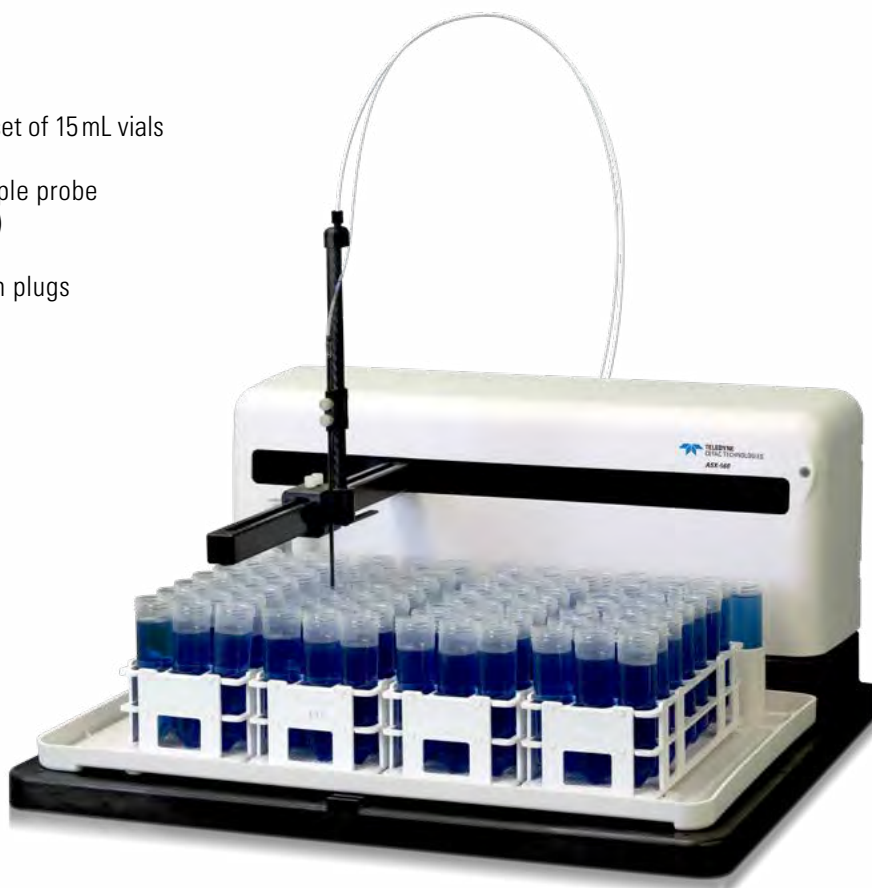
100-240 VAC, 47-63 Hz, 1.9A

Options

Clean Enclosures
HEPA filtration
ASXPRESS PLUS Rapid Sample Introduction System
SDXHPLD High Performance Liquid Dilution System
SimPrep Simple Automated Prep System

Warranty

2 year limited



Part Number	Description
A56-99-0009	ASX-560 Standard Version
A56-99-0013	ASX-560 Standard Dual Rinse Version
A56-99-0021	ASX-560 Standard Version w/ 0.8 mm Probe
A56-99-0003	ASX-560 Standard - No Racks / Vials / Probe
A56-99-0015	ASX-560 Agilent / H.P. Version
A56-99-0017	ASX-560 Agilent / Varian ICP-AES
A56-99-0026	ASX-560 AKTA Pure
A56-99-0027	ASX-560 Bio-Rad
A56-99-0006	ASX-560 P.E. Version
A56-99-0007	ASX-560 Spectro with Pump
A56-99-0008	ASX-560 Spectro without Pump
A56-99-0028	ASX-560 Thermo AA, ICP & ICP-MS

ASX-280 2-Rack Autosampler

Includes (unless otherwise noted):

- 2 each 60 position sample racks with full set of 15 mL vials
- 10 standard locations with 50 mL vials
- 0.5 mm I.D. carbon fiber supported sample probe
- Interface connect cables (DB9 and USB)
- Miscellaneous tubing for hookup
- Power supply with US, UK and European plugs

Technical Specifications

ASX-280 Dimensions

Height (w/ probe)	62 cm (24.4")
Width	35.5 cm (14")
Depth	55 cm (21.6")
X-Axis	22.2 cm (8.74")
Y-Axis	30.0 cm (11.81")
Z-Axis	15.5 cm (6.10")
Weight	8.1 kg (17.8 lb)

Speed

Axis	Min	Max
X	100 mm/sec	330 mm/sec
Y	73 mm/sec	411 mm/sec
Z	164 mm/sec	476 mm/sec

Pump

0 – 80 mL/min

Communication Interface

2 Serial (RS-232) ports
USB (virtual COM port)

Utilities

Autosampler Configuration tool to set XYZ and pump speed
Firmware Update Utility
IQ/OQ and Log Extractor Utilities

Power Requirements

100-240 VAC, 47-63 Hz, 1.9A

Options

Clean Enclosures
HEPA filtration
ASXPRESS PLUS Rapid Sample Introduction System
SimPrep Simple Automated Prep System

Warranty

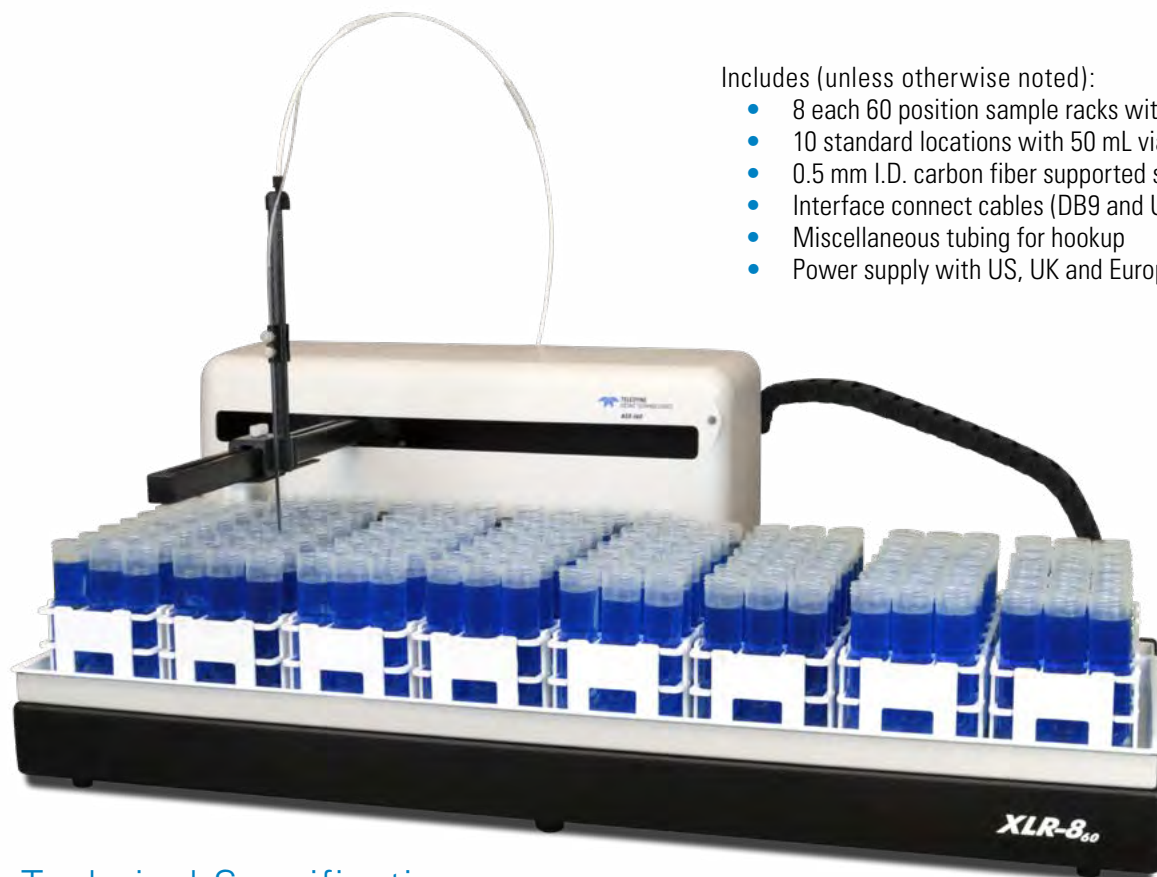
2 year limited



Part Number	Description
A28-99-0009	ASX-280 Standard Version
A28-99-0013	ASX-280 Standard Dual Rinse Version
A28-99-0021	ASX-280 Standard Version with .8 mm Probe
A28-99-0003	ASX-280 Standard - No Racks / Vials / Probe
A28-99-0026	ASX-280 AKTA Pure
A28-99-0027	ASX-280 Bio-Rad
A28-99-0025	ASX-280 P.E. Oils Version
A28-99-0007	ASX-280 Spectro with Pump
A28-99-0008	ASX-280 Spectro without Pump
A28-99-0028	ASX-280 Thermo AA, ICP & ICP-MS



XLR-8₆₀ 8-Rack Autosampler



Includes (unless otherwise noted):

- 8 each 60 position sample racks with full set of 15 mL vials
- 10 standard locations with 50 mL vials
- 0.5 mm I.D. carbon fiber supported sample probe
- Interface connect cables (DB9 and USB)
- Miscellaneous tubing for hookup
- Power supply with US, UK and European plugs

Technical Specifications

XLR-8₆₀ Dimensions

Height (w/ probe)	62 cm (24.4")
Width	112 cm (44")
Depth	55 cm (21.6")
X-Axis	2x 42.0 cm (16.54")
Y-Axis	30.0 cm (11.81")
Z-Axis	15.5 cm (6.10")
Weight	20.4 kg (45 lb)

Speed

Axis	Min	Max
X	100 mm/sec	330 mm/sec
Y	73 mm/sec	411 mm/sec
Z	164 mm/sec	476 mm/sec

Pump

0 – 80 mL/min

Communication Interface

2 Serial (RS-232) ports
USB (virtual COM port)

Utilities

Autosampler Configuration tool to set XYZ and pump speed
Firmware Update Utility
IQ/OQ and Log Extractor Utilities

Power Requirements

100-240 VAC, 47-63 Hz, 1.9A

Options

Clean Enclosures
HEPA filtration
ASXPRESS PLUS Rapid Sample Introduction System

Warranty

2 year limited

Part Number	Description
X86-99-0009	XLR-8 ₆₀ Extended Rack Standard Version
X86-99-0003	XLR-8 ₆₀ Extended Rack Std - No SS / Racks / Vials / Probe
X86-99-0017	XLR-8 ₆₀ Extended Rack Agilent / Varian Version
X86-99-0006	XLR-8 ₆₀ Extended Rack P. E. Version
X86-99-0005	XLR-8 ₆₀ Extended Rack Thermo AA, ICP & ICP-MS

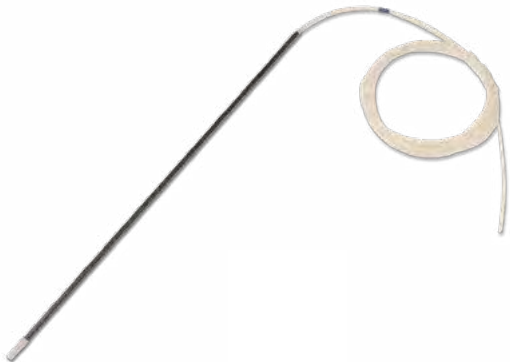
ASX-560, ASX-280, XLR-8₆₀ Spares

Sample Probes

10 in (25.4 cm) FEP-covered carbon fiber probe with PFA capillary. Rigid carbon fiber reinforcement ensures probe accuracy without the use of a guide plate when mounted to a Z-drive with double probe clamps.

Part Number	ID	Band	Length*
SP5799C	0.3 mm	Black	2.74 m (108 in)
SP5800C	0.5 mm	Blue	2.74 m (108 in)
SP5796C	0.8 mm	Red	2.74 m (108 in)
SP5950C	0.9 mm	Yellow	1.78 m (70 in)
SP6013C	1.0 mm	2 Blue	2.74 m (108 in)

*Capillary, not including probe

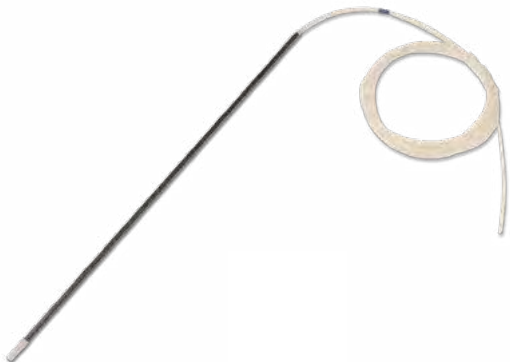


Drip Resistant Sample Probes

10 in (25.4 cm) FEP-covered carbon fiber probe with PFA capillary. Rigid carbon fiber reinforcement ensures probe accuracy without the use of a guide plate when mounted to a Z-drive with double probe clamps.

Part Number	ID	Band	Length*
SP5800N	0.5 mm	Blue	2.74 m (108 in)
SP5796N	0.8 mm	Red	2.74 m (108 in)
SP6013N	1.0 mm	2 Blue	2.74 m (108 in)

*Capillary, not including probe



Part Number	Description
SP5919	Thumbscrew and O-Ring Kit



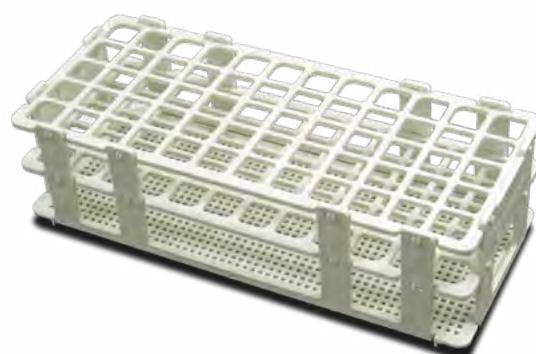
Part Number	Description
SP7174	Z-Axis Tubing Replacement Kit (PEEK Anti-Kink)



ASX-560, ASX-280, XLR-8₆₀ Spares

Sample Racks

Part Number	Vials	Opening	Vial Type
450362	90	13.3 mm round	7 mL or 8 mL vial
450055	90	13.5 mm square	7 mL or 8 mL vial
450056	60	17.0 mm square	14 mL/15 mL vial
450057	40	20.6 mm square	20 mL vial
450058	24	25.2 mm square	30 mL vial
450059	21	30.5 mm square	50 mL vial



Sample Vials

Material for all vials is polypropylene

Part Number	Qty	Vol	Description
SP5178A	1000	7 mL	13 x 82 mm, w/ cap
SP5178E	250	7 mL	13 x 82 mm, w/ cap
SP5178K	1000	8 mL	13 mm x 100 mm
SP5178L	250	8 mL	13 mm x 100 mm
SP5178B	1000*	14 mL	16 mm x 100 mm
SP5178F	250	14 mL	16 mm x 100 mm
SP5178M	1000	15 mL	17 mm x 100 mm
SP5178N	250	15 mL	17 mm x 100 mm
SP5178G	500	20 mL	21.5 mm x 100 mm
SP5178I	100	20 mL	21.5 mm x 100 mm
SP5178H	500	30 mL	25 mm x 95 mm
SP5178C	500	50 mL	30 mm x 115 mm, w/ cap
SP5178J	100	50 mL	30 mm x 115 mm, w/ cap

*approximate quantity, measured by weight



Standards Vials

Part Number	Qty	Vol	Description
SP5178C	500	50 mL	30 mm x 115 mm, w/ cap
SP5178J	100	50 mL	30 mm x 115 mm, w/ cap

250 mL Bottle and Adapter

Part Number	Description
SP5228	Bottle – 250mL (5 per kit)
SP5239	Adapter plate for 250mL bottles (for ASX-280)
SP7640	Adapter plate for 250mL bottles (for ASX-560)



ASX-560, ASX-280, XLR-8₆₀ Spares

2-Channel Peristaltic Pump Tubing Cartridge

Pre-assembled, easy to install. Tubing material is equivalent to the listed brand name, but may be produced by other manufacturers.

The interior diameter (ID) of the tubing affects flow rate. A 2 mm tube on the rinse supply channel may be used with a 3 mm tube on the drain channel to ensure that the rinse station never overflows.

Part Number	Id(mm)	Tubing Color	Endplate Color
Equivalent to PharMed® material. Applications: Pharmaceutical, Biological, and Food and Beverage			
SP7476	2, 2	Tan	Black
SP7477	2, 3	Tan	Red
SP7478	3, 3	Tan	White
Equivalent to Tygon® material. Applications: Laboratory Research, Food & Beverage, Biological, Pharmaceutical, Medical Device, Consumer Products, Environmental			
SP7479	2, 2	Clear	Black
SP7480	2, 3	Clear	Red
SP7481	3, 3	Clear	White
Equivalent to Tygon® Fuel and Lubricant material. Applications: Most fuels and industrial lubricants			
SP7482	2, 2	Yellow	Black
SP7483	2, 3	Yellow	Red
SP7484	3, 3	Yellow	White
Equivalent to Viton® material. Applications: Acids, Solvents, High Temperature			
SP7485	2, 2	Black	Black
SP7486	2, 3	Black	Red
SP7487	3, 3	Black	White

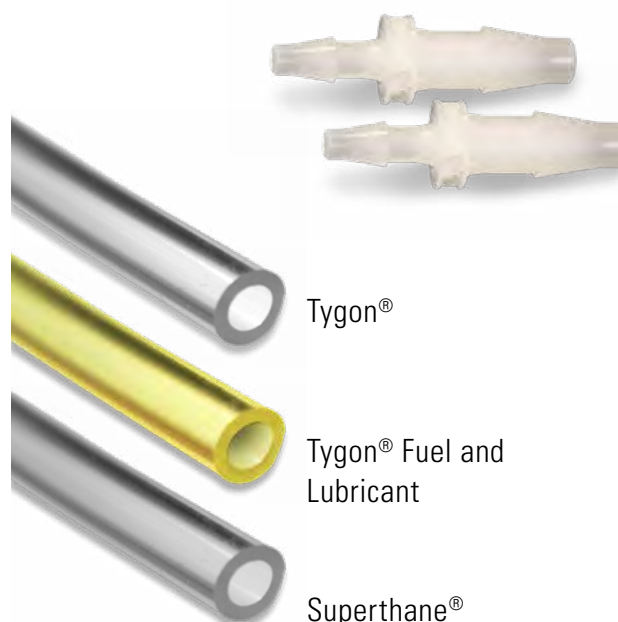


Rinse/Drain Tubing Hookup Kit

Includes:

- 1/8" X 3/16" KYNAR® PVDF couplers (qty. 2)
- 72 in (1.8 m) of 3/16" (4.8 mm) ID tubing
- 72 in (2.1 m) of 1/8" (3.2 mm) ID tubing

Part Number	Material	Typical Use
SP7473	Tygon®	Aqueous
SP7488	Tygon® Fuel and Lubricant	Oils
SP7489	Superthane® without PVDF couplers	Oils

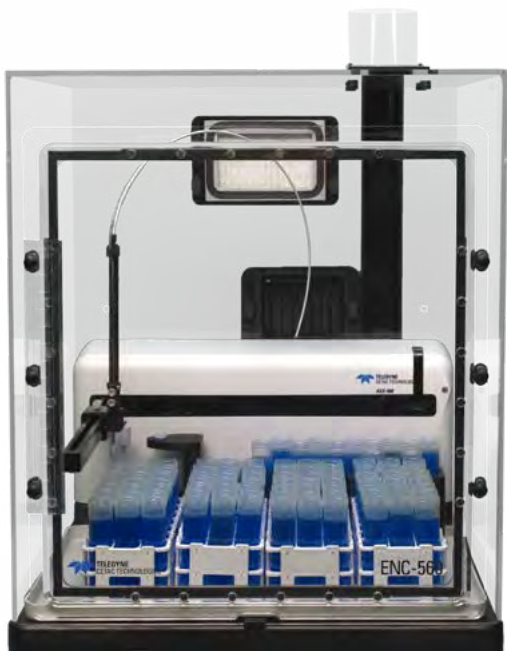


ASX-560, ASX-280, XLR-8₆₀ Spares

Part Number	Description	Image	Part Number	Description	Image
SP7439	ASX-560 Tray (10*)		SP7437	Z-Axis Drive Assembly Rinse Includes crash block with mounting kit and adhesive	
SP8317	ASX-560 Tray (5*)				
SP7521	ASX-280 Tray (10*)				
SP7025	XLR-8 ₆₀ Tray (none*) *standards positions				
SP6686	Internal Standard Addition Mixing Tee 4 x CTFE connectors 6 x CTFE 1.6 mm ferrules 1 x CTFE mixing tee 61 cm PFA tubing, 1.0 mm ID		SP7459	Y-Axis Home Flag without Probe Guide Used for most applications	
SP5337	Rinse Station		SP7458	Y-Axis Home Flag with Probe Guide	
SP7457	Molded Rinse Station		SP6375	USB Cable (3 Meters)	
SP7532	Dual Rinse Station		SP7441	RS-232 interface cable (3 Meters) (Female/Female)	
SP8322	1 Liter Waste Bottle		SP6103	24-Volt Power Supply	
SP5510	2 Liter Waste Bottle		Power Cords		
SP8320	15 Liter Waste Bottle Carboy with Handles		SP5003	North America	
			SP5004	Europe	
			SP5005	UK	
			SP6772	Australia	

ENC-560 Integrated Enclosure

for ASX-560 Autosampler



ENC-560 Integrated Enclosure (shown with ASX-560)

Maximize sample integrity and promote safety in the lab without compromising convenience. The metal-free, acrylic ENC-560 Integrated Anti-Contamination Enclosure isolates samples from external impurities. HEPA filtration cleans the air above the samples while downward airflow maximizes evacuation efficiency.

Corrosive vapors are swept away from the autosampler electronics, improving autosampler reliability and longevity. The vent chimney is attached to the outside of the enclosure to prevent external contamination.

The ENC 560 attaches directly to the ASX-560 base, taking no additional bench space and leaving the pump, tubing, power switch, and cables completely accessible on the outside.

Part Number	Description
ENC-99-0008	ENC-560 Enclosure Installed
ENC-99-0007	ENC-560 Upgrade (ships separately)



Rear view of the ENC-560, showing onboard HEPA filter, external exhaust chimney, and full access to autosampler pump, tubing and cables.

Technical Specifications

Dimensions

Height	78 cm (30.5")
Width	58 cm (22.8")
Depth	61 cm (23.8")
Door (H x W):	50.3 cm x 48 cm (19.9" x 18.9")
Opening (H x W):	47.6 cm x 45 cm (18.75" x 17.75")

Materials

Walls: ¼" acrylic
Hinges: Acrylic
Seals: EDPM Foam

Adhesive

Ethylene dichloride glue, thermoset bonded

Exhaust

4", 5", or 6" fume hood exhaust attachment

Accessories

Flow meter (up to 5 L per minute); HEPA filter; Positive pressure fan

Warranty

12 month limited

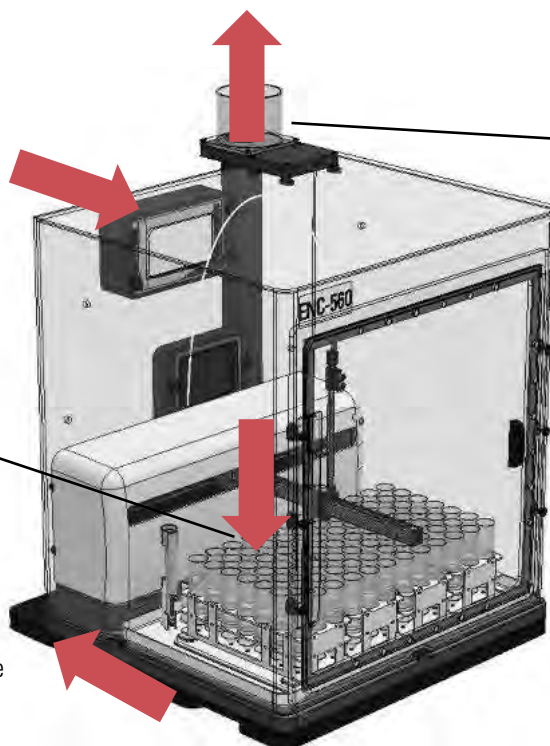


ENC-560 Airflow

1. Laboratory air is pulled in through HEPA filter to ensure clean sample environment.

2. Fumes are pulled down into the base of the ASX-560.

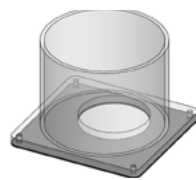
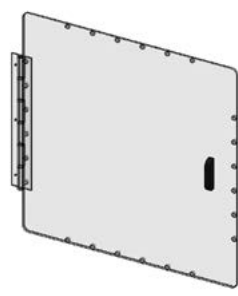
3. Fumes are channeled out the rear of the ASX-560 through a fume tunnel built in the base.



4. Fumes exit the ASX-560 fume tunnel and enter the ENC-560 fume tunnel, moving upwards and exiting from the top of the ENC-560 to your laboratory ventilation.

- ✓ Designed along with the ASX-560 to provide maximum sample integrity
- ✓ Fumes diverted away from electronics and mechanical parts to preserve the long life of the equipment

ENC-560 Enclosure Spares

Part Number	Description	Image	Part Number	Description	Image
SP8321	ENC-560 HEPA Filter (not included with enclosure)		SP8330	ENC-560 Tubing Connection Kit	
SP8326	Positive Airflow Adapter Kit (115V)		SP8323	Exhaust flange 3" adapter	
SP8327	Positive Airflow Adapter Kit (220V)		SP8324	4" adapter	
SP8328	Positive Airflow Adapter Kit with HEPA Filter (115V)		SP8325	5" adapter	
SP8329	Positive Airflow Adapter Kit with HEPA Filter (220V)		SP8331	Replacement door for ENC-560	
SP6040	ENC-500 Gas Flow Meter Kit		SP8332	ENC-560 Door Seal Kit, 100 Inches	

ENC DC Series Autosampler Enclosures

ENC series DC Autosampler Enclosures protect your samples, your employees, and your peace of mind.



DC Autosampler Enclosure Features

- Save bench space with an enclosure sized to fit your autosampler (see below)
- Flat pack design for inexpensive shipping
- Shatter-proof polycarbonate construction
- Quickly evacuates harmful fumes and protects samples from contamination
- Prevents contamination and corrosion
- Easy access to samples and autosampler components through front and rear
- Chemical resistant materials
- Multiple configuration possibilities for vent and fan
- Multiple ports for tubing and power cords
- Can be used without the fan and filter to function as a convenient dust cover
- Included 4" exhaust port flange
- Optional fan maintains positive pressure
- Optional HEPA filter
- Optional rigid base for irregular lab surfaces
- Multiple models, compatible with CETAC ASX-130, ASX-260, ASX-280, ASX-520, ASX-520HS, ASX-560, EXR-8, XLR-8, and XLR-860 autosamplers and more!

Technical Specifications

Dimensions	Height	Width	Depth	Weight
ENC-560DC	65 cm (26 in)	60 cm (24 in)	58 cm (23 in)	11 kg (25 lb)
ENC-280DC	65 cm (26 in)	43 cm (17 in)	58 cm (23 in)	8 kg (17 lb)
ENC-860DC	98 cm (39 in)	111 cm (44 in)	67 cm (27 in)	22 kg (49 lb)

Shipping Details	Box 1	Box 2	Base
ENC-560DC	28" x 28" x 1.5" at 15 lb	8" x 8" x 24" at 10 lb	28" x 25.5" x 1" at 18 lb
ENC-280DC	28" x 28" x 1.5" at 15 lb	8" x 8" x 17" at 7 lb	28" x 18" x 1" at 12 lb
ENC-860DC	33" x 33" x 1.75" at 30 lb	12" x 12" x 48" at 23 lb	48" x 30" x 1" at 35 lb

Materials

polycarbonate frame
silicone and polyethylene plugs
nylon fittings

Exhaust

4" fume hood exhaust attachment

Optional Accessories

HEPA filter
Positive pressure fan
Gas flow meter (up to 5 L per minute)
Base for irregular surfaces

Warranty

1 year limited (by manufacturer)



ENC-560 DC

for ASX-560 and 4-rack autosamplers

Part Number	Description
ENC-99-0010	ENC-560 DC Autosampler Enclosure



ENC-280 DC

for ASX-280 and 2-rack autosamplers

Part Number	Description
ENC-99-0011	ENC-280 DC Autosampler Enclosure

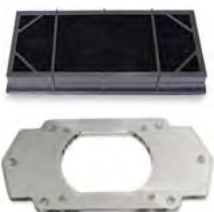


ENC-860 DC

for XLR-8₆₀ and 8-rack autosamplers

Part Number	Description
ENC-99-0012	ENC-860 DC Autosampler Enclosure

ENC DC Series Enclosure Spares

Part Number	Description	Image
	Enclosure Fan - positive air flow for use with HEPA filter when vent is not available. Provides a flow rate of 121 CFM.	
32-0099-045	North America	
32-0100-045	Europe	
32-0101-045	Australia	
	HEPA Filter (Requires adapter plate)	
32-0162-045	Filter with adapter plate	
32-0102-045	Filter replacement only	

Part Number	Description	Image
	Exhaust flange	
32-0288-045	2.5" Diameter	
32-0289-045	3.0" Diameter	
32-0290-045	3.5" Diameter	
32-0103-045	4.0" Diameter	
	Autosampler Base	
32-0105-045	for ASX-280	
32-0104-045	for ASX-560	
32-0106-045	for XLR-8 ₆₀	

SimPrep Automated Liquid Handling Station

The SimPrep is more than just a mixing and dispensing tool; it can automatically create:

- Calibration curves
- Splitting (prep 1 sample 3 different ways)
- Matrix spikes
- Internal standard additions
- Serial dilutions

Typical Results

- Homogenous dilutions up to 2000x
- Carryover < 0.01%
- Precision 100% at < 0.2%
- Accuracy 100% $\pm$ 1%
- Linearity $r^2 = > 0.999996$ over wide ranges



Part Number	Description
SIM-99-0560	SimPrep 560 System
SIM-99-0280	SimPrep 280 System
SIM-99-0000	Upgrade (autosampler not included)

Technical Specifications

Autosampler Dimensions

	ASX-560	ASX-280
Height*	62 cm (24.4")	62 cm (24.4")
Width	58 cm (22.5")	35.5 cm (14")
Depth	55 cm (21.6")	55 cm (21.6")
Weight	11.7 kg (26 lbs)	8.1 kg (17.8 lbs)

*with sample probe

Dilution Module Dimensions

Height	26.7 cm (10.5")
Width	14 cm (5.5")
Depth	17.8 cm (7")
Weight	5.9 kg (13 lbs)

Syringe Sizes

wide range from 10 μ L to 50 mL

Fluid Contact Materials

Components in the sample flow path are inert, non-metallic materials

Rack Options

CETAC 21, 24, 40, 60, 90 position racks

Hardware Interfaces

RS-232 and USB

Power Requirements

100-240 VAC, 47-63 Hz, 1.9 A

Minimum Computer Requirements

Microsoft Windows® 7 operating system or newer
2 free COM or USB ports
Adobe® Acrobat® Reader is required to read the manuals that accompany the software.



SimPrep Spares

Hamilton Standard μ L Syringes

Part Number	Capacity
32-0381-031	10 μ L
32-0382-031	25 μ L
32-0383-031	50 μ L
32-0384-031	100 μ L
32-0385-031	250 μ L
32-0386-031	500 μ L



Hamilton Standard mL Syringes

Part Number	Capacity
32-0387-031	1.0 mL
32-0388-031	2.5 mL
32-0389-031	5.0 mL
32-0390-031	10.0 mL
32-0391-031	25.0 mL
32-0392-031	50.0 mL



Part Number	Description	Image
32-0398-050	Microlab 600, Universal Valve, Left	
32-0399-050	Microlab 600, Universal Valve, Right	
32-0400-028	Fitting, universal valve plug	
32-0401-045	ML600 Valve Cross Tube Assembly	
SP6408C	Probe, 1.0mm Carbon Fiber	
472113	Syringe to Probe tubing	

Part Number	Description	Image
472112	Syringe to Diluent tubing	
SP8336	Tubing Coupler	
360261	Simprep USB to Serial Cables	
SP6103	24-Volt CETAC Power supply	
32-0397-051	Hamilton Power Supply Universal	

See listing starting on page 9 for autosampler spares.

SDX_{HPLD} High Performance Liquid Dilution System



A New Spin On Proven Technology

The SDX_{HPLD} system combines the ASX-560 autosampler with a novel vortex mixing dilution accessory. The SDX uses 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 ICP and ICP-MS.

Vortex mixing promotes homogenization of a sample to ensure accurate and precise analysis following dilution, whatever the sample matrix. This ability to fully homogenize a dilution mixture will improve data quality over in-line combination.

Part Number	Description
SDX-99-0005	SDX Sample Dilution System, Thermo Version
SDX-99-0005XP	SDX Sample Dilution System with <i>ASXPRESS PLUS</i> Thermo

Technical Specifications

ASX-560 Dimensions

Height (w/ probe)	62 cm (24.4")
Width	58 cm (22.5")
Depth	55 cm (21.6")
Weight:	13.6 kg (29.9 lb) with vortex module

SDX Module Dimensions

Height	25.4 cm (10")
Width	13.2 cm (5.2")
Depth	21.6 cm (8.5")
Weight	4.4 kg (9.7 lb)

Autosampler Control Utilities

Firmware Updater Utility

Communication Interface

USB or Serial (RS-232) ports

Power Requirements

100-240 VAC, 47-63 Hz, 3.33A

Options

ENC-560 Integrated Clean Enclosure

ASXPRESS PLUS Rapid Sample Introduction System

Warranty

2 year limited



SDX_{HPLD} Technology Description

During normal operation the autosampler probe draws a sample which passes through the SDX module and continues to the ICP.

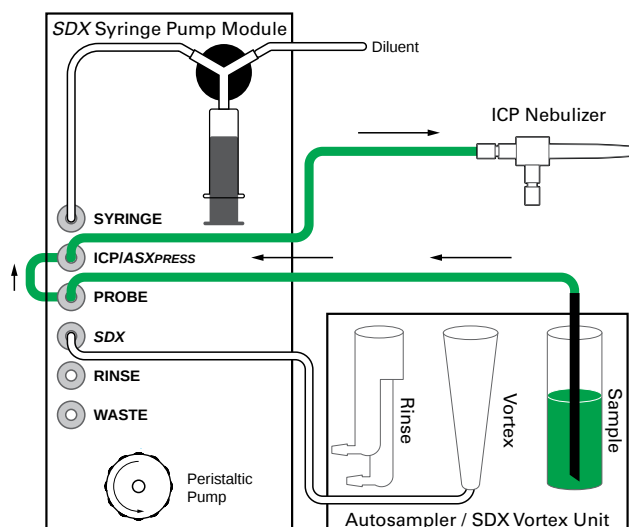
For a dilution, the same probe is connected to a high resolution syringe pump for aliquot and diluent addition to the vortex mixing vessel.

Following measurement, any remaining sample is drained and the vortex vessel is cleaned.

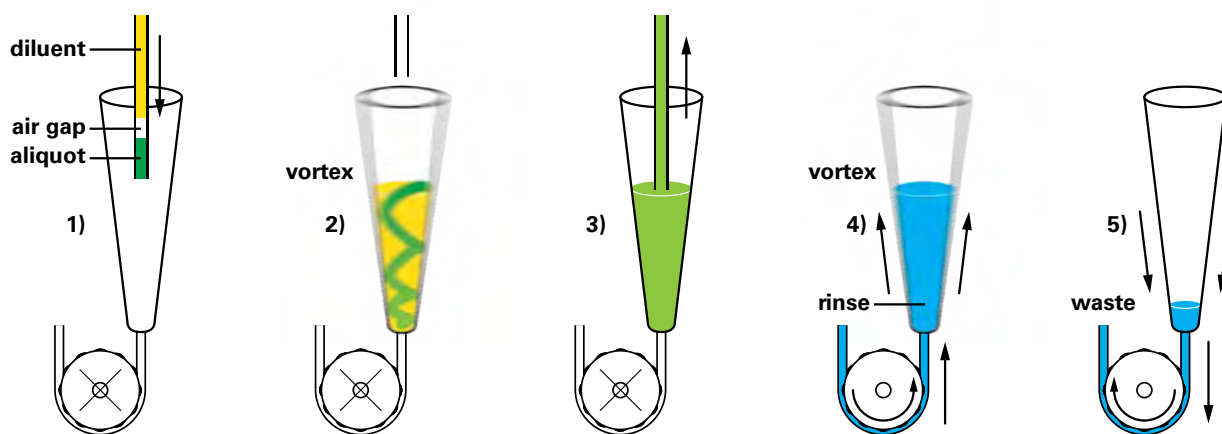
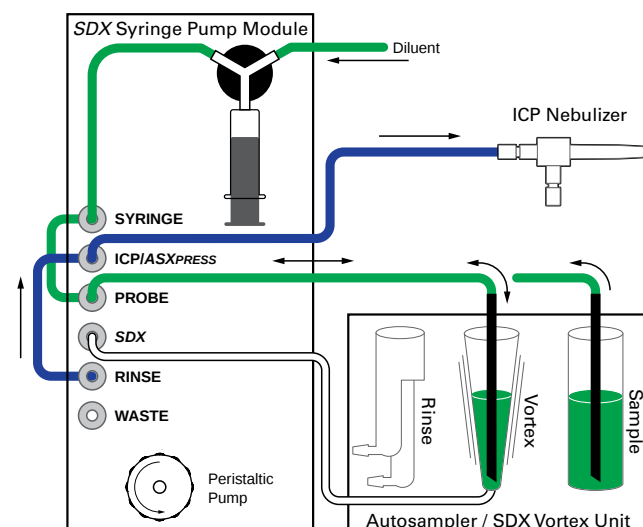
Dilution and Mixing

1. The probe line is primed with diluent
2. The syringe pulls the prescribed amount of diluent
3. The probe pulls up an air gap
4. The probe moves into the sample and takes the prescribed aliquot
5. The probe moves to the vortex vessel and dispenses both aliquot and diluent and the mixture is mixed
6. The probe switches to normal operation then samples the homogenous solution

Normal Operation



Dilution and Mixing



- (1) aliquot and diluent are delivered to the vessel (2) vessel is mixed (3) dilution is sampled
(4) fresh rinse is added and mixed (5) waste is pumped away

The SDX_{HPLD} system can be set to rinse the vortex mixing vessel as many times as desired to ensure there is no carryover. The sample flow path and vortex mixing vessel are comprised completely of inert materials that are free of trace metals and easy to clean.

The SDX_{HPLD} uses an independent rinse source from the ASX-560 Autosampler so that, if needed, a different rinse solution can be used for the autosampler probe versus the SDX_{HPLD} vortex mixing vessel.

SDX_{HPLD} Spares and Accessories

Carbon Fiber Autosampler Probes

10 in (25.4 cm) FEP-covered carbon fiber probe with PFA capillary. Rigid carbon fiber reinforcement ensures probe accuracy without the use of a guide plate when mounted to a Z-drive with double probe clamps.

Part Number	Id	Band	Description
SP5796C	0.8 mm	Red	2.74 m capillary
SP6408C	1.0 mm	2 Blue	2.74 m capillary



Mixing Vessel

Vortex mixing vessel for the SDX_{HPLD} mixing and calibration module. Vessels can be exchanged so separate vessels may be used for differing sample matrices. PFA construction with fluoropolymer seals.

Part Number	Description
SP8306	SDX Vortex Mixing Vessel



Syringe

Long-life, non-metallic syringe for the SDX_{HPLD} high precision syringe pump. Syringes may be exchanged for use with differing diluent solutions. Glass and PEEK construction.

Part Number	Description
SP8305	10 mL Syringe



SDX_{HPLD} Upgrade Kit

This kit includes everything needed to upgrade the ASX-560 Autosampler into an SDX_{HPLD} System. Includes the SDX control module, vortex mixing and calibration module, spill tray, as well as necessary lines and fittings.

Part Number	Description
SDX-99-0005U	SDX _{HPLD} Sample Dilution System, Upgrade Kit, Thermo Version



SDX_{HPLD} Spares and Accessories

Part Number	Description	Image	Part Number	Description	Image
SP8337	Check Valve For Use With <i>ASX_{PRESS PLUS}</i>		SP8314	T-Shaped Syringe Switching Valve (includes two fixing screws)	
SP5919	Thumbscrew & O-Ring Kit		SP6435	2 Liter Rinse Bottle	
SP8304	O-Ring for Vortex Mixer and Vortex Mixing Vessel (2 pk)		SP8313	Vortex Mixing and Calibration Module	
SP8307	Syringe Module Rinse Tubing Kit Includes fitting on one end of each line. Includes RINSE, WASTE, and SYRINGE-DILUENT lines		SP7647	Mounting Shelf Allows mounting of the SDX module to top of the ASX-560 autosampler	
SP8308	Internal Tubing and Valve Kit		SP6375	USB Cable (3 Meters)	
SP6392	Sample Loop, 4.5 mL		SP7441	RS-232 interface cable (3 Meters) (Female/Female)	
SP8311	Peristaltic Pump Tubing		SP6103	24 Volt External Power Supply	
SP8315	ASX-560 Spill Tray for SDX _{HPLD} (no standards)		Power Cords		
			SP5003	US	
			SP5004	Europe	
			SP5005	UK	
			SP6772	Australia	

See listing starting on page 9 for autosampler spares.

ASXPRESS PLUS Rapid Sample Introduction System



The ASXPRESS PLUS is a sample injection accessory that dramatically increases sample throughput with an ICP-AES or ICP-MS. The ASXPRESS PLUS features a metal-free, 6-port injection valve and an inert, high-speed vacuum pump for rapid sample loop loading prior to introduction via the host nebulizer. A simple user interface loaded in the host computer controls ASXPRESS PLUS parameters such as sample loop load time; all system parameters are stored in the ASXPRESS PLUS control module.

Cost Effective

- Minimize sample consumption
- Reduce sample matrix exposure on parts such as nebulizers, spray chambers, ICP torches, and ICP-MS sampling cones
- Run sample sequences in less time, reducing laboratory costs associated with Ar gas and electric power consumption

ASXPRESS PLUS Upgrade Kits

Aqueous version

Part Number	Description	Includes
XPU-99-0021	ASXPRESS PLUS Kit for ASX-260/280/510/520/560 (Aqueous)	• 1.0 mm I.D. carbon fiber supported sample probe • Sample loops: 1 each 2.0mL & 4.0mL • ASXPRESS PLUS Software • Interface connect cables (DB9 & USB) • General tubing and completion kit for operation • Power supply with US, UK & European plugs
XPU-99-0066	ASXPRESS PLUS Kit for XLR-8/XLR-8 ₆₀	
XPU-99-0025	ASXPRESS PLUS Kit for EXR-8	

Oil version

Part Number	Description	Includes
XPU-99-0022	ASXPRESS PLUS Kit for ASX-260/280/510/520/560 (Oil)	• 1.0 mm I.D. carbon fiber supported sample probe • Sample loops: 1 each 1.02mL, 1.36mL & 2.00mL • ASXPRESS PLUS Software • Interface connect cables (DB9 & USB) • General tubing and completion kit for operation • Power supply with US, UK & European plugs • Diaphragm vacuum rinse pump (ASX-1400/1600 only)
XPU-99-0026	ASXPRESS PLUS Kit for ASX-1600	
XPU-99-0027	ASXPRESS PLUS Kit for ASX-1400 Gilson 60 Position Rack	
XPU-99-0028	ASXPRESS PLUS Kit for ASX-1400 60/80 Position Rack	
XPU-99-0029	ASXPRESS PLUS Kit for ASX-1400 90/96 Position Rack	

Technical Specifications

Valve/Pump Module

Height	12.8 cm	(5.0")
Width	5.8 cm	(2.3")
Depth	21.7 cm	(8.5")
Weight	1.30 kg	(2.8 lb)

Electronics Module

Height	25.4 cm	(10.0")
Width	8.3 cm	(3.3")
Depth	20.0 cm	(7.9")
Weight	1.20 kg	(2.6 lb)

Hardware Interfaces

RS-232 to autosampler
RS-232 and/or USB to PC
External pump connector

Power

100-240 VAC ~ 47-63 Hz 1.9A

Sample Loop Sizes

Available in multiple volumes for various applications from 0.7 mL to 5.25 mL.

Computer Requirements

Configuration tool requires Microsoft Windows® 7 operating system or later release.
No software is required for system operation.

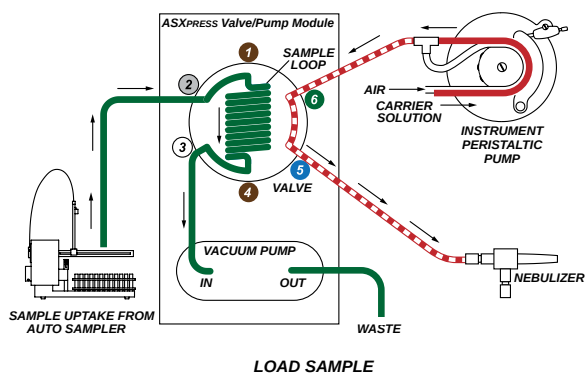
Warranty

2 year limited



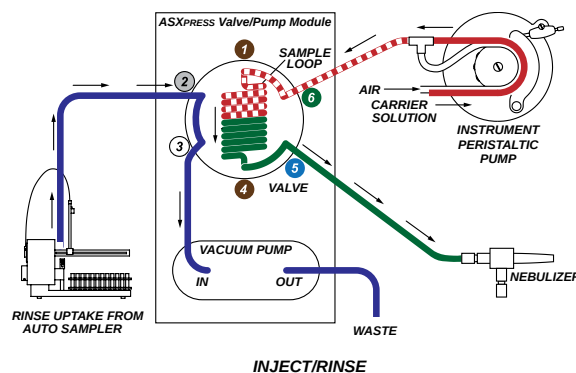
Analysis with ASX^{PRESS PLUS} Technology

The ASX^{PRESS PLUS} utilizes a high speed vacuum pump in addition to the ICP-AES/ICP-MS peristaltic pump. The 6-port valve allows the use of both pumps simultaneously (illustrated below) significantly reducing total sample analysis time.



Load Position

The vacuum pump rapidly fills the sample loop (green path), while the ICP-AES or ICP-MS peristaltic pump simultaneously transports carrier solution, keeping the plasma stable (red path).



Inject/Rinse Position

The loaded sample is then pushed into the nebulizer for analysis via the carrier solution flowing through the ICP-OES or ICP-MS peristaltic pump (red/green path). Simultaneously, the autosampler probe is moved to the rinse station and the uptake flow path is flushed with rinse solution via the vacuum pump.

ASX^{PRESS PLUS} Before and After

The Teledyne CETAC ASX^{PRESS PLUS} saves laboratories valuable time and money. Here are a few examples.

Market	Location	Method	Before (s)	After (s)	Savings (s)	Savings %	Time savings per 100 samples
Environmental	US Lab (OH)	ICP 6010	345	146	<u>199</u>	58%	5.5 hours
Environmental	US Lab (OH)	ICP 200.7	320	144	<u>176</u>	55%	5 hours
Environmental	US Lab (CA)	ICP 200.8	300	110	<u>190</u>	63%	5.2 hours
Environmental	US Lab (IL)	ICP 6020	275	145	<u>130</u>	47%	3.6 hours

Market	Location	Method	Before (s)	After (s)	Savings (s)	Savings %	Time savings per 100 samples
Soil	US Lab (NE)	Soil Method	46	26	<u>20</u>	43%	6 hours
Mining	US Lab (NV)	ICP-Method	70	24	<u>46</u>	66%	13 hours
Mining	Australian Lab	ICP - Method	86	29	<u>57</u>	66%	15.8 hours
Oil/Wear Metal	Canadian Lab	ASTM D5185	87	27	<u>60</u>	69%	16.6 hours
Oil/Wear Metal	US Lab (IN)	ASTM D6130	67	23	<u>44</u>	66%	14 hours

ASXPRESS PLUS Spares and Accessories



Large ID Aqueous Sample Loops

PTFE tubing, for use with the ASXPRESS PLUS valve/pump module. Includes 2 connectors and 2 ferrules.

Part Number	Capacity	ID (mm)
SP6415	0.70 mL	2.0 mm
SP6384	1.00 mL	2.0 mm
SP6385	1.25 mL	2.0 mm
SP6386	1.50 mL	2.0 mm
SP6387	2.00 mL	2.0 mm
SP6388	2.50 mL	2.0 mm
SP6389	3.00 mL	2.0 mm
SP6390	3.50 mL	2.0 mm
SP6391	4.00 mL	2.0 mm
SP6392	4.50 mL	2.0 mm
SP6393	5.00 mL	2.0 mm
SP6394	5.25 mL	2.0 mm



Small ID Multi-Purpose Sample Loops

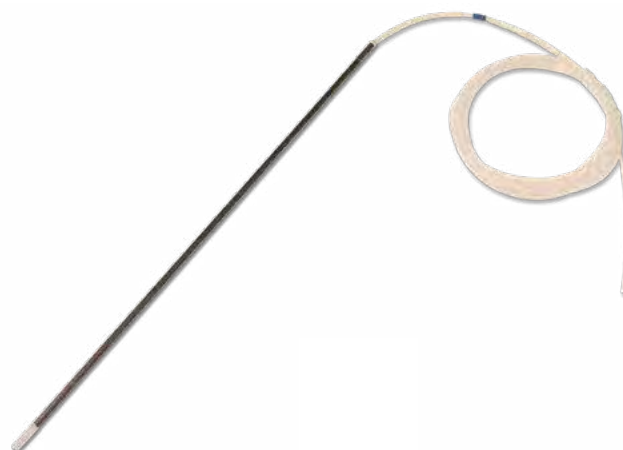
PFA tubing, for use with the ASXPRESS PLUS valve/pump module. Includes 2 flangeless connectors.

Part Number	Capacity	ID (mm)
SP6607	0.91 mL	1.0 mm
SP6608	1.02 mL	1.0 mm
SP6609	1.14 mL	1.0 mm
SP6610	1.25 mL	1.0 mm
SP6611	1.36 mL	1.0 mm
SP6612	1.48 mL	1.0 mm
SP6695	2.0 mL	1.0 mm
SP6696	2.5 mL	1.0 mm
SP6697	3.0 mL	1.0 mm

Carbon Fiber Autosampler Probe

10 in (25.4 cm) FEP-covered carbon fiber probe with PFA capillary. Rigid carbon fiber reinforcement ensures probe accuracy without the use of a guide plate when mounted to a Z-drive with double probe clamps.

Part Number	Id	Band	Description
SP6408C	1.0 mm	2 Blue	2.74 m capillary



ASXPRESS PLUS Spares and Accessories

ASXPRESS Valves

Part Number	Description
SP7588	7-Port Valve for Aqueous Applications with liquid uptake line for standard addition 1.52 mm (0.060") I.D. PPS construction
SP6541	6-Port Valve for Aqueous Applications 1.52 mm (0.060") I.D. PPS construction
SP6556	6-Port Valve for Oil Applications 0.76 mm (0.030") I.D. PPS construction



Part Number	Description	Image
SP6686	Internal Standard Addition Mixing Tee 4 x CTFE connectors 6 x CTFE 1.6 mm ferrules 1 x CTFE mixing tee 61 cm PFA tubing, 1.0 mm ID	
SP6688	Passive Bubbling Tee Tubing material: PFA and PEEK Fitting material: CTFE and PEEK	
SP6412	6-Port Valve Coupler	
SP6614	6-Port Valve Clamp Ring	
SP6404	Vacuum Pump	
SP8294	Vacuum Pump Connecting Plate	
SP6298	Barbed Fitting Kit, 1/4-28 to 1/16" barb (Six each in kit)	

Part Number	Description	Image
SP6399	Ferrule Kit Two each green, blue and Tefzel flangeless connectors with 1/16" ferrules Two 1/4"-28 to 1/8" barb fittings	
SP6406	Rinse Tubing Kit	
SP6407	Rinse Tubing Kit, Ultra-Clean (Used for ultra-clean applications—FEP lined)	
SP6409	Carrier/Rinse Bottle	
SP6572	ASXPRESS PLUS Articulating Mounting System Weight: 3.072 kg (6.7 lb)	

MVX-7100 μ L Workstation

Expanding The Scope Of Measurement

The MVX-7100 μ L Workstation is pushing the boundaries of ICP-MS applications. The μ L Workstation allows for sample volumes as low as 5 μ L. Syringe driven rinse allows for stable low flow from < 1 μ L/min to more traditional working flow rates of > 1 mL/min. Flow injection analysis allows isolation of sample injecting and loading, maximizing efficiency by cleaning the loading side while the sample is injecting. Modular design that allows for optimal placement and to expand your system as needed, including syringe modules and a temperature controlled rack. Dual rinse stations are standard to reduce any carryover for difficult elements or matrices.



Part Number	Description
A71-99-0010HR	MVX-7100 Micro Volume Workstation, 300W
A71-99-0013HR	MVX-7100 Micro Volume Workstation, 600W

Technical Specifications

System Space Requirements

(includes VSM, SPM, and rinse bottle)

Height	45.7 cm (18")
Width	66.1 cm (26")
Depth	50.8 cm (20")

Working Area

X-Axis	25.4 cm (10")
Y-Axis	15.3 cm (6")

Weight

29.5 kg (65 lb)

Reproducibility

< 1% RSD

Minimum Injection Volume

5 μ L

Minimum Flow Rate

1 μ L / min.

Probe Positioning Resolution

384-well microtiter plate capability

Communications Interfaces

2 Serial Ports;
USB (Virtual COM Port);
4 Aux Inputs / 4 Aux Outputs

Power Requirements

100-240 VAC, 50-60 Hz, 3.6 A

Rack Options

VT-54
Microtiter plates up to 384-well, up to 50 mm tall
CETAC ASX-110 racks

Warranty

2 year limited



MVX-7100 Spares and Accessories

Probe Needles

Part Number	Description
SP7508	Quartz sample needle 3" x 0.028" OD x 0.010" ID
SP7536	Quartz sample probe 3" x 0.0625" OD x 0.018" ID
SP6955	Stainless steel needle assembly



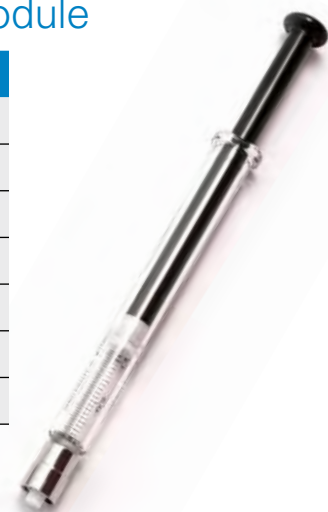
Syringe Pump Module

Part Number	Description
SPM-99-0004	SPM-700+



Syringe Barrels for Syringe Pump Module

Part Number	Capacity
SP7514	25 μ L
SP7515	100 μ L
SP7516	1 mL
SP7539	2 mL
SP7517	5.0 mL
SP7518	10 mL
SP7519	25 mL



Valve Pump Module

Part Number	Description
SP7512	Valve Syringe Pump Module



Syringe Barrels for Valve Pump Module

Part Number	Capacity
SP6863	25 μ L
SP6864	125 μ L
SP6843	500 μ L
SP7535	1.25 mL



MVX-7100 Spares and Accessories

Valve Sample Loops

Part Number	Capacity
SP7533	0.50 mL



Valve to Syringe Loops

Part Number	Capacity
SP7513	0.50 mL
SP7534	1.25 mL



Glass Concentric Nebulizer

Part Number	Flow Rate
SP8135	100 μ L/min
SP8134	250 μ L/min
SP8158	500 μ L/min



Uptake Line for Nebulizer

Part Number	Flow Rate
SP8138	100 μ L/min
SP8137	250 μ L/min
SP8136	500 μ L/min



MVX-7100 Spares and Accessories

Sample Rack

Part Number	Positions	Vial Type
SP6835	54	VT-54 Position Rack



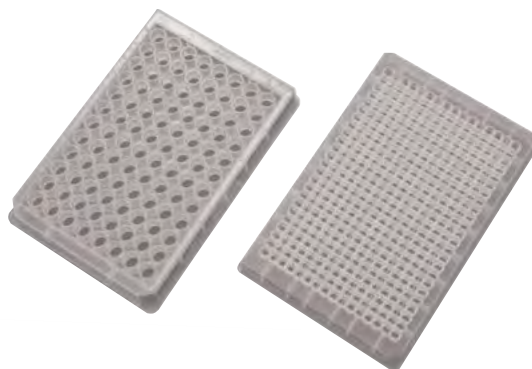
Vials

Part Number	Qty	Vol	Description
SP7503	200	2 mL	Sample Vials with cap
SP7502	6	20 mL	Standards Vials with cap

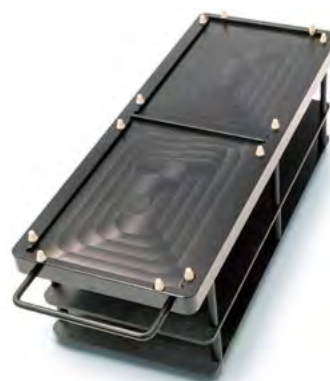


Microtiter Trays

Part Number	Description
SP7504	96 Well Plate (5/pk)
SP7506	96 Well Plate Sealing Film (5/pk)
SP7505	384 Well Plate (5/pk)



Part Number	Description
SP7507	Microtiter Tray Adapter



Part Number	Description
PRP-99-0003	Peltier Module for VT-54 and Microtiter



MVX-7100 Spares and Accessories

2-Channel Peristaltic Pump Tubing Cartridge

Pre-assembled, easy to install. Tubing material is equivalent to the listed brand name, but may be produced by other manufacturers.

The interior diameter (ID) of the tubing affects flow rate. A 2 mm tube on the rinse supply channel may be used with a 3 mm tube on the drain channel to ensure that the rinse station never overflows.

Part Number	Id(mm)	Tubing Color	Endplate Color
Equivalent to PharMed® material. Applications: Pharmaceutical, Biological, and Food and Beverage			
SP7476	2, 2	Tan	Black
SP7477	2, 3	Tan	Red
SP7478	3, 3	Tan	White
Equivalent to Tygon® material. Applications: Laboratory Research, Food & Beverage, Biological, Pharmaceutical, Medical Device, Consumer Products, Environmental			
SP7479	2, 2	Clear	Black
SP7480	2, 3	Clear	Red
SP7481	3, 3	Clear	White
Equivalent to Tygon® Fuel and Lubricant material. Applications: Most fuels and industrial lubricants			
SP7482	2, 2	Yellow	Black
SP7483	2, 3	Yellow	Red
SP7484	3, 3	Yellow	White
Equivalent to Viton® material. Applications: Acids, Solvents, High Temperature			
SP7485	2, 2	Black	Black
SP7486	2, 3	Black	Red
SP7487	3, 3	Black	White

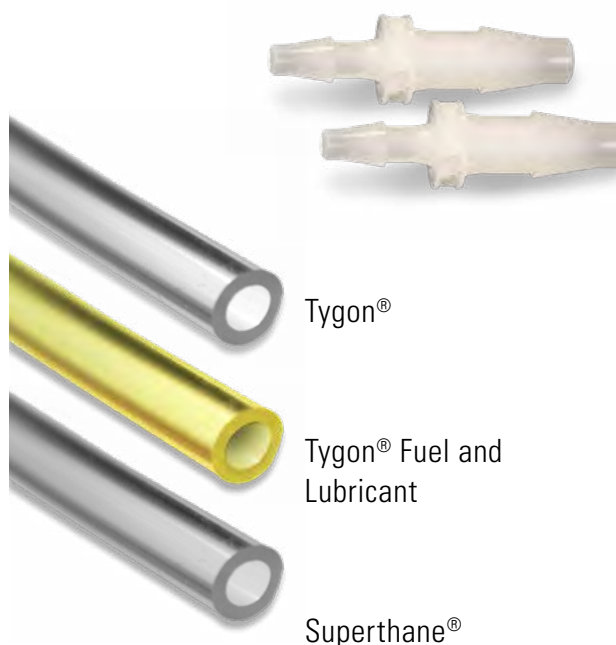


Rinse/Drain Tubing Hookup Kit

Includes:

- 1/8" X 3/16" KYNAR® PVDF couplers (qty. 2)
- 72 in (1.8 m) of 3/16" (4.8 mm) ID tubing
- 72 in (2.1 m) of 1/8" (3.2 mm) ID tubing

Part Number	Material	Typical Use
SP7473	Tygon®	Aqueous
SP7488	Tygon® Fuel and Lubricant	Oils
SP7489	Superthane® without PVDF couplers	Oils



MVX-7100 Spares and Accessories

Part Number	Description	Image	Part Number	Description	Image
SP7461	External Accessory Mounting Block		SP6375	USB Cable (3 Meters)	
SP7497	Internal Accessory Mounting Block		SP6980	RS-232 interface cable (3 Feet) (Female/Female)	
SP7501	Probe Guide		SP7441	RS-232 interface cable (3 Meters) (Female/Female)	
SP7498	Needle Guard Assembly		PRP-99-0001	4-Channel Power Supply	
SP7499	Rinse Station and standards positions		SP5236	5A Fuses for 4-channel power supply *qty 5	
SP6435	2 Liter Rinse Bottle		SP6103	24 Volt External Power Supply	
			SP5003	Power Cords US	
			SP5004	Europe	
			SP5005	UK	
			SP6772	Australia	

ASX-110FR/ASX-112FR Micro Autosamplers

The ASX-110FR and ASX-112FR (Flowing Rinse) Micro Autosamplers each feature a compact size, protective cover and dual flowing rinse station that make them ideal for small volume samples in an ultra clean environment.



Compact

Space Saving Design: Compact footprint enables placement in front, on top, or next to the host instrument for maximum conservation of valuable laboratory bench space.

High Purity

Dual Flowing Rinse: The ASX-110FR and ASX-112FR utilize dual, continuous flow rinse stations, operable in gas-displacement or peristaltic pump mode, minimizing sample contamination and carryover.

Contamination Resistant: All sample vials, racks, and trays are constructed of metal-free, acid-resistant, high-purity polymeric materials. In addition, the ASX-110FR and ASX-112FR each have an integrated transparent enclosure to minimize sample contamination.

Flexible

Adaptable: The ASX-110FR and ASX-112FR accommodate rack configurations allowing operation with sample volumes as low as 200 μ L, and up to 14 mL.

Convenient

Easy Access: Sample and racks may easily be accessed (during operation, if desired) through a hinged door, or by removing the entire anti-contamination enclosure.



Autosampler Enclosure with Door Open

ASX-110FR Micro Autosampler

Technical Specifications

ASX-110FR Dimensions

Height	48.3 cm (19")
Width	22.2 cm (8.75")
Depth	31.8 cm (12.5")
Weight*	9.4 kg (20.7 lbs)

*with enclosure hood

Standards Tray Size

- 5 positions (20 mL vial),
- 9 positions (4 mL vial)

Sample Rack Configurations

- CETAC racks – 24, 48, and 96 positions;
- Bel-Art half racks – 30 and 42 positions

Computer/Hardware Interfaces

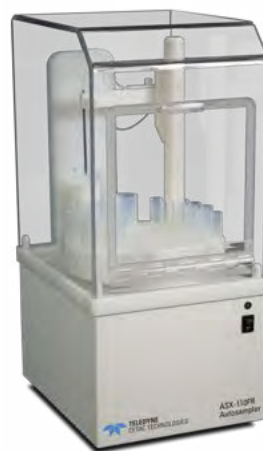
USB, RS-232, IEEE-488 (optional)

Power Requirements

100 - 240 VAC $\pm$ 10%, 50/60 Hz

Warranty

2 year limited



Part Number	Description
A10-99-0009	ASX-110FR w/ peri pump rinse
A10-99-0109	ASX-110FR w/ gas displacement pump rinse
A10-99-0209	ASX-110FR w/ gas displacement pump rinse and PFA rinse station

ASX-112FR Micro Autosampler

Technical Specifications

ASX-112FR Dimensions

Height	42.9 cm (16.9")
Width	33.4 cm (13.1")
Depth	50.8 cm (20")
Weight*	14.1 kg (31.0 lbs)

*with enclosure hood

Standards Tray Size

- 5 positions (20 mL vial),
- 9 positions (4 mL vial)

Sample Rack Configurations

- CETAC racks – 24, 48, and 96 positions;
- Bel-Art half racks – 30 and 42 positions

Computer/Hardware Interfaces

USB, RS-232, IEEE-488 (optional)

Power Requirements

100 - 240 VAC $\pm$ 10%, 50/60 Hz

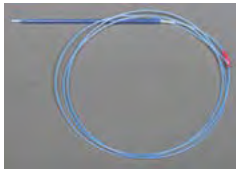
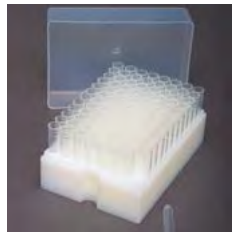
Warranty

2 year limited



Part Number	Description
A12-99-0009	ASX-112FR w/ peri pump rinse
A12-99-0109	ASX-112FR w/ gas displacement pump rinse
A12-99-0209	ASX-112FR w/ gas displacement pump rinse and PFA rinse station

ASX-110/112FR Spares and Accessories

Part Number	Description	Image
SP6328	Sample Probe, .010" ID Carbon	
SP6329	Sample Probe, .035" ID Carbon	
SP6321	Short Rack Kit, 24 Position, 2.0 mL PP Vials (24 Each)	
SP6322	Short Rack Kit, 24 Position, 1.5 mL PFA Vials (24 Each)	
SP6323	Short Rack Kit, 48 Position, 0.5 mL PP Vials (48 Each)	
SP6324	Short Rack Kit, 48 Position, 0.5 mL PFA Vials (48 Each)	
SP6325	Short Rack Kit, 96 Position, 1.0 mL PP Vials (96 Each)	
SP6337	Short Adapter Tray Kit	

Part Number	Description	Image
SP6326	Tall Rack Kit, 30 Position, Bel-Art, 14 mL PP Vials (30 Each)	
SP6327	Tall Rack Kit, 42 Position, Bel-Art, 7 mL PP Vials with caps (42 Each)	
SP6336	Rotary Tray ASX-110FR	
SP5540	2 mL Polypropylene Conical Vials (1000 Each)	
SP5540A	2 mL Polypropylene Conical Vials (100 Each)	
SP5472	1.5 mL PFA Vial, 14.0 mm (24 Each)	
SP5479	0.5 mL Polypropylene Screw Cap Vial, 8.0 mm (1000 Each)	
SP5511	Screw Cap for 0.5 mL Polypropylene Vials, 8.0 mm (1000 Each)	
SP5477	0.5 mL PFA Vial with Cap, 8.0 mm (48 Each)	

ASX-110/112FR Spares and Accessories

Part Number	Description	Image	Part Number	Description	Image
SP5480	1.0 mL Polypropylene Vial, 8.0 mm (1000 Each)		SP6318	Tall Rinse Kit for Gas Displacement	
SP5178B	Sample Vials, 14 mL PP (approximately 1,000, quantity by weight)		SP6319	PFA Short Rinse Kit for Gas Displacement	
SP5178B5	Sample Vials, 14 mL PP (5,000 Each)		SP6320	PFA Tall Rinse Kit for Gas Displacement	
SP5178A	Sample Vials, 7 mL PP (1,000 Each)		SP6330	Peri Pump Rinse Tubing Kit	
SP6332	Short Standards, 4 mL (Qty. 9)		SP6331	Gas Displacement Rinse Tubing Kit	
SP6333	Short Standards, 20 mL (Qty. 5)		SP6341	Bottle, Gas Displacement Reservoir	
SP6334	Tall Standards, 8 mL (Qty. 9)		SP6338	Z-Drive PFA Tubing Replacement Kit	
SP6315	Short Rinse Kit for Peri-Pump		SP5341	Serial Cable	
SP6316	Tall Rinse Kit for Peri-Pump		SP6103	24 Volt Power Supply	
SP6317	Short Rinse Kit for Gas Displacement		SP5003	Power Cords	
			SP5004	US	
			SP5005	Europe	
			SP6772	UK	
				Australia	

APS-1650 Automated Prep Station

Pre-analysis preparation of oil samples is achieved via a relatively simple dilution process; however these dilutions are time consuming and carry the potential for human error.

The APS-1650 Automated Preparation Station addresses the need for an automated process solution for the preparation of diluted oil samples. The system is designed to ensure fast, accurate sample dilutions in a small footprint saving time and laboratory bench space.



Station includes:

- Sample rack options*:
 - 80 and 90 position pour off racks
 - 45 position using 2 or 4 oz bottle rack
- Collection rack options*:
 - 60 and 80 position rack using 15mL vial
 - 90 or 96 position CETAC rack using 8mL vial
- Rinse pump: 2-channel peristaltic pump
- Stainless steel sample probe
- Syringe pumping module
- CETAC offline software
- Miscellaneous tubing used for operation
- Power supply with US, UK & European plugs

*Please specify with your order

Part Number	Description
APS-99-0001	APS-1650 Automated Prep Station
APS-99-0025	APS-1650 without Stirrer

Technical Specifications

Autosampler Dimensions

Height	70 cm (27.5")
Width	110 cm (43.3")
Depth	70 cm (27.5")
Weight	30 kg (66 lb)

Syringe Module Dimensions

Height	26.7 cm (10.5")
Width	14 cm (5.5")
Depth	20.3 cm (8")
Weight	4.5 kg (10 lb)

Viscosity Range

up to 700 centistokes (cSt)

Computer/Hardware Interfaces

RS-232, USB

Power Requirements

AC 100V-240V, 3.2A

Sample Rack Options

45 position 2 oz and 4 oz bottles;
80 and 90 position 2 mL cups

Collection Rack Options

80 position 15 mL (17 mm x 100 mm)
90 position 8 mL (13 mm x 100 mm)

Computer Requirements

Microsoft Windows® 7 operating system or newer
1 GB RAM.

Adobe® Acrobat® Reader is required to read the manuals that accompany the software.

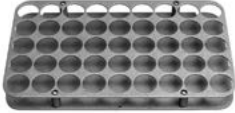
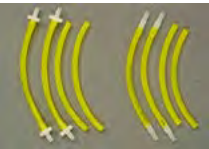
Internet Explorer 6 or higher must be installed for system to function properly

Warranty

2 year limited



APS-1650 Spares and Accessories

Part Number	Description	Image	Part Number	Description	Image
SP6261	Stainless Steel Sample Probe		SP6276	90 Position/2 mL Sample Rack (Oils)	
SP6260	Stirrer Paddle		SP7163	Sample Rack, 60 Position Collection Metal for Oil	
SP6281	Stainless Steel Tube for Kerosene Supply		SP7007	Sample Rack, 80 Position Collection Metal for Oil	
SP6282	Inline Liquid Filter		SP6255	Sample Rack, 90 Position Collection Metal for Oil	
SP6257	APS-1650 Drip Cup		SP6413	Sample Rack, 96 Position Collection Metal for Oil	
SP6258	Sample Probe Holder			Rack Adapter Plate	
SP6259	Stirrer Motor Holder		SP6269	45 Position Sample/80 Position Collection	
SP6274	45 Position/120 CC Sample Rack (Oils)		SP6270	45 Position Sample/90 Position Collection	
SP6291	45 Position/120 CC Sample Rack (Cat Oils Version)		SP6271	80 or 90 Position Sample/80 Position Collection	
SP6275	80 Position/2 mL Sample Rack (Oils)		SP6272	80 or 90 Position Sample/90 Position Collection	
				Rinse/Drain Tubing Hookup Kit (Fuel and lubricant tubing) Used in the oil industry.	
			SP6253	7 ft piece of 1/8" ID (2/kit)	
			SP6254	6 ft piece of 3/16" ID (2/kit)	
			SP6191	Drain Pump Tubing and Connector Kit (Fuel and lubricant) Used in the oil industry.	

APS-1650 Spares and Accessories

Part Number	Description	Image
SP6430	Drain Pump Tubing and Connector Kit (Viton) Used in the oil industry.	
SP5341	RS-232 Interface Cable (Female/Female)	
SP6222	Z-Drive 15 Pin Cable	
SP6286	Liquid Level Sensor Assembly	
SP6287	Fiber Optic Cable Assembly	
SP7020	28 Volt Power Supply (5 Pin Connector)	
SP6103	24 Volt Power Supply (6 Pin Connector)	
SP5003 SP5004 SP5005 SP6772	Power Cords US Europe UK Australia	



The APS-1650 and the Oils 7400 or Oils 7400 Dual are ideal instruments for use in the oil analysis industry.

The Oils 7400 and Oils 7400 Dual Autosamplers feature an integrated stirrer paddle to mix the sample before analysis.

The APS-1650 Automated Preparation Station prepares off-line sample dilutions. Samples are collected from a sample rack and deposited in a collection rack along with a diluent in a specified ratio. A liquid level sensor limits probe depth in the sample to minimize rinse solution, saving time.

Both models feature:

- Integrated stirrer to ensure evenly mixed samples
- Filtered stainless steel probe to strain out large particles
- Drip cups to prevent cross contamination
- Independent rinse stations for stirrer and probe

Oils 7400 and Oils 7400 Dual Homogenizing Autosamplers

The new Oils 7400 and Oils 7400 Dual Homogenizing Autosamplers have 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 Dual 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.



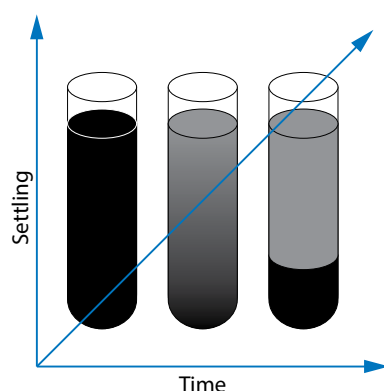
Oils 7400

Part Number	Description
A74-99-1401HR	Oils 7400 Autosampler (no racks included)
A74-99-1403HR	Oils 7400 with 60 position racks
A74-99-1402HR	Oils 7400 with 80 position racks
A74-99-1404HR	Oils 7400 with 96 position racks

Oils 7400 Dual

Part Number	Description
A74-99-1411HR	Oils 7400 Dual Autosampler (no racks included)
A74-99-1413HR	Oils 7400 Dual with 60 position racks
A74-99-1412HR	Oils 7400 Dual with 80 position racks
A74-99-1413HR	Oils 7400 Dual with 96 position racks

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 a software dashboard, to meet the challenge of more viscous oil samples.

Technical Specifications

Dimensions

Height	46 cm	(18")
Width	57 cm	(22")
Depth	54 cm	(21")
Weight	23 kg	(50 lbs)

Capacity

Up to 4 racks, up to 384 samples

Rack Options

Gilson, Bel-Art, CETAC/Bohdan, JANUS

Hardware Interfaces

RS-232 and USB

Power Requirements

100-240 VAC, 47-63 Hz, 1.9 A

Computer Requirements

Microsoft Windows® 7 operating system or newer
1 Free COM or USB port
Adobe® Acrobat® Reader is required to read manuals
Internet Explorer must be installed

Warranty

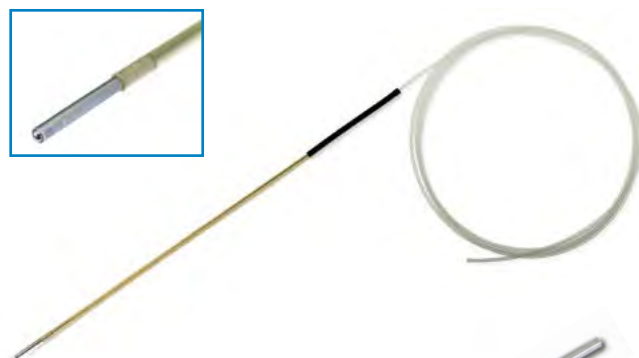
2 year limited

Oils 7400 / Oils 7400 Dual Spares

Filtered Probe for Oils Analysis

The stainless steel sample probe features a screen tip for use in oils applications. Includes capillary tube fitting.

Part Number	Description
SP7604	Stainless Steel Sample Probe w/ Filtered Tip



Stirrer Paddle

6.5 in (16.5 cm) rod with flattened paddle end

Part Number	Description
SP6217	Uncoated – for oils applications
32-0332-065	Coated – for aqueous applications (blue band)



Metal Sample Racks

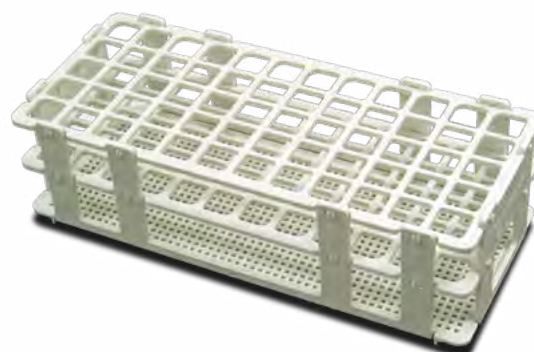
Used in Oil Industry

Part Number	Vials	Opening	Vial Type
SP7163	60	round	
SP7007	80	17 mm round	14 mL/15 mL vial
SP6255	90	13 mm round	7 mL or 8 mL vial
SP6413	96	13 mm round	7 mL or 8 mL vial



Plastic Sample Racks

Part Number	Vials	Opening	Vial Type
450362	90	13.3 mm round	7 mL or 8 mL vial
450055	90	13.5 mm square	7 mL or 8 mL vial
450056	60	17.0 mm square	14 mL/15 mL vial
450057	40	20.6 mm square	20 mL vial
450058	24	25.2 mm square	30 mL vial
450059	21	30.5 mm square	50 mL vial



Oils 7400 / Oils 7400 Dual Spares

Standards Racks

Part Number	Description
SP6242	5 Position Standards Rack (set of 2)



Sample Vials

Material for all vials is polypropylene

Part Number	Qty	Vol	Description
SP5178A	1000	7 mL	13 x 82 mm, w/ cap
SP5178E	250	7 mL	13 x 82 mm, w/ cap
SP5178K	1000	8 mL	13 mm x 100 mm
SP5178L	250	8 mL	13 mm x 100 mm
SP5178B	1000*	14 mL	16 mm x 100 mm
SP5178F	250	14 mL	16 mm x 100 mm
SP5178M	1000	15 mL	17 mm x 100 mm
SP5178N	250	15 mL	17 mm x 100 mm
SP5178G	500	20 mL	21.5 mm x 100 mm
SP5178I	100	20 mL	21.5 mm x 100 mm
SP5178H	500	30 mL	25 mm x 95 mm
SP5178C	500	50 mL	30 mm x 115 mm, w/ cap
SP5178J	100	50 mL	30 mm x 115 mm, w/ cap

*approximate quantity, measured by weight

Standards Vials

Part Number	Qty	Vol	Description
SP5178C	500	50 mL	30 mm x 115 mm, w/ cap
SP5178J	100	50 mL	30 mm x 115 mm, w/ cap



Oils 7400 / Oils 7400 Dual Spares

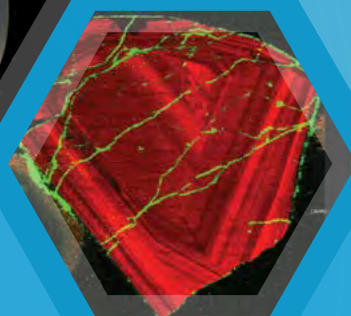
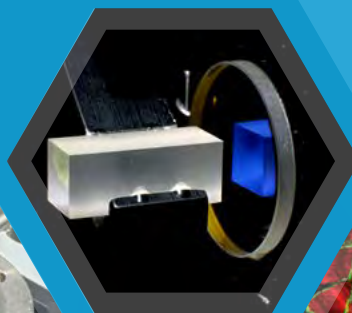
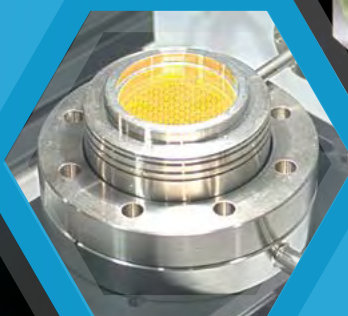
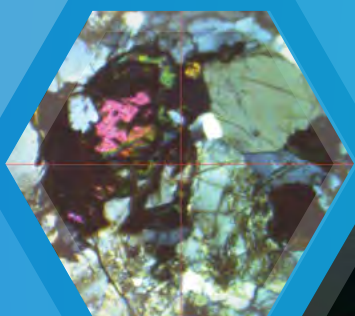
Part Number	Description	Image
	Rinse Stations	
32-0379-044	90/96 Position	
32-0378-044	60/80 Position	
32-0268-039	Drip Cup	
		
32-0280-047	Spill Tray Assembly	
32-0365-047	Probe Block Mounting Plate with 2 screws and 2 pins	
SP6301	KYNAR Thumbscrew Kit (set of 4)	
32-0371-044	Rinse Station Barb Fittings (set of 4)	
SP7478	2-Channel Peristaltic Pump Tubing Cartridge 3.3 mm ID PharMed equivalent, tan w/ white endplates	
SP7487	2-Channel Peristaltic Pump Tubing Cartridge 3.3 mm ID Viton equivalent, black w/ white endplates	

Part Number	Description	Image
32-0374-047	Rinse/Drain Tubing Hookup Kit (Tygon) 7 foot piece of 1/8" ID (2/kit)	
SP6253	Rinse/Drain Tubing Hookup Kit (Fuel and Lubrican tubing, used in oil industry) 7 foot piece of 1/8" ID (2/kit)	
SP6431	Rinse/Drain Tubing Hookup Kit (Superthane, used in oil industry) 7 foot piece of 1/8" ID (2/kit)	
SP7123	Z-Drive PTFE Lubrication Kit	
SP7441	RS-232 interface cable (3 meters) (female/female)	
SP6375	USB cable (3 meters)	
SP6103	24 Volt External Power Supply	
	Power Cords	
SP5003	US	
SP5004	Europe	
SP5005	UK	
SP6772	Australia	

LASER ABLATION

CETAC Technologies and Photon Machines joined forces back in June 2010 with a view to advance laser ablation technology for elemental analysis, and to offer a full range of products globally. This collaboration brought together the experience in Photon Machines' design team with the sample introduction expertise of CETAC. This partnership has taken the next natural step and both companies have merged under the Teledyne Instruments banner.

Teledyne Photon Machines, a brand of Teledyne CETAC Technologies, provides laser ablation systems ranging from CO₂ and diode lasers, through 266 nm and 213 nm solid state Nd:YAG, 193 excimer laser systems and femtosecond laser systems. In addition to this, the company provides accessories to enhance the capabilities of laser ablation systems.





Excite Pharos

Femtosecond LA System

Application Areas

Fundamental Research	Semiconductor Analysis
Geological Analysis	Isotope Ratio Studies

Example Materials

Semiconductor Materials	Quartz
Transparent Glasses	Metallic Matrices

About the Excite Pharos

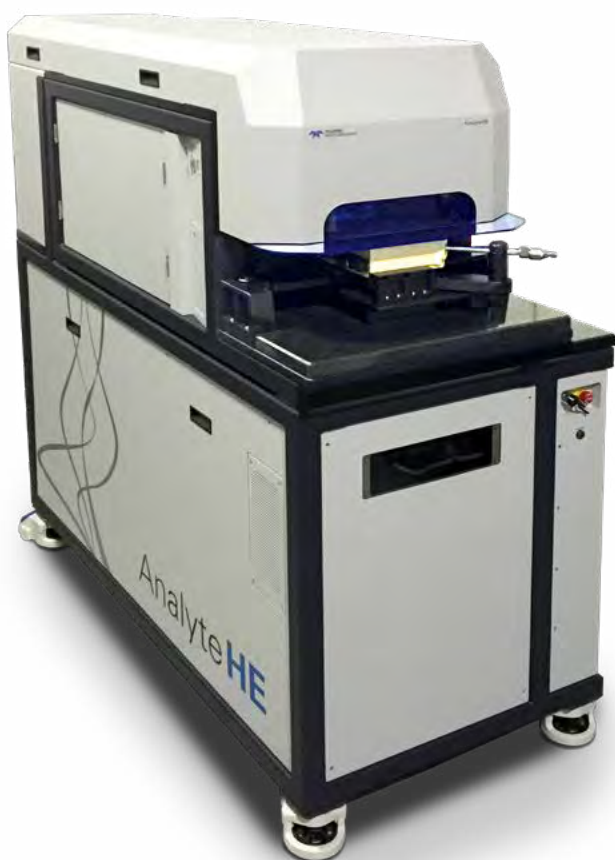
The Excite Pharos is the most user-friendly femtosecond laser ablation system on the market, featuring a compact, fully sealed and factory aligned laser head that does not need routine adjustment or cleaning. The system can be configured for 1028 nm, 257 nm or 206 nm, or configured for a switchable system if desired. An energy density of 10 J/cm² (1028nm), 5 J/cm² (257nm) and 3 J/cm² (206nm) is achievable, with 0.1% RSD on shot-to-shot stability over long runs.

The Excite Pharos is available with the class leading HelEx II Active 2-Volume Ablation Cell, enabling fast washout and a constant ablation environment.

Teledyne Photon Machines has a global license from the University of Michigan to provide femtosecond laser systems that ablate material for the purpose of chemical analysis, as covered by U.S. patent 5,656,186 and U.S. Reissue Patent RE 37,585. Protection against University of Michigan patent infringement concerns related to these patents also extends to Teledyne Photon Machines' customers who use this technology.

Key Features

- Light Conversion Pharos 2.0 mJ or Pharos SP 1.5 mJ
- 1028nm, 257nm & 206nm wavelengths
- Pulse duration <190 fs – 10 ps
- Pulse energy up to 2 mJ
- Flexibility in repetition rate: 1 to 200kHz in 1 Hz steps
- Broad range of wavelength conversion options (harmonic generators, OPA, NOPA, continuum generators)
- Only 1 refractive optic for minimal pulse stretching
- Independent beam paths for each wavelength
- Independent video and lasing optical element for optimal viewing and crater quality
- Continuously variable 1 – 65 µm spot size
- HelEx II active 2-volume ablation cell compatible
- Fully integrated chiller to minimize footprint



Analyte HE

High Energy Excimer LA System

Application Areas

- | | |
|------------------------|------------------------|
| Environmental Analysis | Forensics |
| Geological Analysis | Isotope Fingerprinting |
| • Isotope Ratios | Imaging / Mapping |
| • Fluid Inclusions | Depth Profiling |
| • Geochronology | (Paleo) thermometry |

Example Materials

- | | |
|---------------------|------------------|
| Quartz | Zircons |
| Fluorite | Ceramics |
| Calcite / Aragonite | Plastics |
| Transparent Glasses | Thin Coatings |
| Bone / Fossils | Various Minerals |

About the Analyte HE

The Analyte HE offers excimer technology at 193 nm with all the analytical capabilities you require, delivering finely controlled, “homogenized-flat” ablations with high sensitivity and split second response. “Fire-on-the-fly” lasing that is synchronized to the stage motion, combined with fast washout ablation cells, make precision depth profiling of spots, lines and areas possible and enables high spatial resolution elemental mapping.

Equipped with a high definition, color GigE camera on a high magnification, optical zoom video-microscope, the viewing system is capable of resolving 2 μm features. Flexible lighting systems, rotating cross-polarizers and software selectable camera settings give the user enhanced viewing capabilities.

With enough energy to ablate even the most challenging materials, the Analyte HE allows you to confidently analyze all materials, including hard quartz and resilient carbonates. The beam energy profile is homogenized to ensure uniform ablations across the entire range of spot sizes and on a wide range of materials.

Key Features

- Ultra-short 193 nm wavelength
- Up to 50 J/cm² fluence ablates all materials, including quartz and fluorite
- Optical homogenization of the laser beam for uniform flat ablations
- Sealed gas cabinet
- 100 × 100 mm stage travel as standard, 150 x 150 travel option available
- Synchronized “fire-on-the-fly” lasing for the ultimate depth control during ablation
- Independent video and lasing optical element for optimal viewing and crater quality
- Aperture imaged spots ranging from 1 μm to 170 μm
- 30 apertures as standard; custom masks available
- HelEx II active 2-volume ablation cell as standard



Analyte Excite

Excimer Laser Ablation System

Application Areas

Environmental Analysis	Forensics
Geological Analysis	Isotope Fingerprinting
• Isotope Ratios	Imaging / Mapping
• Transparent glasses	Depth Profiling
• Geochronology	(Paleo) thermometry

Example Materials

Calcite / Aragonite	Ceramics
Transparent Glasses	Plastics
Bone / Fossils	Thin Coatings
Zircons	Various Minerals

About the Analyte Excite

The Analyte Excite offers 193 nm excimer technology with all the analytical capabilities you require, at a more affordable price. The Excite delivers finely controlled, “homogenized-flat” ablations with high sensitivity and split second response. “Fire-on-the-fly” lasing that is synchronized to the stage motion, combined with fast washout ablation cells, make precision analysis of spots, lines and areas possible and enables high spatial resolution elemental mapping. The Excite is equipped with a high definition, color GigE camera on a high magnification, optical zoom, video-microscope capable of resolving 2 μm features. Transmitted, reflective and ring illumination, cross polarizers plus software selectable camera settings give the user enhanced viewing capabilities. The combination of ultra-short pulse length and 193 nm wavelength is unsurpassed in coupling efficiency.

The Excite ablates all materials, from opaque to highly transparent, including delicate powders, hard quartz and resilient carbonates with depth penetration in the tens of nanometers per shot. The beam energy profile is homogenized to ensure uniform ablations across the entire range of spot sizes and on a wide range of materials.

Key Features

- Best value in excimer laser ablation systems
- Ultra-short 193 nm wavelength
- Ultra-short < 4 ns pulse length
- Surplus fluence ablates all materials
- Sealed gas cabinet
- Optical homogenization of the laser beam for uniform flat ablations
- Synchronized “fire-on-the-fly” lasing for the ultimate depth control during ablation
- 100 × 100 mm stage travel as standard
- Independent video and lasing optical element for optimal viewing and crater quality
- Aperture imaged spots ranging from 2.5 μm to >150 μm
- 30 apertures as standard; custom masks available
- HelEx II active 2-volume ablation cell as standard



Analyte G2

Excimer Laser Ablation System

Application Areas

Environmental Analysis	Forensics
Geological Analysis	Isotope Fingerprinting
• Isotope Ratios	Imaging / Mapping
• Transparent glasses	Depth Profiling
• Geochronology	(Paleo) thermometry

Example Materials

Calcite / Aragonite	Ceramics
Transparent Glasses	Plastics
Bone / Fossils	Thin Coatings
Zircons	Various Minerals

About the Analyte G2

The Analyte G2 system delivers finely controlled, flat (homogenized) ablations with high sensitivity and split second response for “shot-to-shot” spatially resolved analyses. “Fire-on-the-fly” lasing triggered by the stage motion controller provides depth profiling of lines and raster areas like never before. The G2 features a color HD zoom video microscope plus a live, wide field of view, sample map camera for fast navigation of the sample cell.

The combination of ultra-short pulse length and 193 nm wavelength is unsurpassed in coupling efficiency. As a result the G2 yields higher peak energy for total ablation, producing smaller particles that ionize readily with less noise and fractionation than large format excimer lasers. The G2 ablates all materials, from opaque to highly transparent, including delicate powders, hard quartz, and resilient carbonates, with depth penetration in the 10’s of nanometers per shot. Thirty (30) spot size selections ranging from ~1 μm to ~400 μm make the G2 a highly versatile instrument with unique capabilities, ideal for both micro-feature and bulk analysis.

Key Features

- Gabbro vibration damping super-structure
- Ultra-short 193 nm wavelength
- Ultrashort < 5 ns pulse length
- Surplus fluence ablates all materials
- Sealed gas cabinet
- Optical homogenization of the laser beam for uniform flat ablations
- Optical attenuator energy control with “open gate” full energy access
- Synchronized “fire-on-the-fly” lasing for the ultimate depth control during ablation
- 100 × 100 mm stage travel as standard
- Independent video and lasing optical element for optimal viewing and crater quality
- Aperture imaged spots ranging from ~1 μm to ~400 μm
- 30 apertures as standard; custom masks available
- HelEx II active 2-volume ablation cell as standard



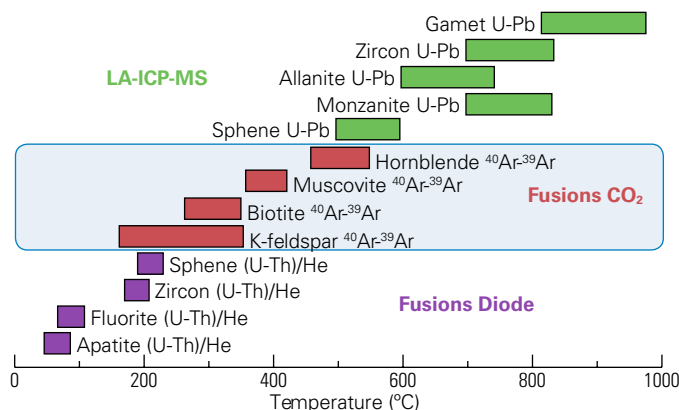
Fusions CO₂

Stepped Heating System

Application Areas

Geochronometry ⁴He/³He Dating
Noble Gas Isotope Ratio Analysis

Example Materials



About the Fusions CO₂

Configured for ⁴⁰Ar-³⁹Ar geochronology analyses in conjunction with a noble gas mass spectrometer, the Fusions CO₂ allows for the targeting and controlled (stepped) heating of mineral samples including feldspars and muscovites, in sections and grains, to their fusion point.

The Fusions CO₂ has the capacity to irradiate sample surface areas up to 6.0 mm in diameter using a field-proven, RF excited, sealed CO₂ laser that can be continuously adjusted in output power to >55W. Unique beam-flattening technology converts the usual Gaussian beam profile to a flat, uniform energy distribution across the sample.

The Fusions CO₂ is a fully integrated system including laser, coaxial beam delivery unit, built-in power meter, motorized zoom video microscope, XYZ motion control stages, variable spot size and ring light illumination for precision, line-of-sight imaging and targeting.

Key Features

Laser

- 55 W RF-excited water cooled CO₂ laser with controller and power supply
- Continuously variable power from ~1W to max. output over 5000 steps
- Water flow interlock

Viewing Optics and Video

- Video zoom microscope with anti-glare during fusions for live images
- Motorized zoom magnification video microscope
- FOV from 5.3 mm to 34 mm (Horizontal)
- Color CCD camera

Beam Delivery Unit (BDU)

- Motorized spot selection from ~125 µm to 6 mm
- Integrated homogenizer for flat, uniform heating over 3 mm diameter wells
- F/O ring light with software controlled variable intensity illuminator
- BDU combines laser, CCD, ring light and power meter for coaxial/coplanar performance
- Integrated adjustable iris

Motion Control

- Motion control tower supports and moves the laser, beam delivery unit, optical system and pyrometer over a stationary sample chamber (not included)
- 52 mm motorized XYZ travel, all axes
- 1 µm resolution
- 3-axis PC and Macintosh compatible stage motor controllers

19" Rack Mount Electronics
Class IV laser enclosure and mounting hardware





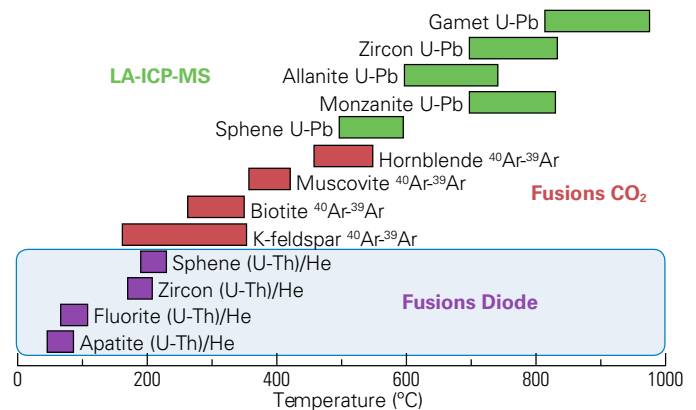
Fusions Diode

Stepped Heating System

Application Areas

Geochronometry Noble Gas Isotope Ratio Analysis
Thermochronometry $^4\text{He}/^3\text{He}$ Dating

Example Materials



About the Fusions Diode

The Fusions Diode is a diode-laser based system for controlled heating of samples within micro-furnace packets to the point of fusion. The Fusions Diode enables the use of high capacity, multiple well, HV sample chambers and provides localized heating of samples in diffusion cells without the use of a furnace. This unique system features co-linear targeting, stepped heating and spot-on temperature measurements through a standard sapphire viewport.

Fusions Diode features simultaneous viewing of the sample via a color, camera that is coaxial with the laser beam for precise targeting and temperature control. Flood lighting of the sample eliminates shadows and dark zones caused by deep wells and when observing samples close to the edge of the viewport.

The Fusions Diode is equipped with an optical pyrometer that measures sample temperature within the area heated by the laser beam for spot-on measurements.

Key Features

Laser

- 75 W water cooled diode laser with controller & power supply
- Continuously variable power from ~1W to max. output over 5000 steps
- Water flow interlock

Viewing Optics and Video

- Video zoom microscope with anti-glare during fusions for live images
- Motorized zoom magnification video microscope
- FOV from 5.3 mm to 34 mm (Horizontal)
- Color CCD camera

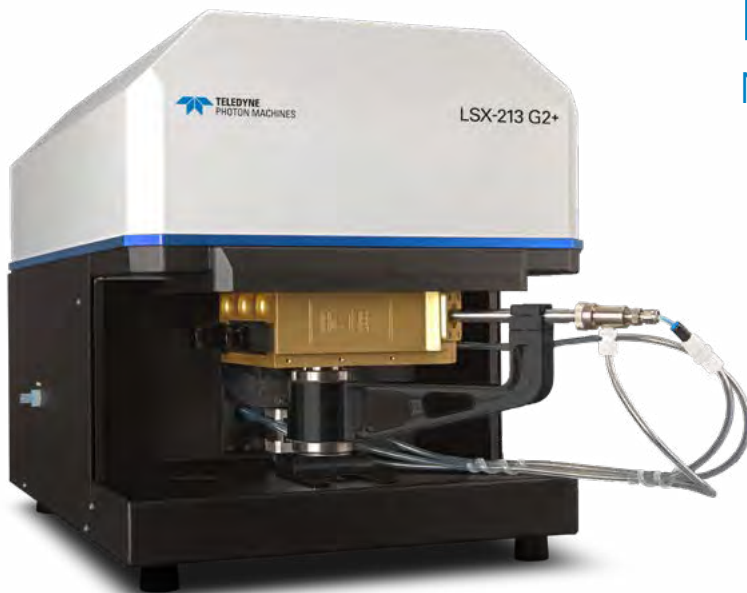
Beam Delivery Unit (BDU)

- Motorized spot selection from ~125 μm to 6 mm
- Integrated homogenizer for flat, uniform heating over 3 mm diameter wells
- F/O ring light with software controlled variable intensity illuminator
- BDU combines laser, CCD, ring light and power meter for coaxial/coplanar performance
- Integrated adjustable iris

Motion Control

- Motion control tower supports and moves the laser, beam delivery unit, optical system and pyrometer over a stationary sample chamber (not included)
- 52 mm motorized XYZ travel, all axes
- 1 μm resolution
- 3-axis PC and Macintosh compatible stage motor controllers

19" Rack Mount Electronics
Class IV laser enclosure and mounting hardware



LSX-213 G2+

Nd:YAG Laser Ablation System

Application Areas

Environmental Analysis	Isotope Fingerprinting
Geological Analysis	Bulk Analysis
• Isotope Ratios	Failure Analysis
• Translucent Glasses	(Bio) Imaging / Mapping
Forensics	Depth Profiling

Example Materials

Calcite	Ceramics
Metals	Plastics
Translucent Glasses	Coatings
Bone	Biological

About the LSX-213 G2+

The LSX-213 G2+ system features the latest in optical design technology to target areas of interest. Built on the rugged and field proven LSX G2 platform, the laser source inside the LSX-213 G2+ is a hermetically sealed, MIL-SPEC laser head affording unmatched stability and user serviceability. Coupled with precision mounted optical components on a vibration isolated optical bench, the system can be used on multiple analytical instruments at multiple locations with confidence and ease. Simple, elegant component layout leads to improved stability and ease of maintenance. The laser ablation platform incorporates an open architecture sample area that enables flexibility for a wide range of specialized and custom sample cells.

Spot sizes ranging from 4 μm to 200 μm are generated using aperture imaging technology, and are easily set using software control. From power, spot size and scan speed to control over timing and communication with your spectrometer, Teledyne CETAC Technologies is focused on making your job easier; simply Target, Ablate, and Analyze.

The LSX-213 G2+ incorporates the latest in high resolution hardware and optical design technology, providing the user with excellent optical resolution and a wide field of view. Images are of startling quality, and high intensity lighting arrays above and below the sample produce extremely clear images even at high zoom.

Key Features

Laser Cabinet

- Frequency quintupled 213 nm Q-switched Nd:YAG laser with > 3 mJ source pulse energy and < 5 ns pulse width
- < 3% pulse to pulse stability throughout
- Flat top energy profile
- Mechanically and thermally isolated laser beam delivery and viewing path for maximum stability
- Variable output energy and variable pulse repetition frequency (1 – 20Hz)
- Variable laser spot size (4 – 200 μm)
- Fully sealed laser head with user changeable flashlamp

Viewing Optics and Video

- Computer controlled, continuously adjustable parfocal video microscope (2.6x – 32.5x optical zoom range)
- Wide field of view (> 6 mm) at high optical resolution (< 2 μm)
- High intensity LED lighting arrays
- Motorized rotating polarizer

Sampling System

- Open architecture for maximum flexibility
- Optional HelEx active 2-volume ablation cell
- High precision XY stages (0.16 $\mu\text{m}/\text{step}$)

HelEx II Active 2-Volume Ablation Cell

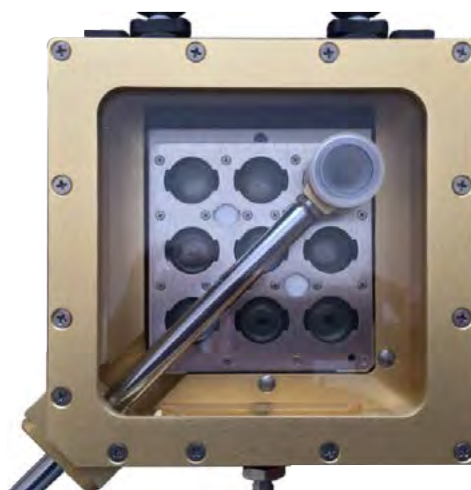
Customizable Performance for All Applications

Sampling (and thus, spatial) resolution in laser ablation is limited by aerosol transfer resolution; therefore, washout becomes critical. The HelEx uniquely uses two mass flow controllers to independently control flow to the main chamber and flow to the inner volume (the cup). This allows the signal intensity and washout to be optimized to the analysis and offers tangible benefits over alternative designs.

The HelEx II active 2-volume ablation cell builds on the class leading performance of the original HelEx cell by providing faster washout, better stability and better reproducibility. The cup can accept a variety of inserts with washout varying from 0.25 seconds to less than 0.75 seconds for washout to <0.1% peak signal, which means individual laser shots can be separated and analyzed.

The HelEx II is available on the Analyte G2, the Excite and the LSX-213 G2+. It is available with leveling drawers, which ensure all samples remain in the focal plane of the laser, that can hold 4 thin sections and 3 one-inch rounds and 2 half-inch rounds (for standards), or 9 one-inch rounds with 2 half-inch rounds.

Combined with the E-Check and the CleanShot, the HelEx II enables the highest accuracy, sensitivity, resolution and stability on the planet.



eQC In-Situ Laser Ablation Energy Detector

The only energy detector “at the sample”

All laser ablation systems have an energy detector that is in the laser or relegated to locations that are far removed from the sample, until now. The eQC is the first and only energy detector that is built-in to the Teledyne Photon Machines HelEx II sample chamber, providing the only accurate, TRUE measurement of energy density (or energy) at the sample, where the ablation occurs.

Energy detectors that are “upstream” of the sample chamber are blind to losses caused by degradation of the laser and beam delivery optics, and other losses in the beam path that result in erroneous readings at the sample, whereas eQC sees what the sample sees during ablation.

In addition to providing the most accurate energy & energy density measurements of any laser ablation system, eQC is an on-board diagnostic tool that monitors the health of the system by comparing the energy output of the laser (as measured by excimer laser’s integrated energy detector) with the eQC readings. Any changes from the original factory measurements that occur are immediately apparent and the software automatically calibrates the energy density display within Chromium for user assurance that the desired energy density is truly achieved at the sample surface.

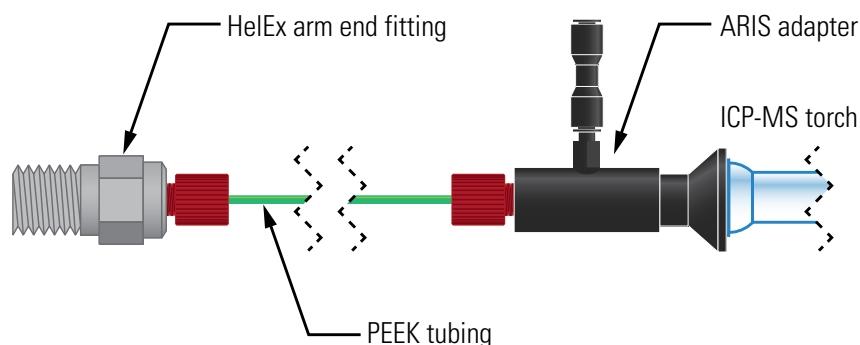
The eQC is the ultimate in Energy Quality Control.



ARIS Aerosol Rapid Introduction System

for HelEx II equipped laser ablation systems

The Aerosol Rapid Introduction System (ARIS) connects a HelEx II laser ablation cell to an ICP-MS instrument with minimal transfer volume and turbulence. Unlike “injector” devices, the ARIS delivers the sample directly to the torch without the use of internal valves or torch modifications to deliver ultrafast washout.



Combined wash-in and wash-out times of < 20 ms to baseline allow the user to resolve individual single pulses at sample rates of up to 30 Hz for biological materials and up to 60 Hz for geological materials. Washout can be altered to suit ones needs.

ExiCheck Gas Exchange Accessory

Performance of an Excimer, Convenience of a Solid State

Over time, excimer gas loses efficacy and the output from an excimer laser head will decrease. Passivation of the laser head extends the usable lifetime of the gas in the laser cavity; however, regular gas exchanges are still necessary. If a gas exchange is missed, passivation is lost and the effective lifetime of the gas fill is reduced. Once missed, it takes significant effort and gas to re-passivate and return to peak performance.



reduced. Once missed, it takes significant effort and gas to re-passivate and return to peak performance.

The ExiCheck accessory connects to your ATL excimer gas system and allows fully unattended gas exchanges. The patent pending system comprises a valve and pressure monitoring system connected to an intelligent control module. This system performs gas exchanges on a regular, programmable schedule to maintain passivation in the laser cavity and internal laser tubing, thereby maintaining peak performance. Additionally, the ExiCheck accessory is fully integrated into your laser system, whether you have an Analyte Excite or Analyte G2.

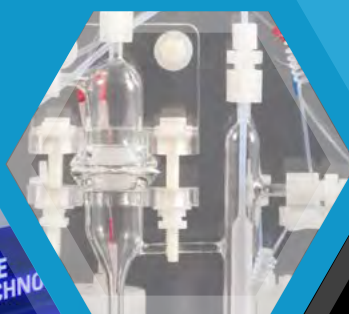
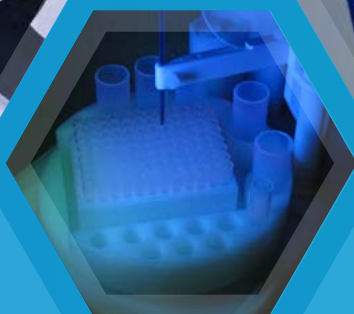


NEBULIZERS

Teledyne CETAC Technologies offers a comprehensive line of specialized liquid sample introduction accessories for ICP-AES and ICP-MS. These accessories provide signal enhancement, reduction of spectral interferences, and resistance to highly corrosive liquids.

These products include:

- U5000AT⁺ Ultrasonic Nebulizer
- U6000AT⁺ Ultrasonic Nebulizer/Membrane Desolvator
- BGX-100 Blend Gas Accessory
- Aridus3 Desolvating Nebulizer System
 - ASX-112FR Micro Autosampler for Aridus3
 - QuickWash3 Accessory for Aridus3
- C-Flow PFA Concentric Nebulizer
- DS-5 Microflow Concentric Nebulizer
- HGX-200 Hydride Generation/Cold Vapor System
- SPR-IDA Reagent for Preconcentration/Matrix Elimination



Aridus3

Desolvating Nebulizer System for ICP-MS

The Teledyne CETAC Aridus 3 Desolvating Nebulizer System is a specialized liquid sample introduction accessory for inductively coupled plasma mass spectrometry (ICP-MS). The Aridus 3 can enhance analyte sensitivity up to 10 times or more and can greatly reduce solvent-based interferences such as oxides and hydrides.



Part Number	Description
AR3-99-0001	Aridus 3 Desolvating Nebulizer System

Introduction

The Aridus 3 couples a low-flow (50, 100, or 200 $\mu\text{L}/\text{min}$) PFA nebulizer and a heated PFA spray chamber with an inert fluoropolymer membrane. This combination provides enhanced analyte sensitivity while reducing solvent based interferences such as oxides and hydrides. The Aridus 3 is particularly advantageous for small volume and highly corrosive samples (e.g. HF) such as those generated in the earth sciences and the semiconductor industry.

The Aridus 3 can be easily interfaced with all current types of ICP-MS instruments, including quadrupole (Q), high resolution (HR), multicollector (MC), and time of flight (TOF) systems.

The sample path (nebulizer, spray chamber, and membrane) are all made of fluoropolymers which are resistant to all acids including hydrofluoric acid (HF). Sample-solvent vapors pass through the inert membrane to vent, providing very low oxides (% CeO/Ce is typically 0.05% or less).

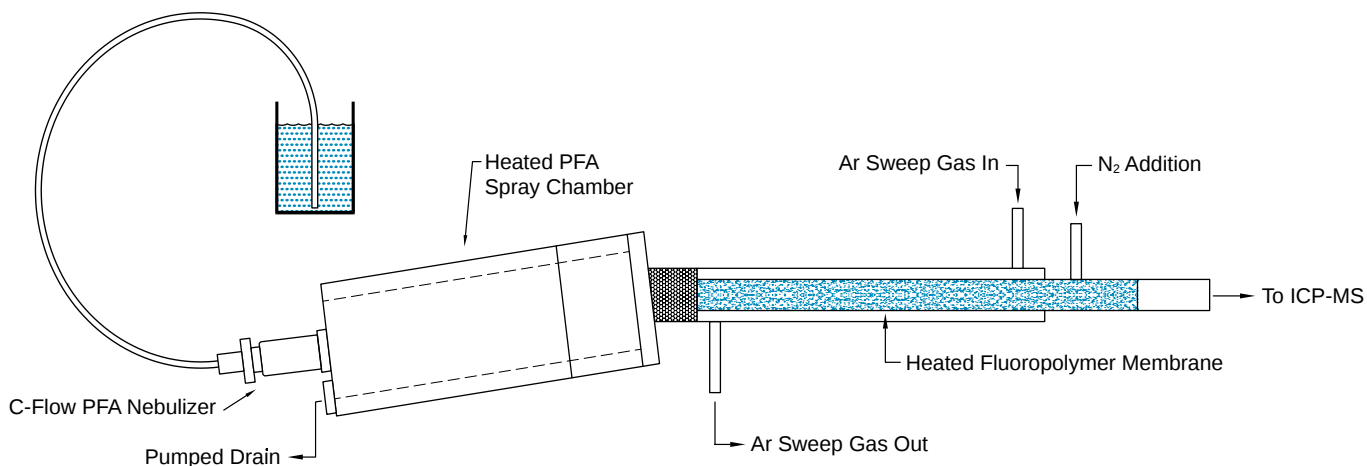
Benefits

- Analyte sensitivity enhanced up to 10 times or more, depending on liquid sample uptake rate
- Low-volume sample uptake rates of 50, 100, or 200 microliters/min, preserving valuable sample
- C-Flow PFA nebulizer with integrated autosampler probe for use with Teledyne CETAC ASX-112FR MicroAutosampler
- Heated PFA spray chamber for higher sample transport efficiency
- Both PFA nebulizer and PFA spray chamber are behind a secured door to alleviate electrostatic effects
- Inert fluoropolymer membrane for resistance to acids (including HF) and low oxide and hydride levels
- Built-in mass flow controllers (MFCs) for precise setting of Ar sweep gas and N_2 addition gas
- Convenient computer software control of spray chamber temperature, membrane oven temperature and both Ar sweep gas and N_2 addition gas allows remote tuning if the Aridus3 is placed in a clean enclosure
- New Flow Saver software application allows the user to turn off Ar and N_2 gas flows after completion of an overnight run, saving valuable gases.
- New removable membrane heater block for ease of cleaning or replacement

Principle Of Operation

Sample solution is introduced to the Aridus 3 by a self-aspirating C-Flow PFA nebulizer. The nebulizer aerosol is sprayed into a heated (up to 110°C) PFA spray chamber to maintain the sample in a vapor phase. The sample vapor then enters a heated fluoropolymer membrane desolvator (140°C) module.

A counter-current flow of argon sweep gas is added to remove solvent vapors that permeate the porous wall of the membrane. Non-volatile sample components do not pass through the membrane wall and continue to the ICP-MS instrument. A schematic of the Aridus3 is given below:



Membrane Desolvator Module

The Aridus 3 is equipped with a removable membrane desolvator module (depicted at right). The module is an integral part of the Aridus 3 chassis and simply pulls directly out of the back panel (no need to open the main cover) after it is unlocked with a hex wrench. Once removed from the Aridus 3, the membrane desolvator module can be conveniently cleaned or replaced. A dedicated rinse kit is provided to introduce an appropriate cleaning solution such as dilute nitric acid.

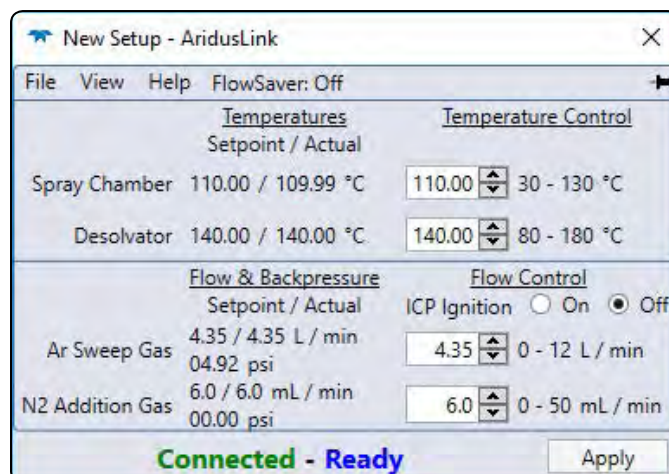


Aridus3 Removable Membrane Desolvator Module

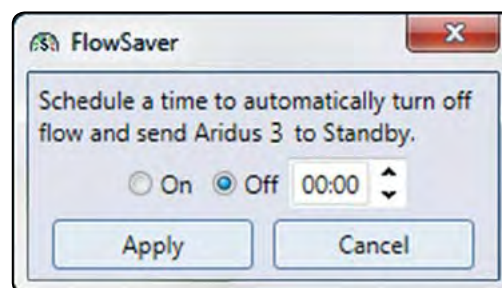
Aridus 3 Software Control

The Aridus3 is equipped with dedicated mass flow controllers (MFCs) for precise control of both the Ar sweep gas and N₂ addition gas flows. Control is also provided for the PFA spray chamber and membrane oven temperatures. An easy-to-use software interface (which can be loaded onto the host ICP-MS computer or a separate computer such as a laptop) allows ease of parameter tuning and minimizes any manual user interaction with the Aridus3. The latter feature is an important benefit if the Aridus3 must be placed in a special enclosure such as a clean box.

In addition to temperature and gas flow control, the Aridus3 software has a new Flow Saver timing function that allows the user to turn off the Ar sweep gas and N₂ addition gas flows at a predetermined time. This benefit saves valuable gases after a longer unattended sample run.



Aridus3 Software Control Screen



Flow Saver Setup Screen

Technical Specifications

Nebulizer

C-Flow PFA; 50, 100, or 200 µL/min

Spray Chamber

PFA with pumped drain

Temperature

110°C

Desolvating Membrane

Fluoropolymer

Ar Sweep Gas

0.00 to 12.00 L/min

N₂ Addition Gas

0.0 to 50.0 mL/min

Input Pressure (Ar and N₂)

75 to 125 psi (5.2 to 8.6 bar)

Temperature

140°C

Voltage

120 VAC +/- 10%, 50/60 Hz, 6A

220 VAC +/- 10%, 50/60 Hz, 3A

Computer Requirements

Microsoft Windows® 7 operating system or newer

.Net 4.6 (included on CD or Windows 10)

Minimum 2GB RAM

One available serial or USB port

Dimensions

Height	19.2 cm	(7.55")
Width	33.7 cm	(13.26")
Depth	52.0 cm	(20.47")
Weight	11.8 kg	(26 lbs)

Optional

ASX-112FR MicroAutosampler

QuickWash3 Rapid Washout Accessory



Aridus 3 Spares and Accessories

Part Number	Description	Image	Part Number	Description	Image
32-0123-047	PFA Spray Chamber Assembly		SP5160	12/5 Glass Socket Adapter	
32-0109-047	Desolvator Oven Assembly		SP8113	ICP Torch Adapter, ESI Style	
SP8015	Nebulizer Inlet Port With O-Rings		SP8241	Torch Adapter for Thermo iCAP™ Q ICP-MS	
32-0114-039	Spray Chamber Extraction Knob		32-0141-047	Aridus 3 Rinse Kit	
SP8143	Fuse Kit – Includes 1 2.5A and 3 5A fuses		32-0045-047	Fan Assembly Kit	
	C-Flow Nebulizer with integrated probe		32-0090-050	Ar Mass Flow Controller	
SP8204	C-Flow 50 PFA		32-0089-050	N ₂ Mass Flow Controller	
SP8204A	C-Flow 100 PFA				
SP8204B	C-Flow 200 PFA				
SP8027	Interface Kit – Thermo Element2™ and Neptune™ ICP-MS, Analytik Jena (ex. Bruker, Varian) ICP-MS		SP8180	Sample Out Line Kit, Aridus3	
SP8027A	Interface Kit – Agilent 4500/7500/7700/7900/8800 ICP-MS, Thermo XSERIES and iCAP™ Q ICP-MS		SP8246	Polyethylene Insulation Tubing for Sweep Gas Out	
SP8027B	Interface Kit – PerkinElmer ELAN® Series and NexION® Series ICP-MS		360200	USB to Serial Converter	
SP8027C	Interface Kit – Nu Instruments ICP-MS		32-0194-036	QuickWash 3 Communications Cable	

QuickWash 3 Fast Washout Accessory for Aridus 3



Prolonged introduction of higher concentration samples can cause analyte and matrix buildup on the inner wall of the heated PFA spray chamber. This buildup can cause signal spikes and longer sample washout times.

The QuickWash Fast Washout Accessory can be used during the rinse cycle of the Aridus 3 to rapidly clean the inner wall of the PFA spray chamber, greatly reducing washout times. The QuickWash controls a second pneumatic nebulizer that is positioned in the side-front of the spray chamber, generating a tangential aerosol to efficiently clean the chamber.

The QuickWash Accessory is designed as a modular accessory that inserts into the front panel of the Aridus 3. Gas, liquid, and electrical / communications connections are simple, enabling easy installation.

The QuickWash can be operated manually or can be set to run automatically when used with the Teledyne CETAC ASX-112FR MicroAutosampler. Wash times are preset from 10 seconds to 160 seconds via the Aridus 3 control software.



Aridus3 Software Screen
with QuickWash Function



Installation of QuickWash Fast Washout
Accessory for the Aridus3

ASX-112FR Micro Autosampler for Aridus 3

The ASX-112FR (Flowing Rinse) MicroAutosampler is designed for use with the Aridus3. The ASX-112FR offers the benefits of a transparent protective cover and a dual flowing rinse station to ensure sample integrity from the first to the last sample in a sequence. All sample vials, racks, and trays are constructed of metal-free, acid-resistant polymer materials. A hinged door in the front of the cover allows easy access to sample and standards.

There are five standard positions for 20-mL PFA vials and nine standard positions for 4-mL PFA vials. Sample racks include 24, 48, and 96 position types for 0.5 mL to 2.0 mL sample volumes. Bel-Art half racks (30 and 42 position) for 7-mL and 14-mL samples are also available.

Compact

The modular design of the ASX-112FR allows placement on the Aridus3 cover for maximum conservation of valuable benchtop space. This arrangement also minimizes sample path length using the C-Flow PFA nebulizer with integrated sample probe. Computer interfaces include RS-232, USB and optional IEEE-488.

High Purity

The ASX-112FR utilizes dual, continuous flow rinse stations, operable in gas-displacement or peristaltic pump mode which minimizes sample contamination and carryover. All sample vials, racks, and trays are constructed of metal-free, acid-resistant, high-purity polymeric materials. In addition, the ASX-112FR has an integrated transparent cover to minimize sample contamination.

Flexible

The ASX-112FR accommodates rack configurations allowing operation with sample volumes as low as 200 µL and up to 14 mL.

Convenient

Samples and racks may be easily accessed (during operation, if desired) through a hinged door, or by removing the entire anti-contamination cover.



Technical Specifications:

Standards Tray Size

5 positions (20 mL vial), 9 positions (4 mL vial)

Sample Rack Configurations

CETAC racks – 24, 48, and 96 positions; Bel-Art half racks – 30 and 42 positions

Computer/Hardware Interfaces

USB, RS-232, IEEE-488 (optional)

Power Requirements

100 - 240 VAC ± 10%, 50/60 Hz

Dimensions

Height	42.9 cm	(16.9")
Width	33.4 cm	(13.1")
Depth	50.8 cm	(20")
Weight*	14.1 kg	(31.0 lbs)

*with transparent cover

Warranty

2 year limited

See page 33 for additional information and spare parts listing.

C-Flow PFA Concentric Nebulizer for Aridus 3

The C-Flow is a molded, fixed-capillary style PFA (perfluoroalkoxy) concentric nebulizer for the introduction of low-volume (<1 mL) samples to the Aridus 3. The inert PFA construction allows the introduction of all acids (including hydrofluoric acid), alkalis and organic solvents.

The C-Flow features a standard 6 mm diameter tip for easy installation to most spray chambers. Nebulizer gas connection is direct with 4 mm diameter tubing attaching via a PFA nut to the gas inlet.

The nebulizer uptake line is designed with a built-in autosampler probe for connection to the ASX-110FR or ASX-112FR Autosamplers. The C-Flow is supplied as standard with the Aridus 3 Desolvating Nebulizer System.



Technical Specifications

Sample Uptake Rate

50 $\mu\text{L}/\text{min}$, 100 $\mu\text{L}/\text{min}$, or 200 $\mu\text{L}/\text{min}$

Nebulizer Gas Flow

0.7 to 1.2 L/min

Nebulizer End (outer diameter)

6 mm

Nebulizer Overall Length

C-Flow 50	820 mm
C-Flow 100	1075 mm
C-Flow 200	820 mm

Uptake Line Length

C-Flow 50	745 mm
C-Flow 100	1000 mm
C-Flow 200	745 mm

Part Number	Description	Image
SP8204	C-Flow 50 PFA Nebulizer with integrated probe	
SP8204A	C-Flow 100 PFA Nebulizer with integrated probe	
SP8204B	C-Flow 200 PFA Nebulizer with integrated probe	

DS-5 Microflow Concentric Nebulizer



The Teledyne CETAC DS-5 Microflow Nebulizer is a specialized device for very low-flow applications (3 to 10 $\mu\text{L}/\text{min}$), including micro-HPLC coupled with ICP-MS. The DS-5 nebulizer kit includes a dedicated low-volume spray chamber which can connect directly via a glass socket to the base of the ICP-MS torch.

Part Number	Description
DS5-99-0001	DS-5 Nebulizer

Introduction

Very limited volume samples and/or the need to introduce neat organic solvents to the ICP-MS may require the use of a very low flow rate nebulizer. The CETAC DS-5 Nebulizer is a concentric type that couples a proprietary capillary and gas orifice design for stable liquid flow.

Samples may be self-aspirated to the DS-5 or pumped via a micro-HPLC pump; nebulizer gas is supplied to the DS-5 from the host ICP-MS instrument. The DS-5 can be inserted directly into the included low-volume (8 mL) spray chamber which can attach directly via a 12/5 glass socket to the base of the ICP-MS torch. This arrangement enables rapid sample stabilization and washout times and maintains chromatographic peak resolution. Note that the DS-5 is a total consumption nebulizer system, as no liquid waste accumulates in the spray chamber at such low flows (3–10 $\mu\text{L}/\text{min}$).

The figure below shows the typical arrangement of the DS-5 setup for online chromatography with ICP-MS.

Application areas for the DS-5 include nano-volume flow injection analysis of very toxic or radioactive samples and metallomic studies.

References:

1. D. Schaumlöffel, J. Ruiz, R. Lobinski. "Development of a Sheathless Interface between Reverse-Phase Capillary HPLC and ICPMS via a Total Consumption Nebulizer for Selenopeptide Mapping", *Anal. Chem.* 2003, 75, 6837.
2. D. Schaumlöffel, P. Giusti, M.V. Zoriy, C. Pickhardt, J. Szpunar, R. Lobinski, J.S. Becker. "Ultratrace Determination of Uranium and Plutonium by Nano-Volume Flow Injection Double Focusing Sector Field Inductively Coupled Plasma Mass Spectrometry," *J. Anal. At. Spectrom.*, 2005, 20, 17.

Technical Specifications

Nebulizer Construction

PVDF body with fused silica capillary

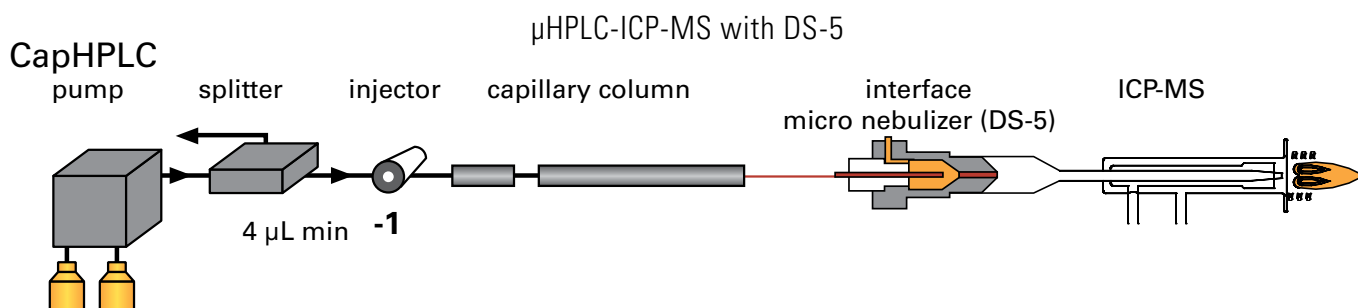
Uptake Rate

3 to 10 $\mu\text{L}/\text{min}$, pumped or self-aspirated

Nebulizer Gas Flow: 0.8 to 1.2 L/min

Spray Chamber

Quartz, 8 mL volume, 12/5 glass socket adapter



U5000AT⁺ Ultrasonic Nebulizer for ICP-AES/ICP-MS

The U5000AT⁺ Ultrasonic Nebulizer offers detection limits up to 10x lower for ICP-AES and ICP-MS. Samples are introduced onto a highly efficient piezoelectric transducer, providing greater analyte transport efficiency to the ICP.



Part Number	Description
U51-99-0001A+	U-5000AT ⁺ Ultrasonic Nebulizer 100/115V
U51-99-0001B+	U-5000AT ⁺ Ultrasonic Nebulizer 220/240V
U51-99-0001C+	U-5000AT ⁺ Ultrasonic Nebulizer 220/240 (Power Cord Required)

Sensitive

Higher Nebulization Efficiency: Conventional pneumatic nebulizers are generally only 2-3% efficient under normal operating conditions. The U5000AT⁺ converts more of the liquid sample into a usable aerosol, with an efficiency of 10-15%. The result is up to 10 times improvement in analyte signal.

Lower Detection Limits: For ICP-AES detection, limits fall below 1 ppb for many elements. For ICP-MS, sub-ppt limits can be achieved. Even lower limits may be obtained under clean-room conditions.

Stable

Short-Term and Long-Term Stability: Short-term (60 min.) and long-term (8 hour) stability is excellent, with %RSDs typically <1%.

Fewer Adjustments: The U5000AT⁺ has an auto-tuned power supply for stable operation. No adjustment is necessary between different sample types.

Efficient

An efficient electrothermal desolvation system is used instead of a re-circulating chiller. This prevents solvent overloading of the ICP, saves laboratory bench space and reduces maintenance. A built-in drain pump removes condensed sample solvent and excess sample liquid from the spray chamber.

Simple

Quick Setup All U5000AT⁺ units are shipped with an interface kit for fast and easy connection to the host ICP. The kit includes a nebulizer gas line and a sample out line with appropriate torch adapter.

Easy Operation: Once sample liquid is introduced to the U5000AT⁺, simply press the operate button to generate the aerosol.

Compact

Bench-Top Operation: The U5000AT⁺ has a small footprint allowing for placement on a bench-top or laboratory cart.

Modular Design: A modular design allows easy replacement of the entire glassware assembly. This unique feature can be useful when switching between very different sample types (ex. low dissolved solids versus high dissolved solids; aqueous versus organic). An optional membrane desolvator (MDX-200) can be added for further removal of sample solvent (aqueous or volatile organic).

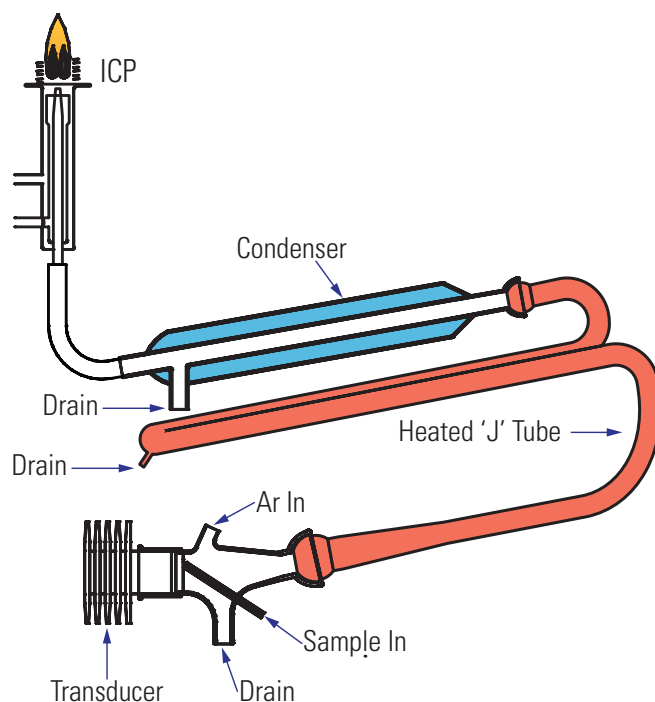


Principle Of Operation

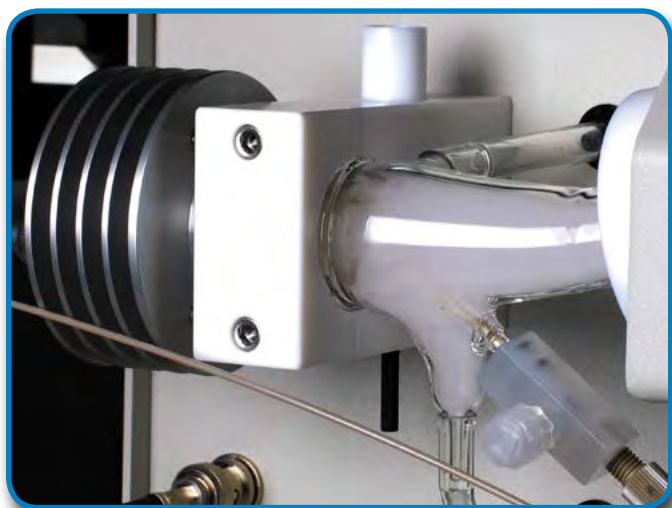
A peristaltic pump introduces liquid sample across an oscillating piezoelectric transducer. The oscillations disperse the sample into a fine aerosol, which is swept out of a spray chamber by a flow of argon gas from the host ICP-AES or ICP-MS instrument.

The aerosol passes through a heated tube and an electrothermally cooled condenser. An integrated drain pump removes the condensed sample solvent and any excess sample liquid from the spray chamber.

After passing through the condenser, the dried aerosol particles are swept by the nebulizer gas to the ICP instrument for analysis.



Schematic of U5000AT+ Ultrasonic Nebulizer



Close-up of Aerosol

Technical Specifications

Sample Uptake Rate

0.5 to 2.5 mL/min

Nebulizer Gas Flow

0.5 to 1.5 L/min

Heater Temperature

120°C to 160°C

Cooler Temperature

-20°C to +10°C

Voltage

100-120 VAC, 50/60 Hz, 4.5A

220-240 VAC, 50/60 Hz, 2.5A

Dimensions

Height	25.4 cm	(10")
Width	35.6 cm	(14")
Depth	34.9 cm	(13.75")
Weight*	12.3 kg	(27 lbs)

Warranty

12 month limited

U6000AT⁺ Ultrasonic Nebulizer/ Membrane Desolvator

The Teledyne CETAC U6000AT⁺ Ultrasonic Nebulizer/Membrane Desolvator is designed for the reduction of sample solvent loading (volatile organic or aqueous) to an ICP-AES or ICP-MS instrument. For ICP-AES the U6000AT⁺ is used primarily for the analysis of volatile organic solvents. These solvents can cause a number of serious problems in ICP-AES: loss of plasma, plasma instability, high carbon emission background, and carbon buildup on the ICP torch. For ICP-MS, the U6000AT⁺ can be used for both volatile organics and aqueous samples.

Benefits for ICP-MS are very similar to those for ICP-AES but include reduction of solvent-based mass spectroscopic interferences (e.g. $^{12}\text{C}_2^+$ interference on $^{24}\text{Mg}^+$). Analyte signal enhancement with the U6000AT⁺ is typically 2 to 5 times greater than a standard pneumatic nebulizer.



Part Number	Description
U61-99-0001A+	U-6000AT ⁺ Ultrasonic Nebulizer/Membrane Desolvator 100/115V
U61-99-0001B+	U-6000AT ⁺ Ultrasonic Nebulizer/Membrane Desolvator 220/240V
U61-99-0001C+	U-6000AT ⁺ USN/MD 220/240 (Power Cord Required)

Compact Design

The U6000AT⁺ consists of the standard Teledyne CETAC U5000AT⁺ Ultrasonic Nebulizer and a modular membrane desolvator. The ultrasonic nebulizer (USN) is placed on top of the membrane desolvator. A general schematic of the U6000AT⁺ is shown on the on the next page.

The U6000AT⁺ features a compact footprint with a width of only 35.6 cm and a depth of 34.9 cm. These dimensions allow placement of the U6000AT⁺ on a bench top or cart, conserving valuable laboratory bench space. The membrane desolvator module can be easily disconnected from the ultrasonic nebulizer if membrane desolvation is not necessary. This allows stand-alone operation of the ultrasonic nebulizer.

Easy Setup

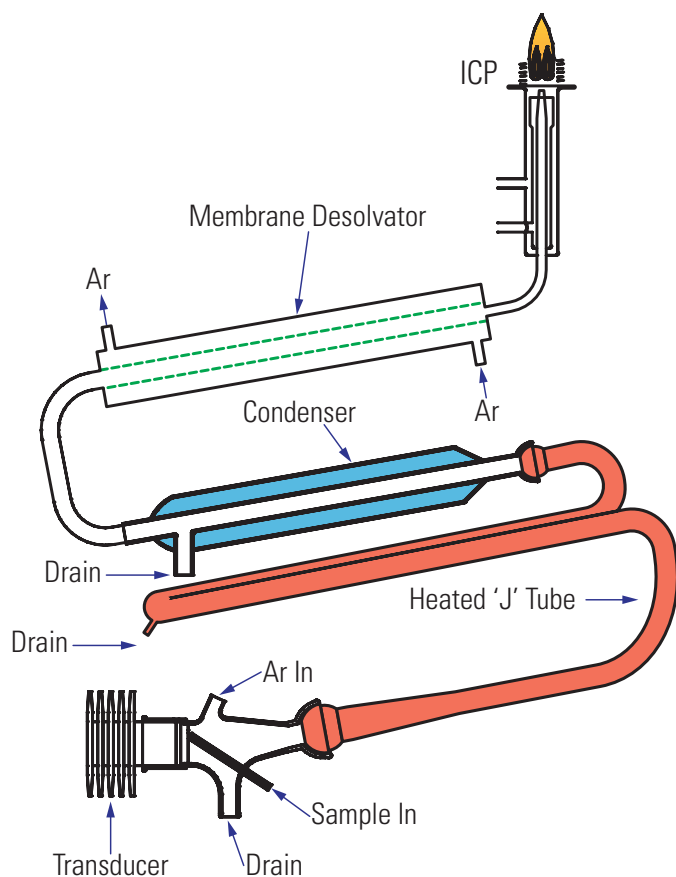
Each U6000AT⁺ is provided with an interface kit for the host ICP-AES / ICP-MS instrument. This kit includes a nebulizer gas line and a sample out line with the appropriate torch adapter. Interface kits are available for all ICP-AES and ICP-MS instruments. Each U6000AT⁺ also includes a rinse kit for cleaning the membrane desolvator.

Principle Of Operation

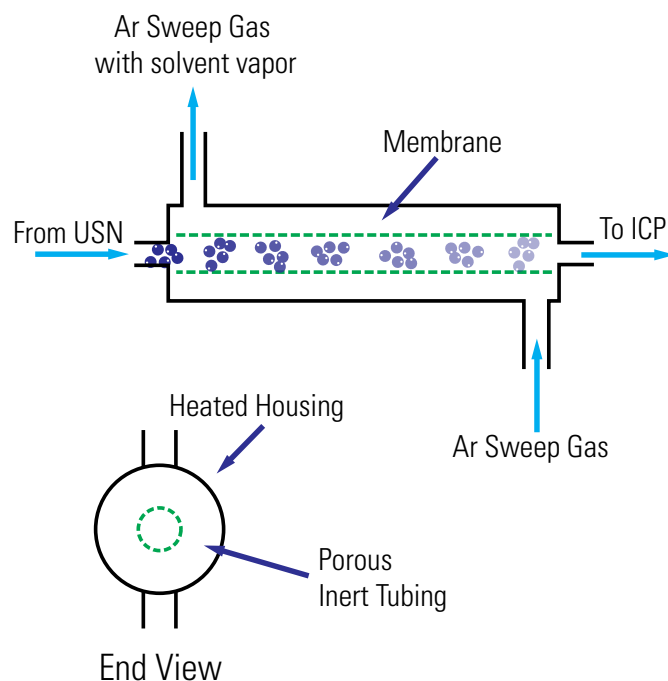
The USN incorporates a condenser that removes much of the sample solvent. However, any escaping solvent vapor (especially organic) can cause some of the problems previously listed. The outlet of the condenser is attached to the inlet of the membrane module. The membrane consists of a porous fluoropolymer tube that is placed inside a heated oven. The sample aerosol from the USN (carried by the argon nebulizer gas) passes into the membrane, and the high temperature of the oven (160°C) maintains the sample solvent as a vapor. A second countercurrent flow of argon gas (the sweep gas) flows outside the porous membrane wall and removes any volatile solvent vapor to vent. Non-volatile sample components do not pass through the membrane wall and continue to the ICP-AES or ICP-MS.

The membrane desolvator has a number of important features: the membrane is chemically inert and it can remove water vapor and both polar and non-polar volatile organic solvents. The membrane desolvator incorporates a dedicated gas control unit for the argon sweep gas, which can be easily teed from the main ICP argon supply.





Schematic of U6000AT⁺



Membrane Schematic

Technical Specifications

Sample Uptake Rate

0.5 to 2.5 mL/min

Nebulizer Gas Flow

0.5 to 1.5 L/min

Sweep Gas Flow

0 to 5.0 L/min

Heater Temperature

120°C to 160°C

Cooler Temperature

-20°C to +10°C

Membrane Oven Temp

80 °C to 160 °C

Voltage

Ultrasonic Nebulizer	100-120 VAC, 50/60 Hz, 4.5A
	220-240 VAC, 50/60 Hz, 2.5A

Membrane Desolvator	100-240 VAC, 50/60 Hz, 4A/2A
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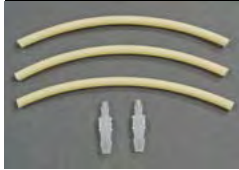
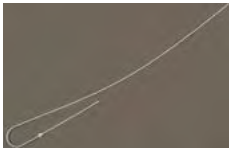
Dimensions

Height	38.7 cm	(15.25")
Width	35.6 cm	(14")
Depth	34.9 cm	(13.75")
Weight*	13.6 kg	(29.9 lbs)

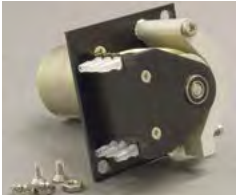
Warranty

12 month limited

U5000AT+/U6000AT+ Spares

Part Number	Description	Image	Part Number	Description	Image
SP5111	Feedthrough BNC connector kit for electrical box		SP5156B	Argon in Flow Restrictor 1000 mL / min	
SP7333	Isolated BNC connector kit for condensor unit		SP5413	Argon-In Connector Kit	
SP5125	Transducer Assembly with o-ring		SP5415	Aerosol Spray Chamber Kit	
SP5427	Transducer Cable		SP5168B	Aerosol Chamber O-Ring Kit (2 per Kit)	
SP5136	Sample Uptake Peristaltic Pump Tubing, 1.3 mm I.D. (12 per Pack)		SP5448	Heated J-Tube Assembly for U5000AT+ & U6000AT+	
SP5119	Sample Inlet Adapter Assembly (PEEK Tubing)		SP5366	Drain Pump Tubing & Connector Kit	
SP5150B	PEEK Sample Inlet Inlet Tubing		SP5447	Spare Parts Kit for U5000AT+ & U6000AT+	
SP5151	ETFE Sample Inlet Tubing for High Acid Samples		SP5159	Sample Out Tubing Kit (5 Feet)	
SP5171	Ferrule Replacement Kit for Sample Inlet Tube (20 Ferrules in Kit)		SP5155CC	Interface Kit – Thermo iCAP™ 6000/7000 series ICP-AES	

U5000AT+/U6000AT+ Spares

Part Number	Description	Image	Part Number	Description	Image
SP5155L	Interface Kit – All PerkinElmer NexION® 300/350 and ELAN® series ICP-MS, Optima™ series and Avio® 200/500 ICP-AES		SP5414	Fan Kit for Electrical Module	
SP5155P	Interface Kit – All Spectro ICP-AES (Genesis, Arcos, Spectroblue)		SP5430	Fan Kit for Glassware Module	
SP5155Y	Interface Kit – Agilent 5100 and 5110 ICP-AES		SP5449	Cooler Assembly	
SP5155S	Interface Kit – Agilent (ex. Varian) Vista and ES-700 Series ICP-AES and Agilent 4100/4200 MP-AES		SP5431	Drain Pump Kit with Motor Kit	
SP5160	Torch Adapter, 12/5 Glass Socket		SP5153	Circuit Breaker, 2 Amp	
SP5426	Clamp for 12/5 Glass Socket Adapter		SP5410	Fuse Kit	
SP6005	Torch Adapter – PerkinElmer Optima™ 2000, 4000, 5000, 7000, and 8000 series ICP-AES		SP5172	Hex (Allen) Wrench	
32-0316-039	Torch Adapter – PerkinElmer NexION® 1000/2000 ICP-MS				
SP6006	Torch Adapter – Thermo iCAP™ 6000/7000 Series ICP-AES				

HGX-200 Hydride Generation/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 elements As, Se and Sb. The HGX-200 can be easily interfaced to any ICP-AES or ICP-MS instrument.

Introduction

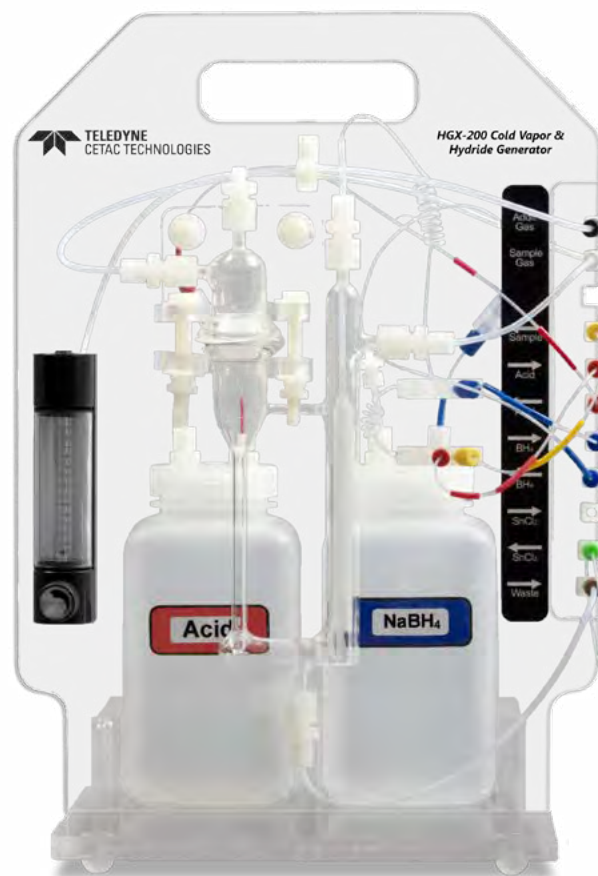
A number of elements can be chemically converted to gaseous forms: As, Bi, Ge, Pb, Sb, Se, Sn, Te to volatile hydrides and mercury to Hg^0 . Sample solutions are typically mixed with a sodium borohydride (NaBH_4) solution for hydride generation and Sn(II)/HCl for reduction of mercury to Hg^0 . This conversion offers a number of advantages for elemental measurement by ICP-AES or ICP-MS. The nearly 100% analyte transport efficiency combined with no water loading (as from conventional nebulizer systems) of the ICP can provide signal enhancements up to 100 fold. This feature is particularly advantageous for difficult to measure elements such as As and Se.

An additional benefit is the separation of analytes from potential matrix interferences. Examples are the argon chloride (ArCl^+) ICP-MS interferences on ^{75}As and ^{77}Se and tungsten oxides (WO^+) on various Hg isotopes.

Design Features

The Teledyne CETAC HGX-200 system features a specialized gas liquid separator (GLS), dedicated reagent vessels, clearly labeled tubing and connections, solution mixing blocks and coils, and a built-in gas flow meter. The peristaltic pump for sample, reagent, and waste flows is user provided.

The special U-shaped GLS incorporates a “frosted” glass post that provides a high surface area for liquid film evaporation and release of hydrides and Hg^0 . This feature helps to enhance analyte sensitivity.



Part Number	Description
HG2-99-0001	HGX-200 Hydride Generator

The GLS also features a porous fluoropolymer membrane and specialized droplet separator to achieve complete gas/liquid separation and reduce signal noise.

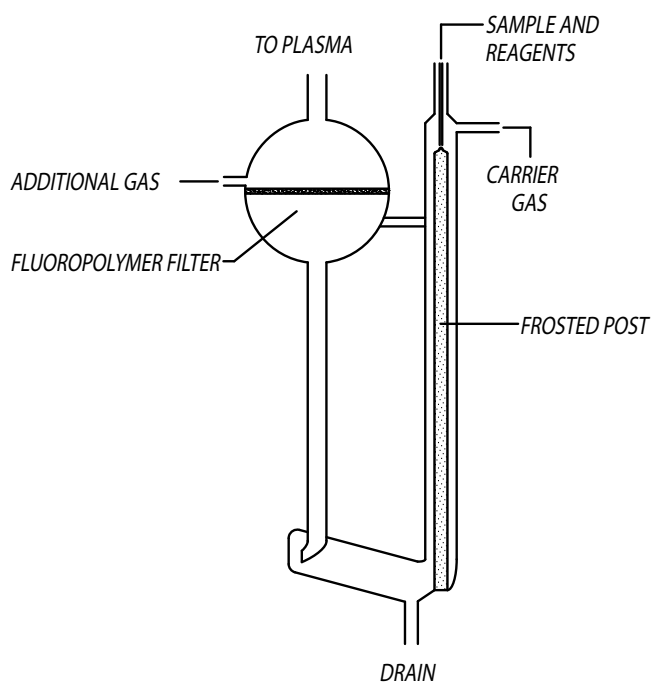
The integrated gas flow meter enables the addition of a second Ar gas flow after the GLS membrane. This second gas allows for best optimization of washout time and reduction of signal noise.

The small footprint of the HGX-200 allows convenient placement in the sample rack tray of the Teledyne CETAC ASX-520 or ASX-560 autosampler for larger sample runs. The top of the HGX-200 transparent stand has a built-in carrying handle for easy transport.

Two peristaltic pumps (user provided) are recommended: one pump for sample and reagent addition and one pump to remove liquid waste from the GLS.



HGX-200 Gas Liquid Separator Schematic



Technical Specifications

Dimensions

Height	43.8 cm	(17.25")
Width	30.5 cm	(12")
Depth	21.9 cm	(8.75")
Weight	3.4 kg	(7.5 lbs)

Gas Flow Meter

1 L/min Ar, up to 200 psi pressure

Reagent Bottles

Acid, NaBH_4 , HCl/Sn (II) , 1 L each

Warranty

12 month limited

HGX-200 Spares and Accessories

Part Number	Description	Image	Part Number	Description	Image
SP7057	Peri Pump Tubing, Black/Black, 0.76 mm I.D. (0.030 in) (12/pkg)		SP7042D	Interface Kit – Nu Instruments & Agilent 7500 /7700/ 7900/8800/8900 ICP-MS	
SP5231	Peri Pump Tubing, Purple/White, 2.79 mm I.D. (0.1099 in) (12/pkg)		SP7060	Gas Liquid Separator (GLS) (3 Pieces)	
SP7042	Interface Kit – Thermo Element2™ and Neptune™ ICP-MS		SP7043	Membrane Assembly for Gas Liquid Separator	

SPR-IDA Reagent

for Preconcentration/ Matrix Elimination

SPR-IDA (Suspended Particulate Reagent – Iminodiacetate) is a sample preparation material for preconcentration of trace elements and reduction of high alkali metal (e.g. Na) sample matrix levels. The reagent consists of 10 micron diameter polymer beads that have been chemically derivatized with the iminodiacetate chelating agent. Small aliquots of the reagent can be added in a batch mode to a sample and separated with bound metals by gravity or centrifugation.

Part Number	Description
SP5627	SPR-IDA Chelating Beads – 0.2 micron diameter beads, 1 g in 10 mL water
SP5646	SPR-IDA Chelating Beads – 10 micron diameter beads, 1 g in 10 mL water

Introduction

The determination of trace elements in liquid samples such as seawater and brines presents a number of challenges for ICP-MS. The high dissolved solids content (approx. 3.5%) of seawater can suppress analyte signal, cause mass spectral interferences, and clog the ICP-MS interface sampler and skimmer cones.

A seawater sample can be diluted, but at the expense of detectability as some elements of interest are in the 5 to 50 ppt (ng/L) range. An alternative is a sample preparation method that can selectively preconcentrate trace elements while having much less affinity for major matrix components such as Na, K, Ca, and Mg.

A chelating polymer resin called SPR-IDA can be used for preconcentration / matrix elimination of samples such as seawater. The resin is supplied as a 10% bead suspension in deionized water and can be easily pipetted into a sample. A typical bead suspension aliquot is 0.1 mL per 15 mL of seawater sample.

After SPR-IDA addition, the sample pH is adjusted to 8 and the beads are separated by gravity or a short (3 to 5 minute) centrifugation. The supernatant liquid is removed and the beads may be washed to remove more of the remaining unbound sample matrix. Diluted nitric acid is then added to the bead residue to release bound analytes and the extract analyzed via conventional nebulization by ICP-MS. Important elements that are chelated by SPR-IDA include Al, Cd, Co, Cu, Fe, Mn, Ni, Pb, U, and Zn.

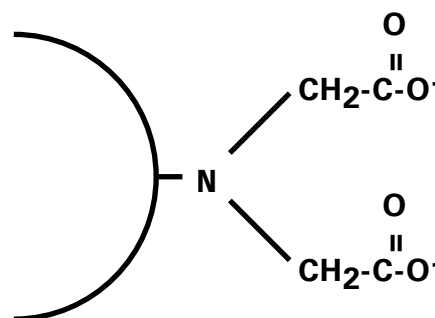


Suspension of SPR-IDA Reagent

This batch mode method with SPR-IDA has a number of important advantages versus online columns:

- Sample preparation can be done offline, saving valuable ICP-MS running time (argon gas, electricity) that is lost during column loading, washing, and elution steps.
- The SPR-IDA bead aliquot is used only once, avoiding sample memory effects from incomplete column elution.
- No additional complex, costly liquid handling hardware (e.g. injection and switching valves) are needed.

Iminodiacetate (IDA) on SPR Bead



Specifications:

Chelating Agent
Iminodiacetate (IDA)

Bead Substrate
Polystyrene

Average Bead Diameter
10 microns (0.01 mm)

Bead Capacity
75 mg Cu / 1 gram of beads

Bead Suspension
10% w/v



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This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

