PROMOCHROM TECHNOLOGIES

Sample Preparation Without Limits

SPE-03

8-Channel Automated SPE System

A compact and efficient workhorse for semi-volatile pollutants in water, food, soil, petroleum and biological samples

Capable of fully automating even the most challenging extractions like PFAS following EPA Method 537.1/533/1633 and ISO 21675

Configurable for high-throughput protein purification

Proudly Canadian and supporting the local industry
Products designed, built and tested at our Richmond and Surrey locations

ABOUT PROMOCHROM

PromoChrom Technologies focuses on the development of sample preparation solutions for trace analysis. Our highly versatile systems have helped customers automate even the most challenging sample extraction processes.

Since **2005**, PromoChrom has developed the SPE-01 and SPE-03 cleanup stations, SPE-04 online/offline SPE's, LC-04 online SPE, RT-01 sample purifier and SPE-06 mini-SPE. Each of the instruments targeted specific applications

In **2011**, the **flow-path-integration technique** was patented for multi-channel liquid handling. It combines various switching valves into one liquid handling module. This simplified our instruments considerably, making them more cost-effective and reliable

In **2017**, "**Two-tier online SPE**" was invented by PromoChrom which uses a second SPE column for online SPE. This method significantly increased the detection sensitivity and mitigated column compatibility and clogging issues commonly found in online SPE systems

In **2018**, the MOD-004 **sample bottle rinsing** function and MOD-005 **minimal-Teflon** option were added to fully automate PFAS extraction in drinking water

By **2019**, the SPE-03 is widely used by government and commercial labs for PFAS extraction following EPA, DOD, ISO, modified and other proprietary methods. To expand production, a new office location was opened in Richmond.

In **2020**, we transitioned to remote installation support which allowed greater focus on R&D. This led to exciting new features such as MOD-00P **Volume-Matrix Plus** option for large volume surface/waste water samples, **integrated sample bottle resonators** for MOD-004 and inline sample filters for samples with particulates

Today, we continue to seek new breakthroughs in laboratory process automation

SMALL

BUT VERSATILE

Imagine an 8-channel system so compact in size, you can easily fit 3 in a 10-ft fume hood. It performs the most challenging SPE procedures, with every step in parallel. Method editing is quick and easy using its 5” touch screen interface. By providing constant flow rate and well-controlled elution procedures, SPE-03 helps to improve quality and efficiency of trace analysis and relieve chemists from tedious sample preparation. Accelerate your water, food, fuel and biological testing today.

• parallel operation • positive pressure system • minimal-teflon option • 0.5 - 4000mL sample loading • sample bottle rinsing and sonication • SPE cartridge conditioning/washing/elution • SPE cartridge blockage detection • nitrogen dry • air purge • solvent mixing • programmable wait • system cleaning • 2 fractions per sample • 2 waste channels • 1/3/6 mL or 6/12/20 mL SPE cartridges • 5” touch interface • up to 100 methods • customizable

APPLICATIONS

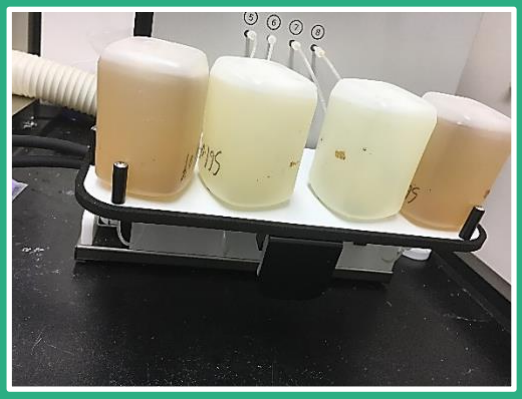
Petroleum Products

Marine diesel oil, jet fuel

Saturated hydrocarbon, Aromatic hydrocarbon, additives, Oxidized components, Polar compounds

Soil, Solids & Biosolids

Extract clean up of PFAS, EPHs, PPCPs



Water

Drinking, Surface, Waste

PFAS, PAHs, PCBs, EPHs, Pesticides, Herbicides, Drugs

Food & Feed

Mycotoxins, Food additives, Pesticides, Drugs

Biological Samples

Protein, Urine & Blood

Antibodies, Antigens, Metabolites, Drugs, Hormones

SAMPLE LOADING OPTIONS

Highly flexible

Default Sample Tubing

General applications that do not require automated sample container rinsing.

The SPE-03 comes with default 30cm sample tubing that can be used for open-mouth containers such as 15mL/50mL centrifuge tubes and up to 500mL sample bottles. Longer tubing is available for larger sample containers.

ADD-002

PFAS and applications that require automated rinsing of up to 250mL bottles.

For automated rinsing of up to 250mL bottles. Common HDPE and PP bottles can be loaded up-side down using the ADD-002 sample bottle rack to allow easy handling and maximum sample transfer.

ADD-001

Flexible design for efficient loading and rinsing of up to 1L sample bottles. High tolerance to sample particulates.

The Volume-Matrix Plus option speeds up sample loading and can perform automated rinsing of up to 1L bottles of any kind. Separate rinsing and loading lines allow for handling of samples with high turbidity and particulate levels.

ADD-004

Simplify handling and maximize sample transfer for 0.5-20mL samples.

For applications with small sample sizes 0.5mL to 20mL, ADD-004 offers a convenient way to directly dispense samples into empty tubes on either side of the system. Maximizes sample transfer and simplifies sample line cleaning.

Contact us for customization options

FEATURES

Fast. Easy. Versatile

8-CHANNEL SYSTEM

The SPE-03 processes 8 samples up to 4L in parallel. All samples start and finish at the same time. Our patented multi-channel valve has separate flow paths for each sample to remove cross-contamination.

SPE CARTRIDGE

Compatible with 1/3/6mL or 6/12/20mL SPE cartridges without the need for extra adapters. Custom adapters can be made for other sizes.

FRACTION COLLECTION

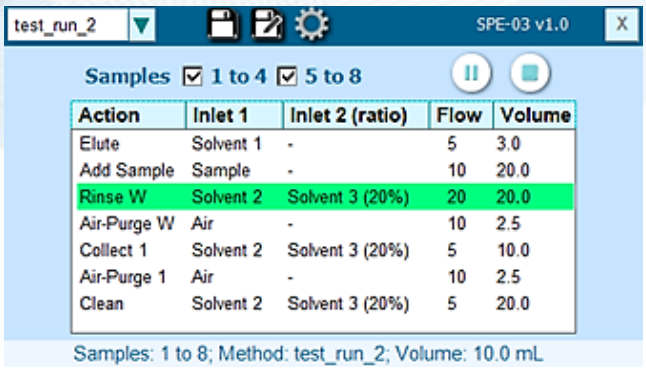
The default fraction collection tray comes with 1 row for 15mL tubes and 1 row for 50mL tubes. Customizations available for sizes between 1.5mL HPLC vials and 60mL ASE tubes and up to 6 rows.

AUTOMATIC BOTTLE RINSE

Using ADD-001 or ADD-002, the SPE-03 can rinse the sample containers using solvents and add the rinsate back to the SPE cartridges to improve recovery. This feature can also be used for cleaning sample lines after each extraction.

INTUITIVE TOUCH INTERFACE

The SPE-03 comes with a resistive touch screen interface that works even under wet conditions. There is no need for an external computer. Sample selection and method editing can be intuitively performed in just a few steps. When running, the screen highlights the current step being run and displays its processed volume and remaining time.



Action	Inlet 1	Inlet 2 (ratio)	Flow	Volume
Elute	Solvent 1	-	5	3.0
Add Sample	Sample	-	10	20.0
Rinse W	Solvent 2	Solvent 3 (20%)	20	20.0
Air-Purge W	Air	-	10	2.5
Collect 1	Solvent 2	Solvent 3 (20%)	5	10.0
Air-Purge 1	Air	-	10	2.5
Clean	Solvent 2	Solvent 3 (20%)	5	20.0

INLINE SAMPLE FILTERING

Inline filters can be connected to sample lines to prevent sample particulates from entering the system. Solvent rinsing of sample lines can be used before elution to ensure compounds are recovered.

NITROGEN DRYING

Nitrogen drying of sorbent material can be programmed into the methods. Drying duration can be time-controlled or until the user wishes to resume next steps.

2 WASTE OUTLETS

Sample and solvent waste can be separated on the system for labs that require special treatment of organic, halogenic or acidic waste. This also prevents waste bottles from filling up too quickly.

COLUMN BLOCKAGE DETECTION AND SMART HANDLING

The system can detect the blockage of SPE columns and reduce the flow rate accordingly. If blockage continues, an alarm will sound and the instrument will pause for the user to step in.

POSITIVE PRESSURE

The SPE-03 system uses positive pressure to achieve controlled flow rates and prevent sorbent drying when delivering samples and solvents. Liquids are much less likely to build up in SPE cartridges than vacuum-based systems.

AUTO-RECOVERY AND LOGGING

The powerful software keeps track of extraction step performed and can allow users to resume during disruptions such as power failure. Up to 7 days of logs can also be viewed or retrieved.

AUTO-DECLOGGING

De-clogging can be applied at preset intervals to purge inline filters when running challenging samples.

MINIMAL TEFLON OPTION

- Validated for low background
- Non-PTFE solvent and sample tubing
- Used by labs with MRL as low as 0.3ppt for PFAS

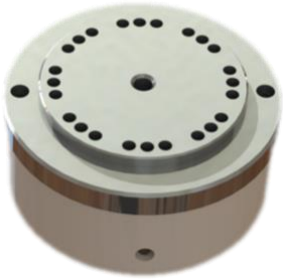
A widely tested and proven solution
for applications that are sensitive to Teflon (such as PFCs and PFAS in drinking water). Request MOD-005 when ordering.

WORKING PRINCIPLE

Patented Valve Design to Achieve Complex Liquid Handling

PromoChrom's multi-functional valve shown below is based on our flow-path-integration technique. The function of one such valve is equivalent to several normal stream selection valves and isolation valves.

With 1 stream selection valve and an 8-channel distribution valve, the SPE-03 can provide isolated flow paths for 8 samples, choose from 7 solvents, blow air and nitrogen and perform solvent mixing.



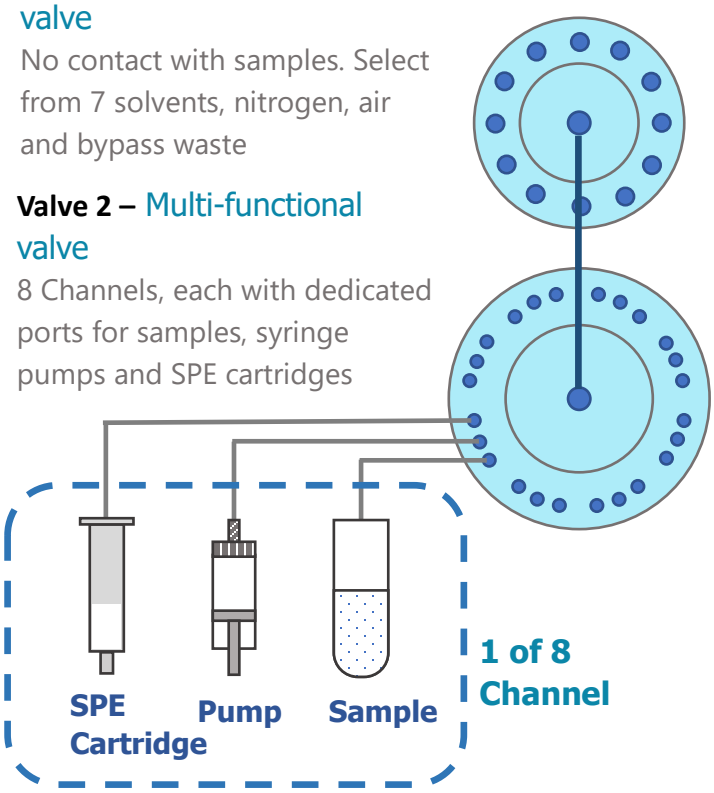
8-Channel Valve

Valve 1 - Stream-selection valve

No contact with samples. Select from 7 solvents, nitrogen, air and bypass waste

Valve 2 – Multi-functional valve

8 Channels, each with dedicated ports for samples, syringe pumps and SPE cartridges



Reduced Number of Valves

This design has replaced the conventional method of using one stream selection valve and one isolation valve per channel. Not only does it save space and reduce complexity, there is also more room for other functionalities.

Valves in Conventional Systems

Design Benefits

Low Maintenance Requirement

With significantly fewer parts in operation, very little maintenance and part replacement is required.

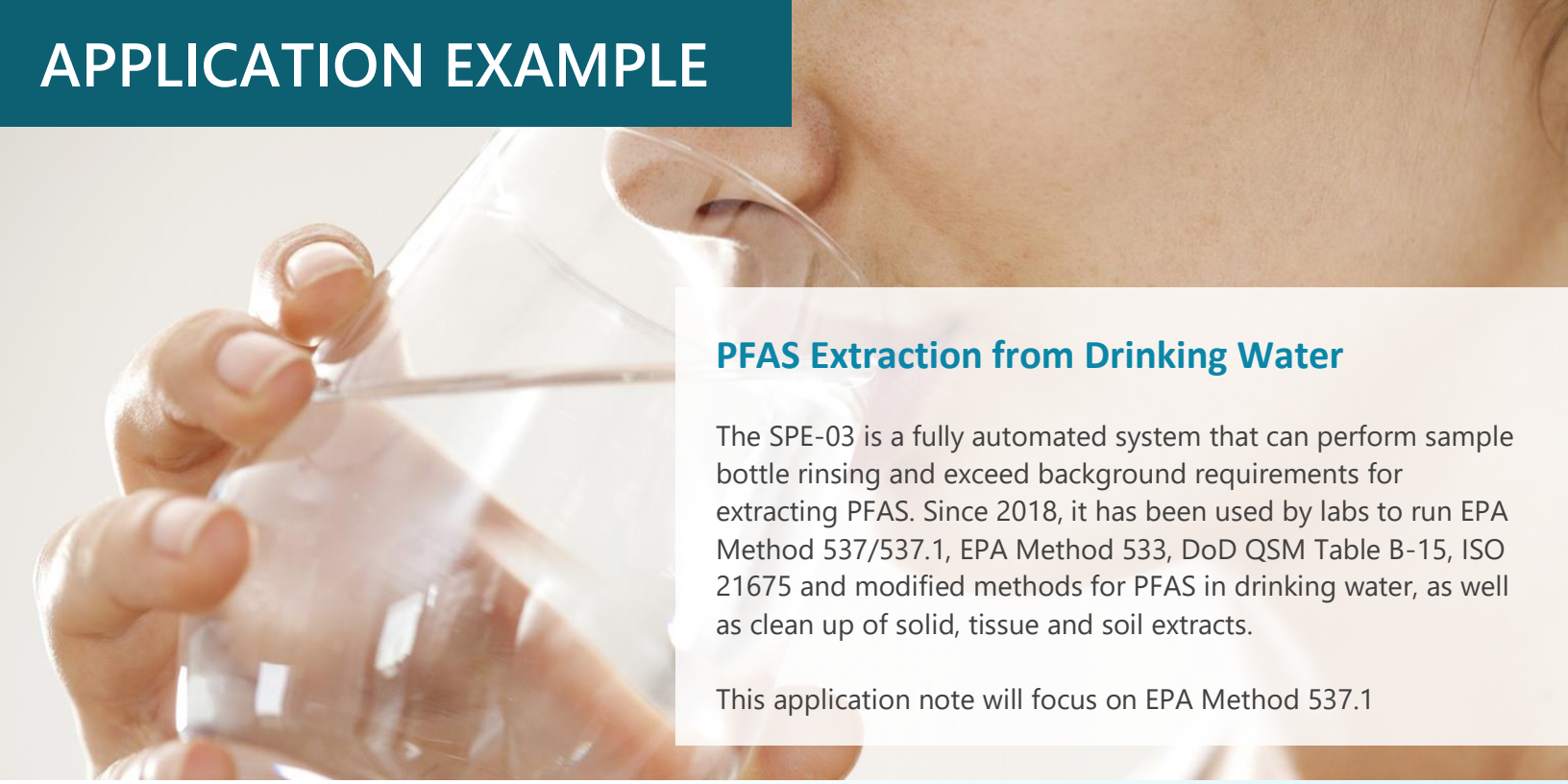
Small Footprint

The SPE-03 is only 34cm x 34cm x 45cm in size and can easily fit on crowded lab benches and inside fume hoods.

Minimal Carry-Over

Shorter and reduced number of fluid lines makes the system easy to clean after each sample run.

APPLICATION EXAMPLE



PFAS Extraction from Drinking Water

The SPE-03 is a fully automated system that can perform sample bottle rinsing and exceed background requirements for extracting PFAS. Since 2018, it has been used by labs to run EPA Method 537/537.1, EPA Method 533, DoD QSM Table B-15, ISO 21675 and modified methods for PFAS in drinking water, as well as clean up of solid, tissue and soil extracts.

This application note will focus on EPA Method 537.1

The following summarizes a typical SPE-03 setup for EPA Method 537.1. LC-MS grade Methanol is connected as Solvent 1 and reagent water is connected as Solvent 2. Waste 1 and Waste 2 are used for aqueous and organic waste respectively. Fractions are collected into fraction 1.

Steps Programmed on SPE-03

Action	Inlet 1	Flow	Volume	Description
Elute W2	Solvent 1	10	15 mL	Pre-condition with 15mL MeOH at 10mL/min
Elute W1	Solvent 2	10	18 mL	Pre-condition with 18mL H_2O at 10mL/min
Elute W1	Solvent 2	10	3 mL	Add 3mL H_2O to SPE cartridges
Add Samp W1	Sample	10	250 mL	Load 250mL of sample at 10mL/min
Rinse W1	Solvent 2	15	7.5 mL	Rinse bottles with 7.5mL H_2O and deliver rinsate
Rinse W1	Solvent 2	15	7.5 mL	Rinse bottles with 7.5mL H_2O and deliver rinsate
Air-Purge W1	Air	10	5 mL	Purge lines with air to remove excess H_2O
Blow N2	Time Based		5 mins	Dry cartridges for 5mins using Nitrogen
Rinse 1	Solvent 1	5	4 mL	Rinse bottles with 4mL MeOH and elute to fraction 1
Rinse 1	Solvent 1	5	4 mL	Rinse bottles with 4mL MeOH and elute to fraction 1
Collect 1	Sample	5	5 mL	Collect remaining MeOH in fluid lines into fraction 1

Good and Consistent Recoveries

Below are Initial Demonstration of Capability (IDC) and Mimium Reporting Level (MRL) confirmation results obtained from a customer lab. IDC was performed on one batch of 4 x 50ppt LFBs. MRL was performed on 7 x 2ppt LFBs over the span of 3 days. Tables show the mean recovery and RSD for all 18 compounds.

IDC – 4 x 50 ppt LFBs

Requirements: Mean within 70%-130%, RSD <20%

Compound	%Recovery	%RSD
PFBS	84	5.16
PFHxA	93	7.81
HFPO-DA (GenX)	95	6.59
PFHpA	104	8.71
PFHxS	99	1.81
ADONA	101	4.92
PFOA	104	5.60
PFOS	95	3.98
PFNA	105	4.73
9Cl-PF3ONS	96	1.88
PFDA	96	8.48
NMeFOSAA	101	3.93
PFUnA	96	6.78
NEtFOSAA	101	1.26
11Cl-PF3OUdS	86	1.84
PFDoA	87	4.83
PFTrDA	89	7.81
PFTA	85	10.11

MRL – 7 x 2 ppt LFBs

Requirements: Mean±HR_{PIR} within 50%-150%

Compound	%Recovery	%RSD
PFBS	100	5.69
PFHxA	101	4.77
HFPO-DA (GenX)	97	5.14
PFHpA	111	5.02
PFHxS	104	3.79
ADONA	101	5.92
PFOA	112	8.08
PFOS	102	2.24
PFNA	105	7.59
9Cl-PF3ONS	96	2.95
PFDA	96	8.52
NMeFOSAA	98	5.56
PFUnA	100	5.47
NEtFOSAA	103	4.21
11Cl-PF3OUdS	95	6.38
PFDoA	95	12.66
PFTrDA	95	11.45
PFTA	92	5.99

The accuracy and precision of the SPE-03 are well within method requirements. The system reliably performs the same extraction process each time which eliminates significant sources of human error.

Improved Recovery on Field Samples

The SPE-03 has also shown good recovery for samples with complex matrices. Better surrogate recovery of well water samples was seen after switching from the vacuum manifold to the SPE-03. The improvement is attributed to the controlled flow rate of our positive-pressure system.

APPLICATION EXAMPLE

Low Background Contamination and Carry Over

The minimal-Teflon option keeps background interference well below the tightest limits. Most of our customers have 1ppt and 2ppt MRLs, but data shows that the system is capable of much lower limits. Carry over was validated at multiple customer sites by running a batch of high spikes (80ppt to 400ppt) followed by blanks, with a quick cleaning method in between. The cleaning method was effective in reducing any carry over to <1/3MRL.

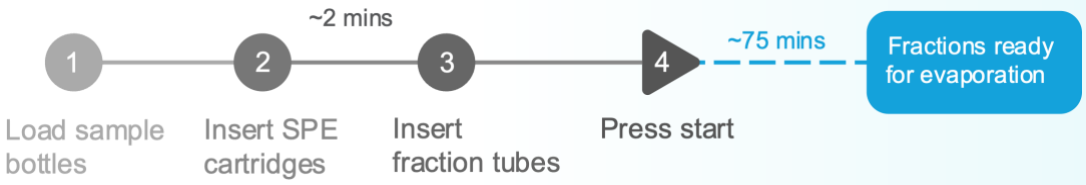
System Background

Batch of 8 blanks following EPA Method 537.1, [ng/L]

Compound	Pos 1	Pos 2	Pos 3	Pos 4	Pos 5	Pos 6	Pos 7	Pos 8
PFBS	ND	ND	ND	ND	ND	ND	ND	ND
PFHxA	ND	ND	ND	ND	ND	ND	ND	ND
HFPO-DA (GenX)	ND	ND	ND	ND	ND	ND	ND	ND
PFHpA	ND	ND	ND	ND	ND	ND	ND	ND
PFHxS	ND	ND	ND	ND	ND	ND	ND	ND
ADONA	ND	ND	ND	ND	ND	ND	ND	ND
PFOA	0.060	0.036	0.052	0.007	0.076	0.072	0.012	0.006
PFOS	ND	ND	ND	ND	ND	ND	ND	ND
PFNA	ND	ND	ND	ND	ND	ND	ND	ND
9Cl-PF3ONS	ND	ND	ND	ND	ND	ND	ND	ND
PFDA	ND	ND	ND	ND	ND	ND	ND	ND
NMeFOSAA	ND	ND	ND	ND	ND	ND	ND	ND
PFUnA	ND	ND	ND	ND	ND	ND	ND	ND
NEtFOSAA	ND	ND	ND	ND	ND	ND	ND	ND
11Cl-PF3OUdS	ND	ND	ND	ND	ND	ND	ND	ND
PFDoA	ND	ND	ND	ND	ND	ND	ND	ND
PFTrDA	ND	ND	ND	ND	ND	ND	ND	ND
PFTA	ND	ND	ND	ND	ND	ND	ND	ND

Operator Involvement

Only 2 minutes of operator involvement is required to load the samples, SPE cartridges and fraction tubes. After pressing start, the system will automate the rest of the extraction until the fractions are ready for evaporation. A quick system cleaning method is employed between batches with minimal manual setup.



SPECIFICATIONS

SPE-03

No. of Samples	Up to 8 in parallel
No. of fractions	2
No. of waste channels	2
No. of solvents	7
Sample volume	0.5 – 4000 mL
Fraction volume	Up to 50 mL
SPE cartridge size	1/3/6 mL or 6/12/20 mL
Flow rate	0.5 – 100 mL/min
Fluid delivery	Positive pressure
Display	5" resistive touch
No. of methods	100
Method actions	Cartridge pre-condition/soak/wash, add sample, elution, sample bottle rinsing, sample bottle shaking, sample line cleaning, air purge, solvent mixing, nitrogen dry, pause
Dimensions	35 cm x 35 cm x 45 cm
Weight	13 kg
Power	1.5 A @ 24 VDC

Customizations

Minimal-Teflon Option

Replaces all PTFE solvent and sample lines

Sample Container Rack

Custom sample racks for sample tubes or bottles, specify when ordering

Fraction Rack

Default rack holds 1 row of 15mL and 1 row of 50mL centrifuge tubes. Customizable for 1.5mL HPLC vials up to 60mL ASE vials and up to 6 rows

SPE Cartridge Adapters

Default system works with 1/3/6 mL or 6/12/20 mL cartridges. Can be customized for sizes up to 70mL

ACCESSORIES

ADD-004 (0.5mL to 20mL samples)

Sample tubes with fluid lines on the bottom to allow direct dispensing of samples and maximum transfer of small volume samples. Easy to clean since sample lines are not submerged. Inline filter compatible.

ADD-002 (Automated bottle rinsing for PFAS)

Up to 250mL plastic bottles can be loaded up-side down using the ADD-002 sample bottle rack to allow rinsing and maximum sample transfer. Comes with built-in resonators for maximum rinse coverage, water droplet removal and desorption of sticky compounds. Inline filter compatible. 64cm total width with ADD-002.

ADD-001 (Large volume samples with particulates)

The Volume-Matrix Plus option speeds up sample loading and can perform automated rinsing of up to 1L bottles of any kind. Built to withstand samples with higher particulate levels using a 3rd multi-channel valve to separate rinsing and loading lines. Inline filter compatible. Includes bottle tilting racks and sample line hangers.

ADD-003 (Disk kit for 47mm SPE disks)

Includes disk rack and holders for 47mm SPE disks. Option only available with ADD-001. Can be used interchangeably with SPE cartridges.

Inline Filters (for samples with particulates)

Prevents sample particulates from entering the system. Analytes trapped in filters can be automatically recovered after loading. Polypropylene and glass fiber filters available.

Ordering Info

Part No.	Description
SPE-03	8-channel SPE-03, 24V power supply, touch screen stylus pen, solvent bottle adapters, default sample tubing and user manual
ADD-003	Disk kit for 47mm disks, includes disk rack and 8 disk holders
ADD-002	Sample bottle rack for rinsing up to 250mL bottles. Includes 2 racks with built-in resonators and 8 bottle rinsing adapters
ADD-004	Sample rack for small volume sample loading, includes 2 racks and 8 25mL sample tubes
MINIMAL TEFLON OPTION	Minimal-Teflon option for PFAS applications
ADD-001	Volume-Matrix Plus option, includes 3rd multi-channel valve, 2 tilt racks, 8 integrated sample lines for loading/rinsing, 2 sample line hangers and vacuum pump for inline filter drying
ADD-00C	Ceramic valve upgrade for highly-corrosive applications with significant salt and/or acid content
Anti-clogging solutions	Refer to www.promochrom.com/consumables
SPE Mini-disks	Refer to www.promochrom.com/mini-disks
Sample Bottles	Refer to www.promochrom.com/sample-bottles

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