

# Prominence Preparative HPLC System

Shimadzu  
High Performance Liquid Chromatograph

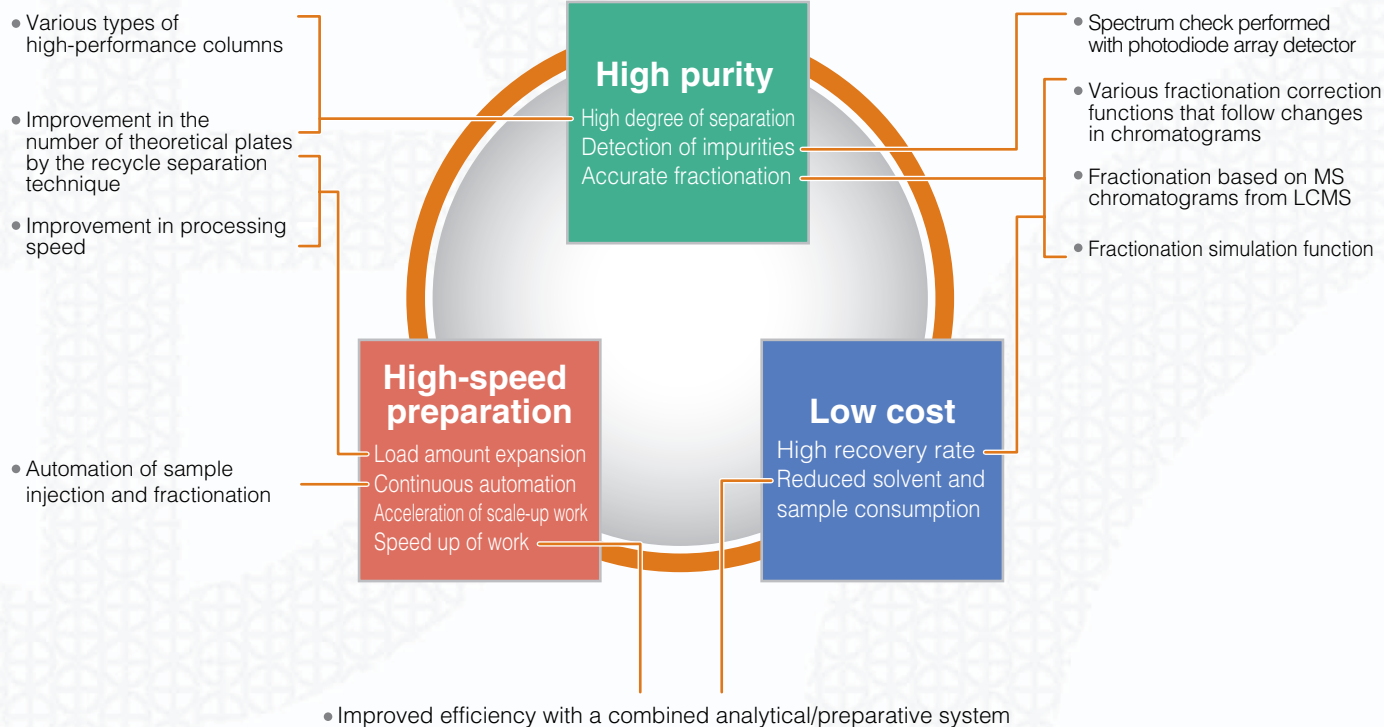


# Prominence Preparative System

The most important aspects of separation and purification are purity results, preparative processing speed, and cost-effectiveness. The Prominence preparative system enhances all of these aspects in each scale-up process.

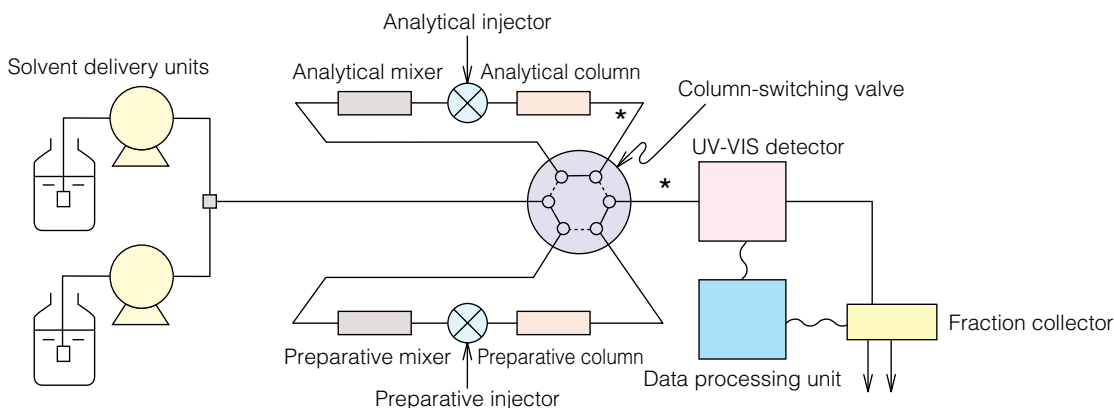
## Scale-Up Processes

- Consideration of separation conditions using an analytical column
- Consideration of load amount expansion improvement conditions using an analytical column
- Confirmation of chromatogram pattern reproducibility using a preparative column
- Consideration of fractionation conditions using a preparative column and fraction purity check using an analytical column that includes reconfirmation of the chromatogram pattern
- Automated continuous preparative purification with a preparative column



## Increased Efficiency of Processes from Consideration of Conditions to Scaling Up

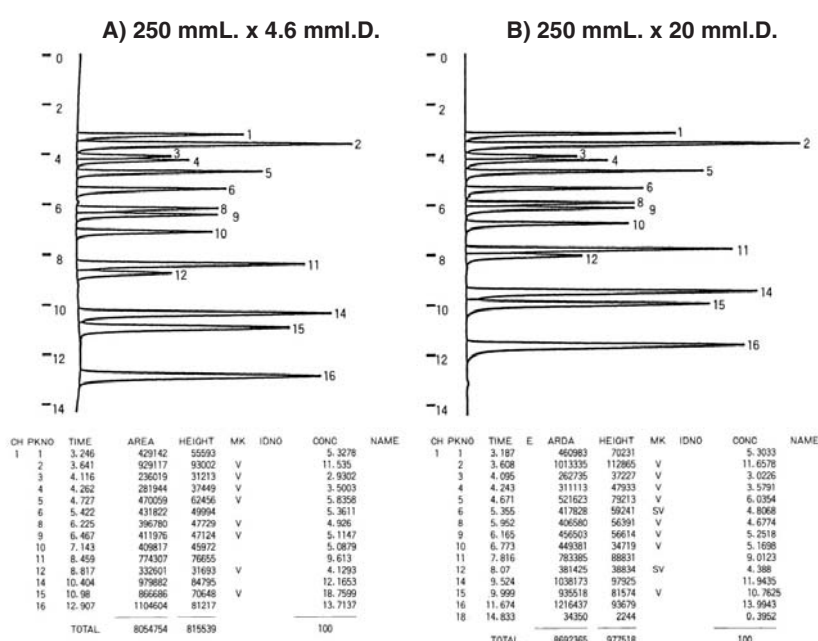
Starting the scale-up processes from the analytical column size and performing these processes with the same instrument help reduce the consumption of mobile phase solvent and sample as well as operational training costs. With the Prominence preparative system, in addition to handling both analytical and preparative isocratic elution, the flow channels can also be configured to handle both analytical and preparative gradient elution.



\* The piping analytical samples pass through is created with 0.3 mm inner diameter tubes.

**Example of Flow Channels in the Prominence Preparative System**

Packing material with the same properties is used for the column pair (analytical column and preparative column) when scaling up is performed. Furthermore, if a column pair filled to the same length with packing material of the same particle size is used, and the sample injection volume per unit cross-sectional area and the linear flow rate are a match, the same chromatogram patterns are obtained. The results obtained using packing material with a particle size of 5  $\mu\text{m}$  in a pair of columns with respective inner diameters of 4.6 mm and 20 mm are shown below. It can be seen that the retention times and areas match.



**Example of Scaling Up Performed with the Same Packing Material**

### Analytical/Preparative Conditions

Column: Shim-pack PREP-ODS(H)kit

A) -250 mmL. x 4.6mm I.D., 5 $\mu\text{m}$

B) -250 mmL. x 20mm I.D., 5 $\mu\text{m}$

Mobile phase: 10 mmol/L phosphoric acid (sodium)  
buffer solution (pH 2.6)/methanol = 1/9 (v/v)  
methanol = 1/9 (v/v)

Flow rate: A)-0.8 mL/min

B)-15 mL/min

Sample: A)-5 $\mu\text{L}$ , B)-100 $\mu\text{L}$

### Peak Components

- |                       |                      |
|-----------------------|----------------------|
| 1. Phthalic acid      | 9. n-Propyl benzoate |
| 2. Caffeine acid      | 10. Naphthalene      |
| 3. Salicylic acid     | 11. Biphenyl         |
| 4. Benzoic acid       | 12. Pentyl benzoate  |
| 5. 2-Naphthol         | 14. Phenanthrene     |
| 6. Benzene            | 15. Anthracene       |
| 8. Isopropyl benzoate | 16. Fluoranthene     |

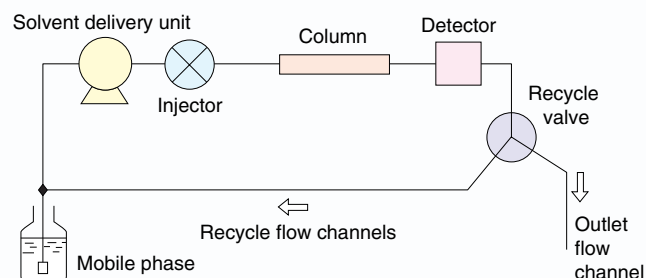


## Increased Efficiency by the Recycle Separation Technique

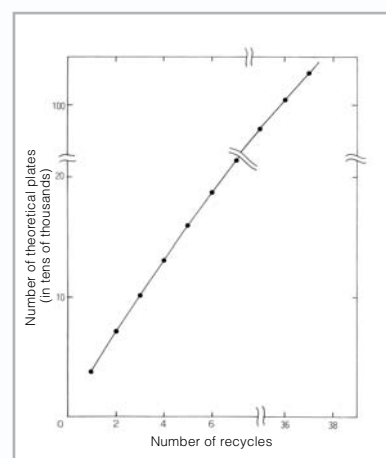
### Separation Improved at a Low Cost

The cost of preparative columns increases with their size. In order to reduce costs, relatively cheap columns of lengths that are unlikely to produce a high level of separation are often used. Even in such cases, however, there is a method that can be used to improve the separation capacity: recycle separation (closed loop recycling). With this method, reintroducing an eluate band containing the target components eluted from the separation column into the column inlet makes it possible to achieve the same result that would be achieved by lengthening the column.

In order to perform recycle separation effectively, it is important to reduce the dispersion of the sample component band outside the column. With the Prominence preparative system, reducing the internal volume of the solvent delivery unit enables the creation of a high-efficiency system with a number of theoretical plates exceeding one million.



Flow Channels Used for Closed Loop Recycling



#### Example in Which One Million Theoretical Plates are Exceeded on the 36th Elution (LC-6AD Semi-Preparative Recycle System)

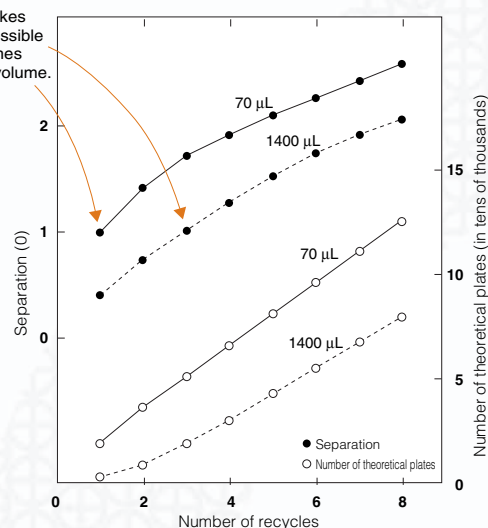
Column: STR ODS-II (250 mmL. x 20 mm I.D., 5  $\mu$ m) x 2  
 Mobile phase: Acetonitrile  
 Flow rate: 9.4 mL/min  
 Sample: Phenyldecane

### Increased Preparative Processing Speed

Although recycle separation is perceived as being a time-consuming technique, in the separation of neighboring components as shown in the example on the right, using recycle separation with a large amount of sample may make it possible to increase the preparative processing speed.

For example, if n-butyl/n-propylbenzene is obtained using a Shim-pack GPC-2001C column with a resolution ( $R_s$ ) of 1, then the sample injection volume does not exceed 70  $\mu$ L. If the injection volume is increased by a factor of 20, although the resolution decreases to 0.4, it increases to 1 on the third recycle, and the processing speed is increased by a factor of 6. Also, the way that the number of theoretical steps initially improves by factors of 3 and 2, respectively, when the sample volume is 1,400  $\mu$ L reflects the way that the adverse influence of band dispersion at the time of injection decreases as recycling progresses.

Recycling makes separation possible even at 20 times the injection volume.



#### Example in Which the Preparative Processing Speed Is Improved Using Recycle Separation with a Semi-Preparative GPC Column (LC-6AD Recycle System)

Column: Shim-pack GPC-2001C (300 mmL. x 20 mm I.D.)  
 Mobile phase: Chloroform  
 Flow rate: 3 mL/min  
 Sample: n-Butyl/n-Propylbenzene

# Solvent Delivery Units for a Wide Variety of Needs

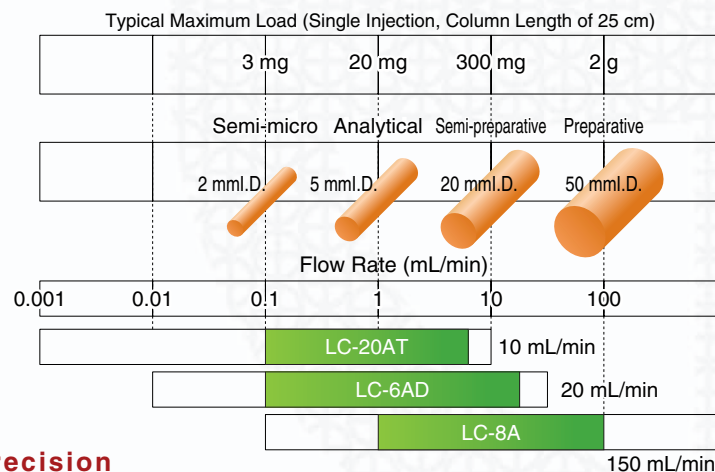
While conducting high-precision analysis on a daily basis, I would like to perform semi-preparation when necessary...

I would like to perform the process of scaling up to high-volume preparation with one system...

The Prominence preparative system responds to these needs across a wide range of flow rates.

## Typical Values for Maximum Load

Typical values of the total component weight for a single injection performed by a column of 250 mm in length, where the target component's (1) highly soluble in the mobile phase, (2) separated from contaminating components, and (3) subjected to ion suppression, are indicated on the right. With isocratic elution, these values are basically proportional to the volume of the column.



### Supports a Range of Applications from High-Precision Analytical to Semi-Preparative

#### LC-20AT

- This solvent delivery unit can handle flow rates ranging from those used in analytical scale to those used in semi-preparative (up to 10 mL/min).
- High-precision analysis is possible even in the semi-micro flow-rate range.



### Supports Semi-Preparative and Recycle Preparative

#### LC-6AD

- This solvent delivery unit can handle flow rates as high as those used in semi-preparative scale (up to 20 mL/min).
- Using a recycle kit enables semi-preparative recycling.



### Supports Large-Scale Preparative Fractionation

#### LC-8A

- This preparative solvent delivery unit enables solvent delivery at high flow rates (up to 150 mL/min).
- It can be used at analytical flow rates and, therefore, makes it easy to perform scaling up with a preparative column after considering the conditions with an analytical column.

## Specifications (LC-20AT/6AD/8A)

	LC-20AT (228-45001-xx)	LC-6AD (228-45068-xx)	LC-8A (228-45069-xx)
Solvent delivery method	Parallel-type double plunger	Series-type double plunger	Series-type double plunger
Plunger capacity	Primary side: 47 $\mu$ L, Secondary side: 23 $\mu$ L	47 $\mu$ L	280 $\mu$ L
Maximum discharge pressure	40 MPa	49.0 MPa	29.4 MPa
Flow-rate setting range	0.001 mL/min to 10.000 mL/min	0.01 mL/min to 20.00 mL/min	0.1 mL/min to 150.0 mL/min
Flow-rate accuracy	No more than 2% or 2 $\mu$ L/min, whichever is greater (0.01 mL/min to 5 mL/min)	No more than 1% or 10 $\mu$ L/min, whichever is greater (0.1 mL/min to 5.0 mL/min)	No more than 2% (0.5 mL/min to 150.0 mL/min)
Flow-rate precision	0.3% max. (RSD: 0.1% max.)	0.3% max. (RSD: 0.1% max.)	0.5% max.
Constant-pressure solvent delivery	Supported	Supported	Supported
Plunger rinsing mechanism	Syringe or rinsing pump (228-45568-91)	Syringe or FCV-7AL (228-45077-91)	Syringe or FCV-130AL (228-45078-91)
Operating temperature range	4°C to 35°C	10°C to 40°C	10°C to 35°C
Dimensions, weight	260 (W) x 140 (H) x 420 (D) mm, 11 kg	260 (W) x 160 (H) x 500 (D) mm, 20 kg	350 (W) x 210 (H) x 450 (D) mm, 32 kg
Power requirements	AC110V, 230V, 150 VA, 50/60 Hz	AC110V, 230V, 200 VA, 50/60 Hz	AC110V, 230V, 750 VA, 50/60 Hz

## High Purity and a High Recovery Rate - Achieving

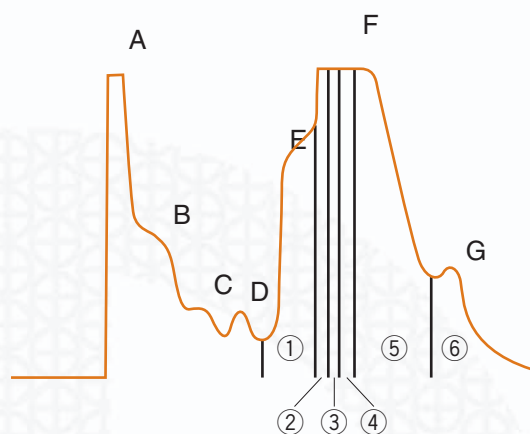
### The FRC-10A - A Fraction Collector That Follows Changes in Chromatograms

#### Meeting a Wide Range of Needs

This fraction collector can be used over a wide range of flow rates, covering small and large-scale preparative work. It adapts to various applications, such as simple manual preparation performed while viewing chromatograms, and automated continuous preparation performed in combination with an autosampler.

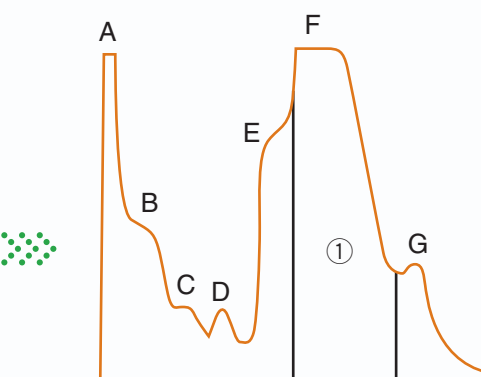
#### Reliable Tracking of Changes in Elution Patterns

In continuous preparative work, the peak separation patterns and peak shapes may vary due to fluctuations in the ambient temperature, the composition of the mobile phase, or the sample load. In addition to time-based fractionation and peak-detection fractionation, by using unique fractionation functions such as the band method, the FRC-10A allows target components to be fractionated with high purity and a high recovery rate.



Example of Fractionation Performed with a Conventional Fraction Collector

With the FRC-10A



Example of Fractionation Performed with the FRC-10A

#### Fraction Collector

#### FRC-10A



#### Specifications

	FRC-10A (228-45070-xx)
Drive system	Arm-movement X-Y system
Maximum number of fractions	16 to 144 (depending on the type of rack used)
Collection method	Solenoid valve (fraction collector head with valve) or nozzle (fraction collector head)
Maximum flow rate	150mL/min
Fractionation mode	Set as a combination of the basic mode (initial parameters) and time-program mode (14 parameters)
Cooling function	Possible with sample cooler L (228-45064-91)
Ambient temperature range	4°C to 35°C
Dimensions, weight	260 (W) x 280 (H) x 420 (D) mm, 15 kg
Power requirements	100 VAC, 100 VA, 50/60 Hz

#### Fraction Collector Heads, Racks, and Collection Tubes (Optional)

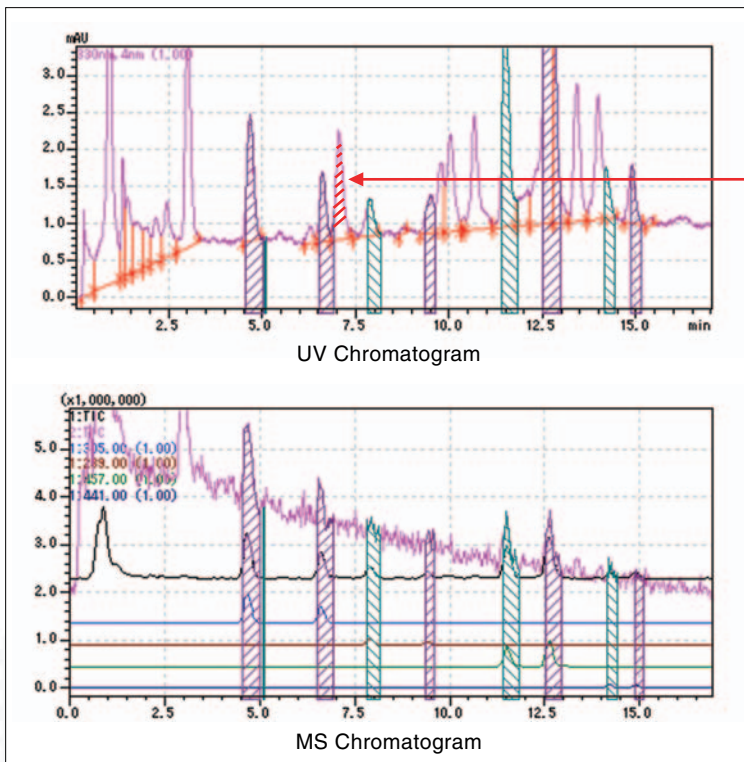
See the back cover for details.



# High Levels of Preparative LC Requirements

## Preparative LCMS - High-Efficiency Preparation Based on a MS Trigger

With LCMS becoming increasingly common, a great deal of attention is being paid to fractionation and purification in which MS is used as a trigger to achieve the precise fractionation of target compounds. The high selectivity of the LCMS-2010EV enables the high efficient recovery of target components from samples containing large amounts of contaminants, and makes it easy to scale up from analytical to preparative.



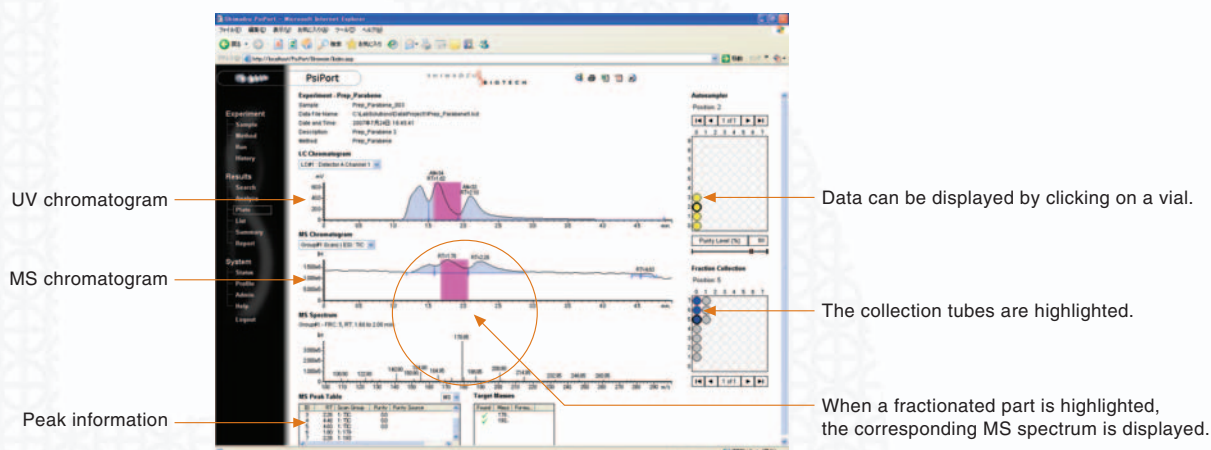
Fractionation performed using UV chromatograms involves fractionation that depends on retention times and peak integration. For this reason, not only are the fractionation conditions complex, but the peaks for components other than the target compounds are fractionated, and high-efficiency preparation may not be possible.



In preparation based on MS chromatograms, because the masses of the target compounds are specified, reliable fractionation is possible with simple fractionation conditions.

## All Steps from Fractionation to Data Display Possible with Optional "PsiPort" Preparative/Analytical Software

The open-access function of the optional PsiPort preparative/analytical software uses a Web browser, making it possible to execute analysis and fractionation with simple operations. Regarding fractionation results, the vials and collection tubes displayed visually are linked to data such as MS chromatograms and MS spectra. As a result, by just clicking on a vial, it is possible to quickly ascertain information related to fractionated compounds.



# Detectors That Support High-Purity

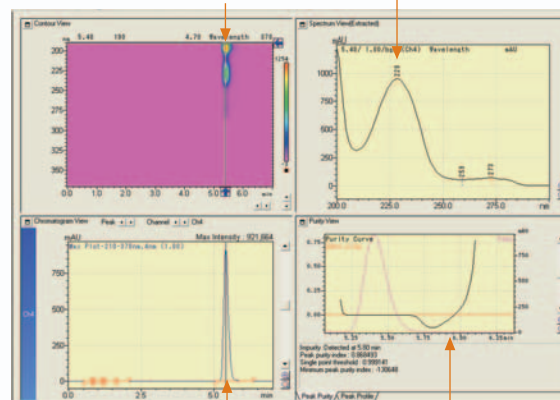
## Photodiode Array UV-VIS Detector

### SPD-M20A



Contour plots enable the estimation of peak overlaps and optimum wavelengths, which was not possible with a single-wavelength monitor.

Spectra corresponding to a specific time period can be analyzed.



Chromatograms for specific wavelengths can be selected and analyzed.

Peaks for minute quantities of impurities that are hidden by other peaks can be detected with a peak-purity curve.

- A high-sensitivity 3D UV-VIS detector. That is effective at detecting impurity peaks.
- While continuing the original analysis, it is possible to perform repeat analysis and library searches on the peak spectra that have been eluted by that stage.
- Automatic wavelength accuracy checks encompassing the UV region can be performed on four wavelengths, and increasing the reliability of the acquired spectra.

## UV-VIS Detector

### SPD-20A/20AV



- A UV-VIS detector designed for high sensitivity, with a noise of level of  $0.5 \times 10^{-5}$  AU max.
- Superior linearity allows use across a wide range of concentrations, covering analytical and preparative work.

## Specifications

	SPD-20A (228-45003-xx)	SPD-20AV (228-45004-xx)	SPD-M20A (228-45005-xx)
Light source	Deuterium (D <sub>2</sub> ) lamp	Deuterium (D <sub>2</sub> ) lamp, tungsten (W) lamp	
Wavelength range	190 nm to 700 nm	190 nm to 900 nm	190 nm to 800 nm
Bandwidth, slit width	8 nm		1.2 nm (high-resolution mode) 8 nm (high-sensitivity mode)
Wavelength accuracy	1 nm max.		
Wavelength precision	0.1 nm max.		
Noise	$0.5 \times 10^{-5}$ AU (under specified conditions)		$0.6 \times 10^{-5}$ AU (under specified conditions)
Drift	$1 \times 10^{-4}$ AU/h (under specified conditions)		$5 \times 10^{-4}$ AU/h (under specified conditions)
Linearity	2.5 AU (ASTM standard)		2.0 AU (ASTM standard)
Functions	Dual-wavelength detection in the range of 190 nm to 370 nm or upwards of 371 nm, ratio-chromatogram output, wavelength scanning		Contour output, spectrum library, MAX plotting
Cell	Optical path length: 10 mm; Capacity: 12 $\mu$ L; Withstand pressure: 12 MPa		Optical path length: 10 mm; Capacity: 10 $\mu$ L; Withstand pressure: 12 MPa
Cell temperature-control range	5°C above room temperature to 50°C		
Dimensions, weight	260 (W) x 140 (H) x 420 (D) mm, 13 kg		260 (W) x 140 (H) x 420 (D) mm, 12 kg
Power requirements	100 VAC, 160 VA, 50/60 Hz		

## Preparative Flow Cells (Optional)

Type	Optical path length	SPD-20A/20V	SPD-M20A
Variable optical path length	0.5 mm	228-23405-91	228-34189-91
	0.2 mm	228-23405-92	228-34189-92
	0.1 mm	228-23405-93	228-34189-93
Fixed optical path length	0.5 mm	228-23406-91	228-34188-91



# Preparation

## LC/MS High-Throughput Multi-Sample Semi- to Large-Scale Preparative System

### PrepLCMS-2010EV

Configuration of Multi-Sample Semi- to Large-Scale Preparative System



- While performing analysis in scan mode, it is possible to apply fractionation triggers based on specific masses.
- Split ratios in the range of 100:1 to 100:100,000 can be set with the APV active splitter.
- Analytical/preparative flow-line switching is performed automatically, so it is easy to scale up to preparative work.
- Up to a maximum of 384 test tubes (capacity of 9 mL) can be used.
- AND/OR fractionation based on MS and UV signals is possible.

## Refractive Index Detector

### RID-10A



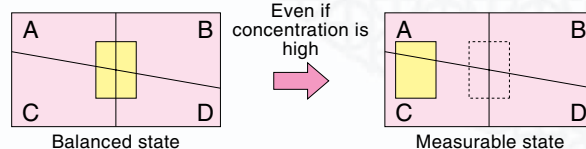
- Dual-temperature control of the optical system helps reduce the stabilization time after power-ON and baseline drift.
- The adoption of three measurement modes allows all applications from high-sensitivity analysis to preparative work to be handled with a single unit.

## Original 4-Partition Detector Element

All applications from high-sensitivity analysis to preparative work can be handled with a single unit using the following three measurement modes:

A (analytical) mode	From high-sensitivity analysis to general-purpose analysis
P (preparative) mode	High-concentration analysis and semi-preparative analysis (up to 20 mL/min)
L (large-scale preparative) mode	Large-scale preparative analysis (150 mL/min)*

\*When optional flow selection block (228-34102-91) is attached.



## 4-Partition Detector Element

The detector element of the RID-10A is partitioned into four parts, and the parts used can be changed electrically. In A mode (for high-sensitivity analysis), the partitions are grouped vertically (combinations of A+C and B+D), and in P and L modes (for preparative analysis), the partitions are grouped horizontally (combinations of A+B and C+D). In P and L modes, because measurement is possible regardless of the position of the element's center line, large refractive indexes for high-concentration samples can be handled.

## Specifications

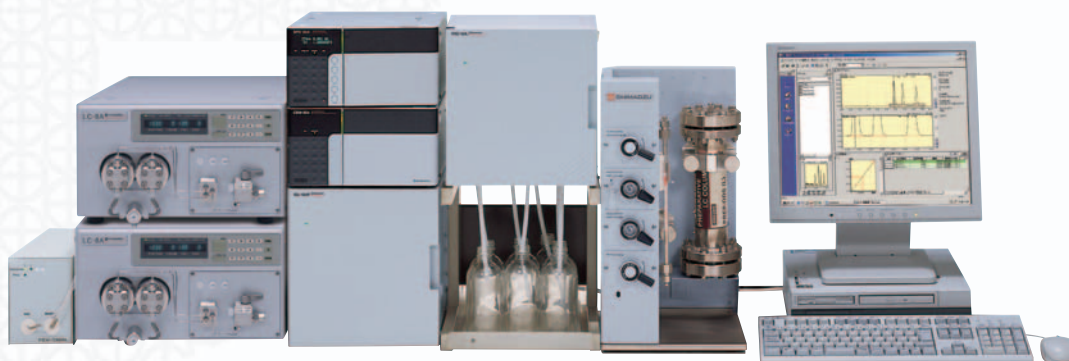
RID-10A (228-45095-xx)			
Refractive index range	1 RIU to 1.75 RIU	Maximum operating flow rate	20 mL/min (150 mL/min with option)
Noise level	$2.5 \times 10^{-9}$ RIU max.	Temperature control of cell unit	30°C to 60°C (1°C steps)
Drift	$1 \times 10^{-7}$ RIU/hour max.	Cell volume	9 $\mu$ L
Range	A mode: $0.01 \times 10^{-6}$ RIU to $500 \times 10^{-6}$ RIU	Cell withstand pressure	2 MPa (cell unit)
	P and L modes: $1 \times 10^{-6}$ RIU to $5,000 \times 10^{-6}$ RIU	Operating temperature range	4°C to 35°C
Response	0.05 sec to 10 sec, 10 steps	Dimensions, weight	260 (W) x 140 (H) x 420 (D) mm, 12 kg
Polarity switching	Supported	Power requirements	100 VAC, 150 VA, 50/60 Hz
Zero adjustment	Auto zero, auto-optical zero, fine zero		

\* Hexafluoroisopropanol (HFIP) cannot be used as the mobile phase. Contact your Shimadzu representative if you wish to use HFIP.

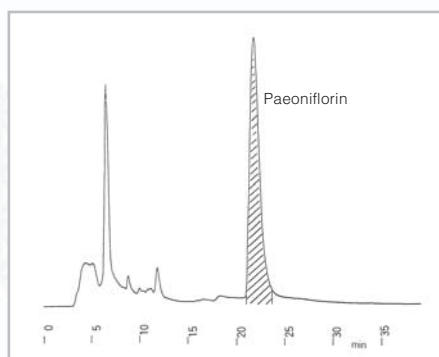
## Pressure Relief Valve (228-33615-91)

The RID-10A incorporates various safety features. Its maximum withstand pressure is five times that of previous comparable Shimadzu products and, as a standard feature, it incorporates a sensor that detects leakage from the cell unit. For extra safety, a pressure-relief valve that prevents problems related to back-pressure irregularities is also available as an option.

# Large-Scale Preparative System for

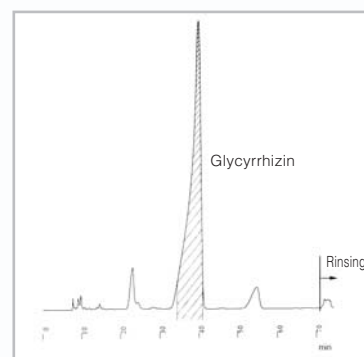


- This system enables automated continuous preparation with a maximum flow rate of 150 mL/min and a preparative column with an inner diameter of up to 50 mm.
- It is also possible to consider the separation conditions, consider the load, and evaluate the purity of the fractionated liquid using the analytical column.



**Fractionation of Paeoniflorin in Peony**

Column: Shim-pack PREP-ODS  
(250 mmL. x 50 mm I.D., 15 $\mu$ m)  
Mobile phase: Acetonitrile/water = 6/1  
Flow rate: 100 mL/min  
Sample: 200 mL of peony powder extract  
(equivalent to 2 g of powder),  
injected by pump



**Refinement of Glycyrrhizin Used for Food Additive Tests**

Column: Shim-pack PREP-ODS  
(250 mmL. x 50 mm I.D., 15 $\mu$ m)  
Mobile phase: 2% (v/v) acetic acid/acetonitrile = 65/35  
Flow rate: 70 mL/min  
Sample: 1 g/100 mL of ammonium glycyrrhizate  
used for food additive tests,  
injected by pump

## Example of High-Pressure Gradient System

### Main Components

1	System controller	CBM-20A	228-45012-xx
2	Solvent delivery unit	LC-8A (2 units)	228-45069-xx
3	Interface board	PC-31L (2 units)	228-31103-91
4	Gradient mixer	For preparation using 8A column holder	228-20600-91
5	Gradient mixer	For analysis, 8A	228-20601-91
6	Reservoir selection valve	FCV-130AL	228-45078-91
7	Autosampler	SIL-10AP	228-45057-xx
8	Sample injector	7725	228-32210-91
9	Column holder	Column holder, 8A	228-45079-91
10	Photodiode array detector UV-VIS detector	SPD-M20A	228-45005-xx
11	Preparative cell	Preparative flow cell with variable optical path length (0.5 mm)	228-34189-91
12	Manual column switching valve		228-13000-95
13	Fraction collector	FRC-10A	228-45070-xx
14	Fraction collector head with FRC valve		228-24105-91
15	FRC large-volume kit		228-45116-91
16	LC workstation	LCsolution Ver. 1. 21 Multi-PDA	223-05663-92
17	PC, Monitor and Printer		Local Supply

\* Sample vials, sample racks, collection tubes, preparative racks, columns, preparative sample loops, printers, and other items must be obtained separately.

# Laboratory Use

## Autosampler

### SIL-10AP



#### Sample Racks

- Sample rack S (228-21046-91) for 1.5-mL vials
- Reagent bottle rack (228-20905) for 15-mL reagent bottles
- Sample rack L (228-21046-92) for 4.0-mL vials
- Sample rack LL (228-39384-91) for 13-mL vials\*<sup>1</sup>
- Sample rack MTP2 (228-40460-91)\*<sup>2</sup>

\*<sup>1</sup> Sample rack LL is a standard accessory of the SIL-10AP.

\*<sup>2</sup> For 96-well microtiter/deep-well plates.

#### Sample Coolers (Block Cooling/Heating: 4°C to 70°C)

- S (228-45063-91)
- L (228-45064-91)

	SIL-10AP (228-45057-xx)
Injection method	Loop injection, variable injection volume
Injection-volume setting range	1 µL to 5,000 µL (standard)
	1 µL to 400 µL (option)
	1 µL to 2,000 µL (option)
Number of processed samples	1.5-mL vials: 100 (60 with cooler installed)
	4-mL vials: 80 (50 with cooler installed)
	13-mL vials: 25
Number of repeated injections	30 max. per sample
Needle rinsing	Set freely before and after sample injection.
Operating pH range	pH1 to pH10
Operating temperature range	4°C to 35°C
Dimensions, weight	260 (W) x 280 (H) x 150 (D) mm, 19 kg
Power requirements	100 VAC, 100 VA, 50/60 Hz

### Column Holder 8A (228-45079-91)

- Capable of holding three columns: two with inner diameters in the range of 20 mm to 50 mm and one analytical column.
- Capable of holding four manual selection valves.
- Capable of holding an 8A preparative mixer or an 8A analytical mixer.



## Reservoir Selection Valve

### FCV-130AL (228-45078-91)

- Capable of switching between two solvents using a solenoid valve.
- Incorporates a pump that can automatically rinse the rear side of the plunger seals.
- Can be controlled from the LC-8A or from a system controller or workstation connected via the LC-8A.



## Sample Injector

### Rheodyne 7725 (228-32210-91)

#### Option Sample Loops

Volume	Material	Part Number
100 µL	SUS	228-32211-16
200 µL	SUS	228-32211-17
500 µL	SUS	228-32211-18
1 µL	SUS	228-32211-19



### Manual Column Switching Valve (228-13000-95)

- This manual switching valve is used to switch between preparative columns, or between a preparative column and an analytical column, in a preparative system.



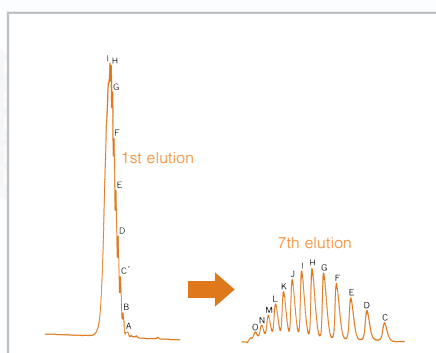


# Semi-Preparative Recycle System

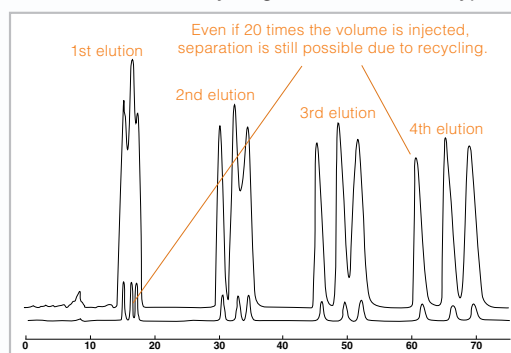


- This system enables recycle preparative work with a maximum flow rate of 20 mL/min and a semi-preparative column with an inner diameter of up to 20 mm.
- Recycling elution realizes highly cost-effective separation and purification\*.

\* The effective recycling elution volume is typically 35 mL or greater.



**Example of Recycle Separation of Oligomer Performed with a Semi-Preparative GPC Column**  
 Column: Shim-pack GPC 20025 + 2002 + 2001 (300 mmL. x 20 mm I.D.)  
 Flow rate: 3 mL/min  
 Sample: Triton X-100



**Example of the Increase in Preparative Processing Speed Achieved by Performing Recycle Separation with an Analytical ODS Column**  
 Column: STR ODS-II (150 mmL. x 6 mm I.D., 5  $\mu$ m)  
 Flow rate: 2 mL/min  
 Sample: sec-, iso-, and n-butylbenzene

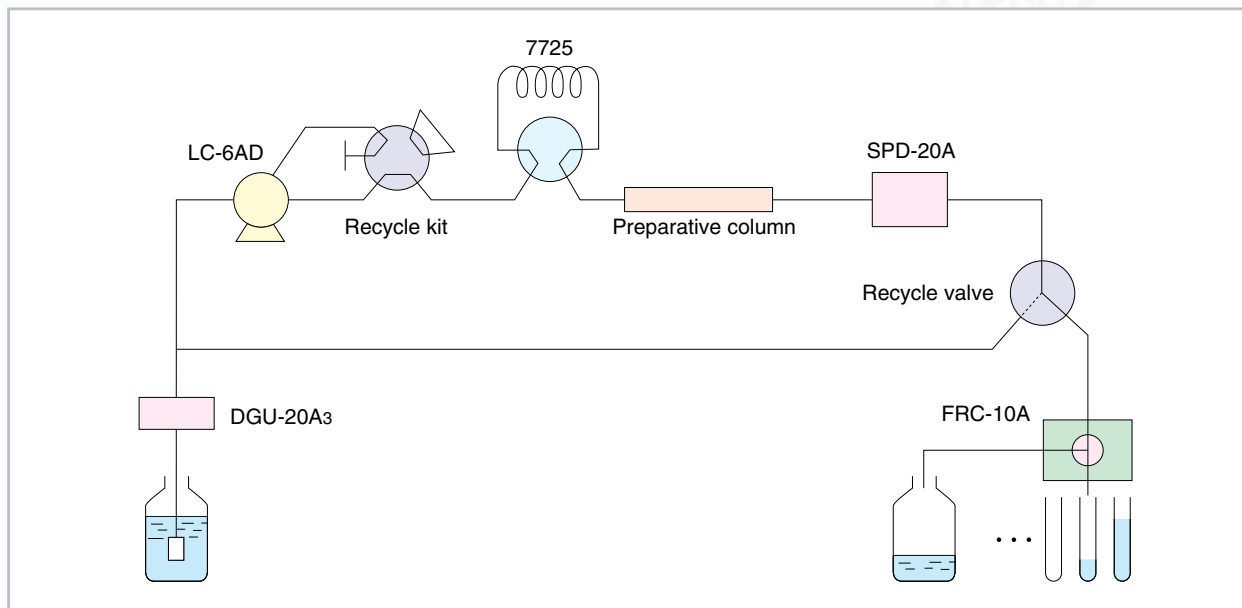
## Example of Semi-Preparative Recycle System

### Main Components

1	System controller	CBM-20A	228-45012-xx
2	Solvent delivery unit	LC-6AD	228-45068-xx
3	Interface board	PC-31L	228-31103-91
4	6AD recycle kit		228-28711-92
5	Online degasser	DGU-20A <sub>3</sub>	228-45018-32
6	Degasser power supply unit		228-45110-xx
7	High-pressure flow-line selection valve	FCV-20AH <sub>2</sub>	228-45015-xx
8	Rotor assembly, 3-port valve		228-21217-91
9	Reservoir tray		228-45041-91
10	Sample injector	7725	228-32210-91
11	Column holder	Column holder, 8A	228-45079-91
12	Fraction collector	FRC-10A	228-45070-xx
13	Fraction collector head with valve		228-24105-91
14	UV-VIS detector	SPD-20A	228-45003-xx
15	SPD-20A cell	Standard flow cell	228-23400-91
16	LC workstation	LCsolution Ver. 1.21 single	223-05661-92
17	PC, Monitor and Printer		Local Supply

\* Sample vials, sample racks, collection tubes, preparative racks, columns, preparative sample loops, printers, and other items must be obtained separately.

## Flow Line Diagram of a Semi-Preparative Recycle System



## High-Pressure Flow-Line Selection Valve

### FCV-20AH2 (228-45015-xx)

- A stand-alone, high-pressure, flow-line selection valve.
- The valve position is controlled by event signal input.
- Direct control is also possible from the unit itself.

Valve type: 2-position/6-port rotary valve

Maximum operating pressure: 39.6 MPa

Operating pH range: pH1 to pH10

Operating temperature range: 4°C to 35°C



## Reservoir Selection Valve

### FCV-7AL (228-45077-91)

- Capable of switching between two solvents using a solenoid valve.
- Incorporates a pump that can automatically rinse the rear side of the plunger seals.
- Can be controlled from the LC-6AD or from a system controller or workstation connected via the LC-6AD.



## Online Degasser

### DGU-20A3 (228-45018-32)

- A low-capacity degasser (with 3 flow lines) that uses a special fluororesin membrane. There is also a 5-flow-line type, the DGU-20A5 (228-45019-32).
- The maximum operating flow rate per flow line is 20 mL/min.\*

\* In order to create a parallel flow-line arrangement when using a high flow rate, a 4-way joint (for 3 parallel flow lines; 228-24259-91) and a 5-way joint (for 4 parallel flow lines; 228-24259-92) are available as options.

- When using this unit with the LC-6AD or LC-8A, a power supply unit (228-45110-xx) must be obtained separately.



# General-Purpose Semi-Preparative System



- From simple systems based on manual injection and isocratic elution to automated systems based on autosampler injection and gradient elution, systems suited to your purpose can be created.
- Systems based on the LC-6AD can handle columns ranging from analytical columns to semi-preparative columns with inner diameters of up to approximately 20 mm. Systems based on the LC-20AT can handle columns ranging from semi-micro analytical columns to semi-preparative columns with inner diameters of up to approximately 10 mm.

## Example of a High-Pressure Gradient Semi-Preparative System (Based on LC-6AD)

### Main Components

1	System controller	CBM-20A	228-45012-xx
2	Solvent delivery unit	LC-6AD (2 units)	228-45068-xx
3	Interface board	PC-31L (2 units)	228-31103-91
4	Online degasser	DGU-20A <sub>3</sub>	228-45018-32
5	Degasser power supply unit		228-45110-xx
6	Gradient mixer	For preparation using 8A column holder	228-20600-91
7	Reservoir tray		228-45041-91
8	Autosampler	SIL-20AP	228-45057-xx
9	Column holder	Column holder, 8A	228-45079-91
10	Fraction collector	FRC-10A	228-45070-xx
11	Fraction collector head with valve		228-24105-91
12	UV-VIS detector	SPD-20A	228-45003-xx
13	Preparative cell	Preparative flow cell with variable optical path length (0.5 mm)	228-23405-91
14	LC workstation	LCsolution Ver. 1.21 single	223-05661-92
15	PC, Monitor and Printer		Local Supply

\* Sample vials, sample racks, collection tubes, preparative racks, columns, printers, and other items must be obtained separately.

## Example of a Simple Semi-Preparative System (Based on LC-20AT)

### Main Components

1	System controller	CBM-20A	228-45012-xx
2	Solvent delivery unit	LC-20AT	228-45001-xx
3	Online degasser	DGU-20A <sub>3</sub>	228-45018-32
4	Reservoir tray		228-45041-91
5	Sample injector	7725	228-32210-91
6	Column holder	Column holder, 8A	228-45079-91
7	Fraction collector	FRC-10A	228-45070-xx
8	Fraction collector head with valve		228-24105-91
9	UV-VIS detector	SPD-20A	228-45003-xx
10	Preparative cell	Preparative flow cell with variable optical path length (0.5 mm)	228-23405-91
11	LC workstation	LCsolution Ver. 1.21 single	223-05661-92
12	PC, Monitor and Printer		Local Supply

\* Collection tubes, preparative racks, columns, preparative sample loops, printers, and other items must be obtained separately.



# Scale-Up Columns

## Shim-pack PRC/MRC/HRC Series

Shim-pack Name	Stationary Phase	Length x Inner Diameter (mm), Particle Diameter (μm)	Part Number
MRC-ODS	Octadecyl	250 x 6, 15	228-23464-92
PRC-ODS	Octadecyl	250 x 20, 15	228-23464-93
PRC-ODS(K)	Octadecyl	250 x 30, 15	228-23464-94
PRC-ODS(L)	Octadecyl	250 x 50, 15	228-23464-95
HRC-ODS	Octadecyl	250 x 4.6, 5	228-23463-92
PRC-ODS(H)	Octadecyl	250 x 20, 5	228-23464-91
MRC-SIL	Silica	250 x 6, 15	228-23461-92
PRC-SIL	Silica	250 x 20, 15	228-23461-93
PRC-SIL(K)	Silica	250 x 30, 15	228-23461-94
PRC-SIL(L)	Silica	250 x 50, 15	228-23461-95
HRC-SIL	Silica	250 x 4.6, 5	228-23461-92
PRC-SIL(H)	Silica	250 x 20, 5	228-23461-91

\* C8 (octyl), TMS (trimethyl), NH2 (aminopropyl), and CN (cyanopropyl) stationary phases and guard columns are also available. Contact your Shimadzu representative for details.

## Shim-pack PREP Series

Shim-pack Name	Stationary Phase	Length x Inner Diameter (mm), Particle Diameter (μm)	Part Number
PREP-ODS(H)kit	Octadecyl	250 x 20, 5	228-17888-91
		250 x 4.6, 5	
PREP-ODS	Octadecyl	250 x 20, 15	228-00815-91
PREP-ODS(K)	Octadecyl	250 x 30, 15	228-18319-91
PREP-ODS(L)	Octadecyl	250 x 50, 15	228-18320-91
PREP-SIL(H)kit	Silica	250 x 20, 5	228-17887-91
		250 x 4.6, 15	
PREP-SIL	Silica	250 x 20, 15	228-00814-91
PREP-SIL(K)	Silica	250 x 30, 15	228-18273-91
PREP-SIL(L)	Silica	250 x 50, 15	228-18274-91

\* C8 (octyl), TMS (trimethyl), NH2 (aminopropyl), CN (cyanopropyl), and Ph (phenyl) stationary phases and guard columns are also available. Contact your Shimadzu representative for details.


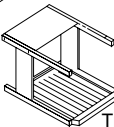

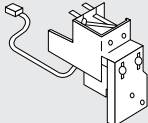










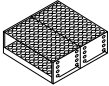




## Shim-pack GPC Series (Non-aqueous Size Exclusion)

Shim-pack Name	Exclusion Limit Molecular Weight	Length x Inner Diameter (mm)	Part Number
GPC-2003C	70,000	300 x 20	228-23343-94
GPC-20025C	20,000	300 x 20	228-23343-93
GPC-2002C	5,000	300 x 20	228-23343-92
GPC-2001C	1,500	300 x 20	228-23343-91
GPC-2000CP	Guard column	50 x 8	228-20812-95

\* The GPC-2000C series is used with chloroform mobile phases. The GPC-2000 series is available for use with THF mobile phases.



# Fraction Collector Heads, Racks, and Collection Tubes for the FRC-10A Fraction Collector (Optional)

	Fraction Collector Head	Rack	Collection Tubes		
Large-scale fractions		Large-volume kit (includes the items shown below) (228-45116-91)  Rack chassis 5 collection tubes Mount  Rack No. 28: 64 fractions  Tray 	Commercial reagent bottles (500 mL to 1,000 mL) can be used. 		
		Fraction collector head with valve (228-24105-91) 	Rack No. 3: 16 fractions (228-25313-91) 	50-mL vials (glass) (228-25318-91) (78 (length) x 35 (outer diameter) mm)  20 per set	50-mL vials (polypropylene) (228-25321-91) (75 (length) x 35 (outer diameter) mm)  20 per set
Semi-large fractions		Rack No. 2A: 64 fractions (228-25311-91) 	20-mL test tubes (glass) (228-25316-91) (105 (length) x 18 (outer diameter) mm)  100 per set	32-mL test tubes (glass) (228-25317-91) (165 (length) x 18 (outer diameter) mm)  100 per set	25-mL test tubes (PP) (228-25320-91) (150 (length) x 18 (outer diameter) mm)  100 per set
		Sample cooler L: 50 fractions (228-45064-91) 	4-mL vials (glass) (228-21287-91) (45 (length) x 15 (outer diameter) mm)  100 per set	5-mL vials (polypropylene) (228-25322-91) (45 (length) x 15 (outer diameter) mm)  100 per set	
Small fractions		Rack No. 1: 144 fractions (228-25310-91) 	3.5-mL test tubes (glass) (228-25315-91) (75 (length) x 10 (outer diameter) mm)  350 per set		
		Fraction collector head (228-25169-91) 	Rack No. 5: 120 fractions (228-25314-91) 	4.5-mL test tubes (polypropylene) (228-25319-91) (75 (length) x 10 (outer diameter) mm)  250 per set	

- A "fraction collector head with valve" allows the eluate to be switched between the fraction side and the drain side using a 3-way solenoid valve. Use this model with standard fractionation in order to fully attain the FRC-10A's functionality.
- A "fraction collector head" (i.e., without a valve) continuously directs the eluate to the fraction side without using a solenoid valve. It is used for micro-volume fractionation.



JQA-0376

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