

Preparative and Purification Liquid Chromatograph

# Nexera Prep



# Be simple. Be flexible.

The Nexera™ Prep Purification System provides optimal solutions for your laboratory needs.

For Example:

- Easy optimization of preparative parameters and scale up
  - Fractionation simulation for rapid setup of collection logic
  - Column line-up for scale-up from analytical to preparative
- Time- and energy-saving by automation of the purification workflow
  - Collection of target components at high purity by automated desalting
- Expandable to suit the sample/fraction number and volume
  - Choose from a wide range of options for recovery scale and analytical detection
  - Problems are resolved simply, to accommodate a variety of needs.



## Streamline and Simplify Establishing the Conditions for Preparative Work — P. 4

Using the Nexera Prep system saves on labor when scaling up from the development of analytical conditions to the conditions for preparative work.

Nexera Prep System



## Preparative Work for Target Components at High Purity Levels and High Concentrations — P. 6

The Nexera UFPLC, Ultra Fast Preparative and Purification Liquid Chromatograph significantly reduces the cost and labor involved in preparative purification. Additionally, the system not only performs purification of target components, but can also recover impurities with high yield enabling direct impurity analysis.

Nexera UFPLC, Ultra Fast Preparative and Purification Liquid Chromatograph System



## Preparative Work for Non-UV Absorptive Components — P. 10

With LH-40 and FRC-40 able to perform signal-based logic and collection on up to four signal channels, not having a chromophore is not a limitation. Nexera Prep can use LCMS, RID, and ELSD to detect and/or identify targets for purification.

Nexera Prep LC/MS Preparative System



## Increased Efficiency from Preparative Analysis Setup to Data Processing — P. 12

Open Solution™ is open access software that not only streamlines preparative purification operations, but also supports multi-user operation of preparative systems.

Open Solution Software for Preparative Systems



## High Separation via Preparative Recycling — P. 14

By repeatedly cycling the sample through the column, the target component can be resolved and recovered from coeluting species or impurities without the need for longer or multiple columns.

Recycling Preparative System



## Excellent System Expandability — P. 16

The solvent delivery unit and fraction collector can be selected to suit the recovery volume. Sample introduction and reinjection options cover a wide range of uses. Additionally, the Shim-pack Scepter™ columns feature excellent scalability from analytical to preparative separations with a variety of phases for different applications.



# Streamline and Simplify Establishing the Conditions for Preparative Work

Fully Equipped with Functions to Reliably Prepare Target Components

## Nexera Prep System

Streamline development of Analysis Conditions and Optimization of Preparative Parameters

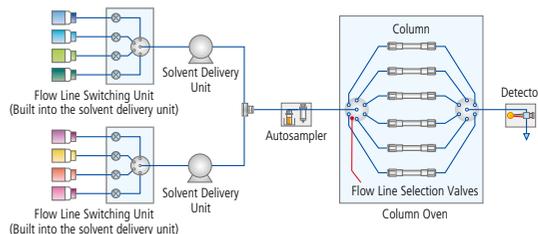
In order to separate multiple components, the analysis and fractionation parameters must be optimized, which involves a great deal of work.

Shimadzu provides the Method Scouting system, which investigates conditions at the analytical level. Method Scouting system fully automates method scouting in which combinations of mobile phases and columns are automatically changed, equilibrated, and evaluated, allowing efficient method development.

Further, the preparative system performs automatic simulations using the pre-preparative results, enabling optimization of the fractionation parameters.

This reduces the work involved in investigating conditions, which saves on mobile phase solvent and samples.

### Development of Analytical Conditions (Method Scouting System)



A development is performed to separate the target compounds at the analysis level.

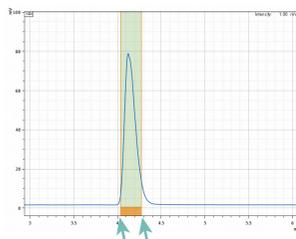
Using the Shimadzu Method Scouting system together with Method Scouting Solution, a special software program, provides a fast and accurate method scouting workflow, which supports heightened efficiency in method development.

### Significantly Reduces the Process of Setting Fractionation Parameters

Simple parameter setting by fraction simulator

LabSolutions™ software provides simulation functions that reduce the labor involved in investigating conditions for analytical and preparative work.

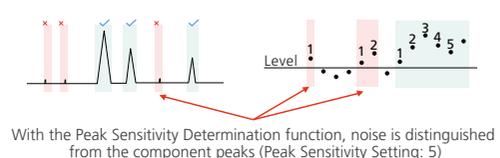
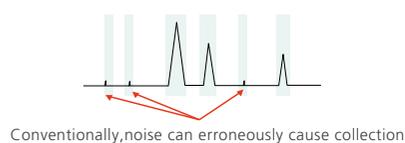
With the LabSolutions fractionation simulator (patent pending), specify the peak segment in the chromatogram to fractionate, and the system automatically sets the parameters required for fractionation. This reduces the time spent on setting fractionation conditions to about 1/4 the typical expenditure.



|                                     |                     |
|-------------------------------------|---------------------|
| <input checked="" type="checkbox"/> | Use                 |
| Peak Detection Parameter            |                     |
| Slope                               |                     |
| <input checked="" type="checkbox"/> | Use Slope           |
| Front Slope:                        | 4321 uV/sec         |
| Back Slope:                         | 1017 uV/sec         |
| Level                               |                     |
| <input type="checkbox"/>            | Use Level           |
| Level:                              | 1000 uV             |
| <input checked="" type="checkbox"/> | Slope Disable Level |
| Peak Collection Sensitivity:        | 3                   |
| Delay Time (Detector Filter):       | 1.00 sec            |

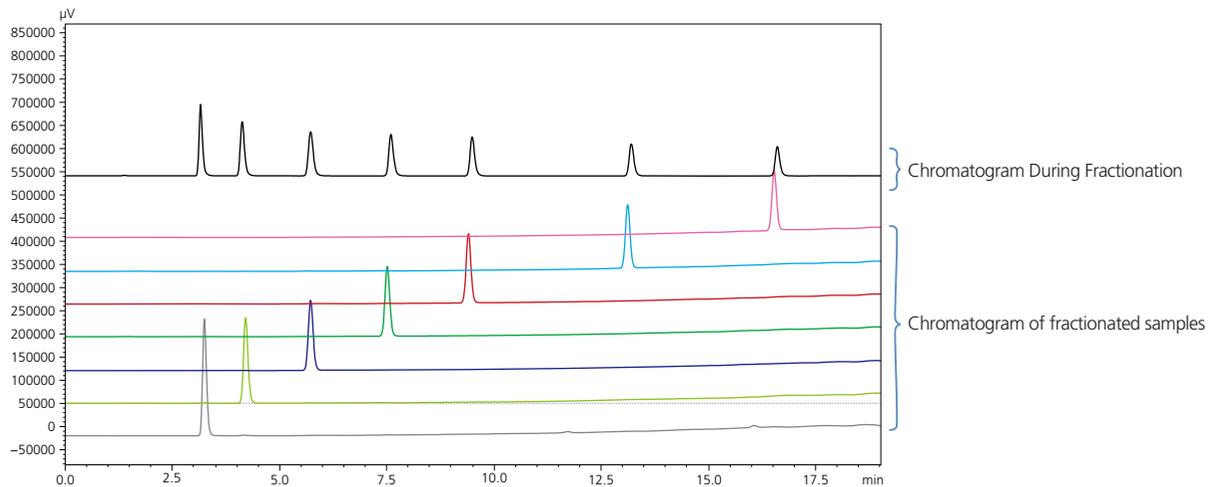
### Noise skipping by new algorithm

When configuring fractionation via automatic peak recognition, noise in the chromatogram is sometimes mistaken for component peaks, resulting in an insufficient number of test tubes for intended collection or improper positioning of collected fractions. With the LabSolutions software Peak Sensitivity Determination function (patent pending), peaks are recognized from the number of data points consecutively exceeding the configured threshold value, to determine whether to fractionate.



## Fraction Purity Checks (LH-40)

A fraction purity check can easily be performed with a single system. Purity checks can be performed without changing the fraction recovery container, so the workload is reduced and throughput is improved.



Results of a purity check: the chromatogram during fractionation and the recovered fraction

Note: FRC-40 Analytical kit is required.

## Sample Rescue Function Prevents the Loss of Precious Samples (LH-40, FRC-40)

Even if a problem occurs during preparative work, the sample remaining in the system can be recovered. By following the rescue instructions, the precious sample is recovered into the specified container rather than being discarded. Additionally, by using the optional waste collector, samples that cannot be recovered due to fractionation mistakes can be retained.

Sample Rescue

Sample Status: INJ

Execute Error Clear

Stop Pump Flow

Collect from injection flow

Switch HPV position to Load, after Move Arm

Drain from Syringe

Collect from analysis flow

Remove clogging from analysis  
Switch HPV position to INJ, after Move Arm

Pump start, after switch Prep Valve position to Open

# Preparative Work for Target Components at High Purity Levels and High Concentrations

Equipped with Technology for the Trap Enrichment of Target Components

## Nexera UFPLC, Ultra Fast Preparative and Purification Liquid Chromatograph System

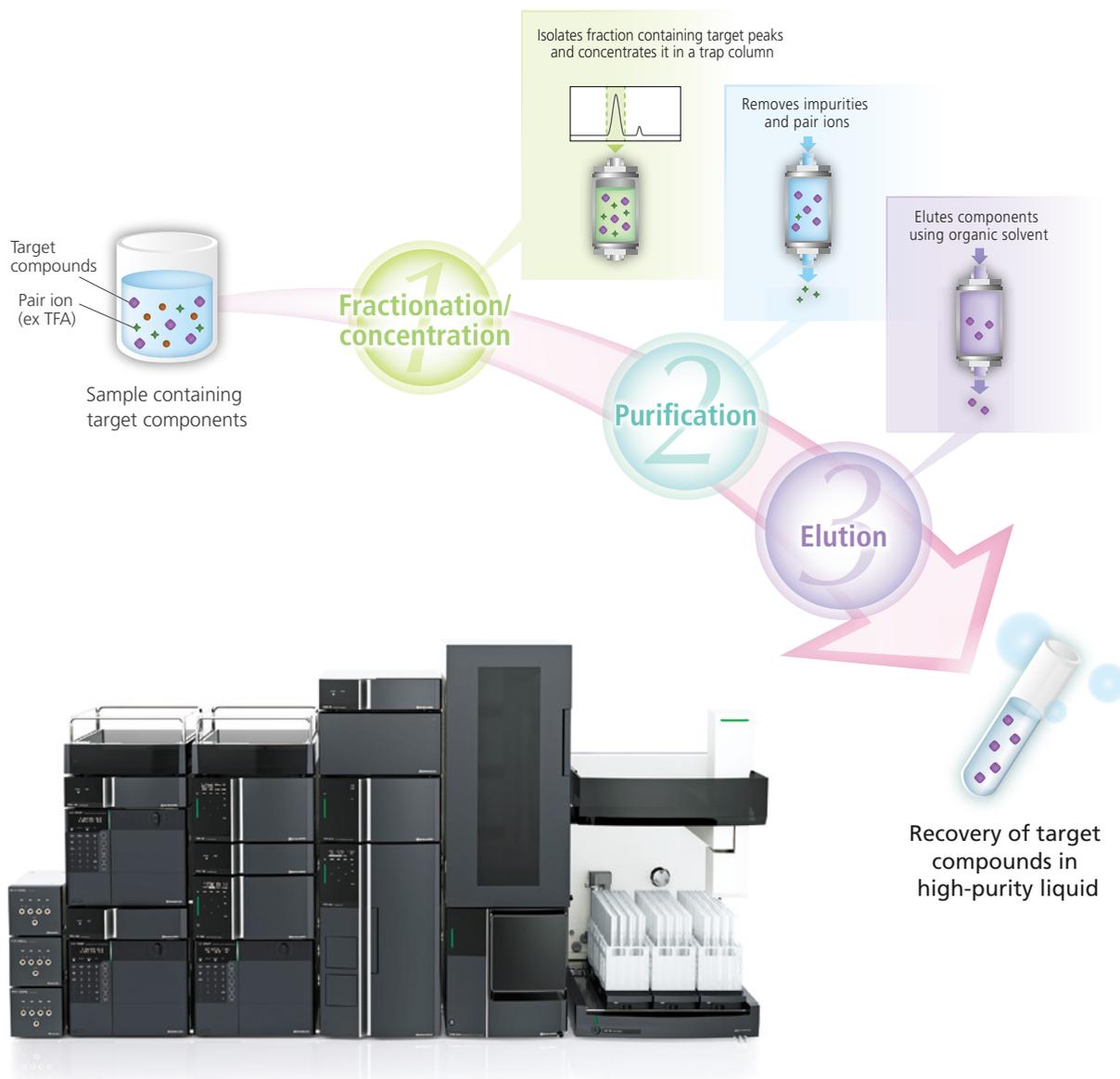
Significantly Reduces the Processes involved from Separation to Purification (Free-basing Treatment) and Powderization

The ultra fast preparative and purification liquid chromatograph system, Nexera UFPLC, streamlines purification operations by automating the preparative process from separation to concentration, purification, and collection.

In conventional preparative LC, the amount of fraction is diluted with the mobile phase, resulting in a huge volume, which takes time to evaporate, and post-treatment work, such as removal of salts derived from the mobile phase, is required.

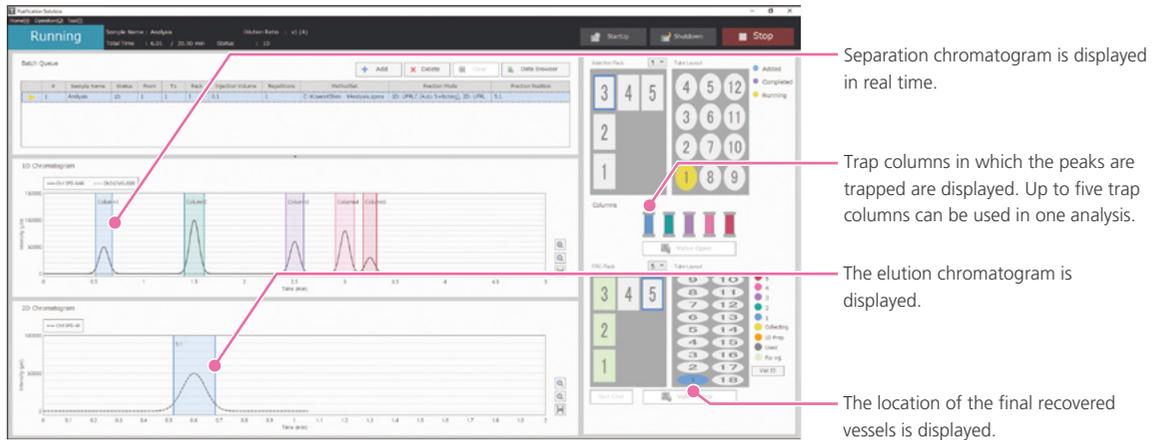
Nexera UFPLC concentrates target components by using a trap column. In addition, salts derived from the mobile phase and counter ions of the target compound are removed. Furthermore, because organic solvents are used to elute the target components, the time for evaporation can be significantly reduced.

Nexera UFPLC can also be used for standard preparative chromatography by collecting the fractions directly without any concentration steps.



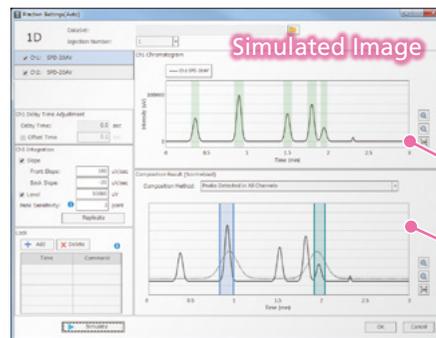
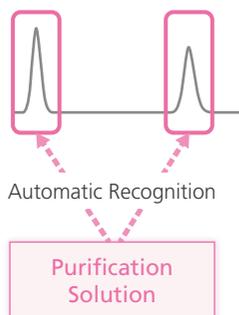
## Purification Solution™ Simplifies Settings Related to Preparative Purification

Purification Solution software supports Nexera UFPLC. By using templates, purification can be performed without complicated settings for the trap purification process. In addition, the separation chromatogram, the destination trap column, and the elution chromatogram can be displayed on a single screen, making it easy to confirm the location of the target components.



## Various Fractionation Modes

To ensure that valuable samples are fractionated, Purification Solution offers three fractionation modes.

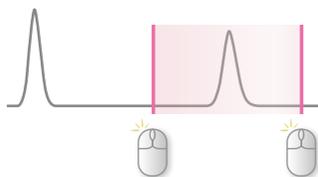


### (1) Automation Fractionation Mode

Peaks are automatically recognized and fractionated according to the fractionation parameters.

Fractionation simulation can be performed using pre-acquired chromatograms.

The fractionation simulation results are displayed using theoretical processing of multiple detector signals.



### (2) Manual Fractionation Mode

In this mode, the mouse pointer is used to fractionate peaks while viewing the window. When the same sample is concentrated by repeated injections, the first fractionation range is saved and the second and subsequent samples are automatically fractionated using the same fractionation range.



### (3) Time-Specified Fractionation Mode

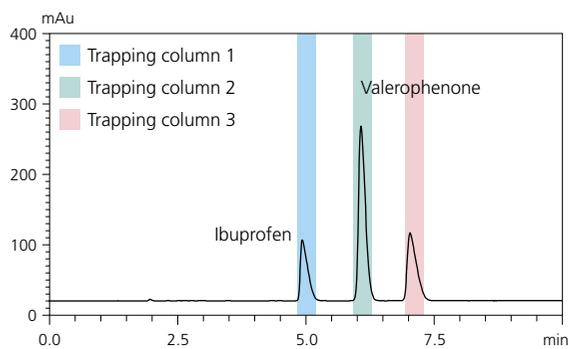
This mode collects fractions based on the retention times in previously acquired data. It is ideal for routinely performed preparative purification processes.

# Preparative Work for Target Components at High Purity Levels and High Concentrations

## Automatic Removal of Non-volatile Salts

In the conventional preparative LC, salts derived from the mobile phase are included in the recovered product. With Nexera UFPLC, salts derived from the mobile phase can be removed on the trap column.

In the picture below, Ibuprofen was prepared using a solvent containing ammonium chloroacetate, a non-volatile salt. With conventional preparative LC, ammonium chloroacetate precipitated at the same time during evaporation. However, ibuprofen was recovered as a single component with Nexera UFPLC due to the use of a trap column.



Preparative Chromatogram for Ibuprofen and Analogous Substances (Nexera UFPLC)



## Concentration and Powdering of Target Ingredients in a Short Period of Time

Using Nexera UFPLC, samples are repeatedly injected and the target components are introduced into the same trap column, allowing concentration on the trap column (up to 100 mg capacity). After concentration, the target component is eluted with an organic solvent, allowing recovery of the target component at a high concentration and shortening the time for evaporation.

The volume of recovered liquid and the time required for evaporation were measured when 100 mg of the target component, ibuprofen, was purified by trap purification. Compared to the conventional preparative LC process, the overall time was reduced by 50%.

Comparison of Preparative LC and UFPLC Fractionation

| System                 | Fraction vol. (mL) | Fraction conc. (mg/mL) | Drying time <sup>*1</sup> (min) |
|------------------------|--------------------|------------------------|---------------------------------|
| Typical Preparative LC | 93.0               | 1.1                    | 355 <sup>*2</sup>               |
| Nexera UFPLC           | 9.1                | 11.0                   | 130                             |

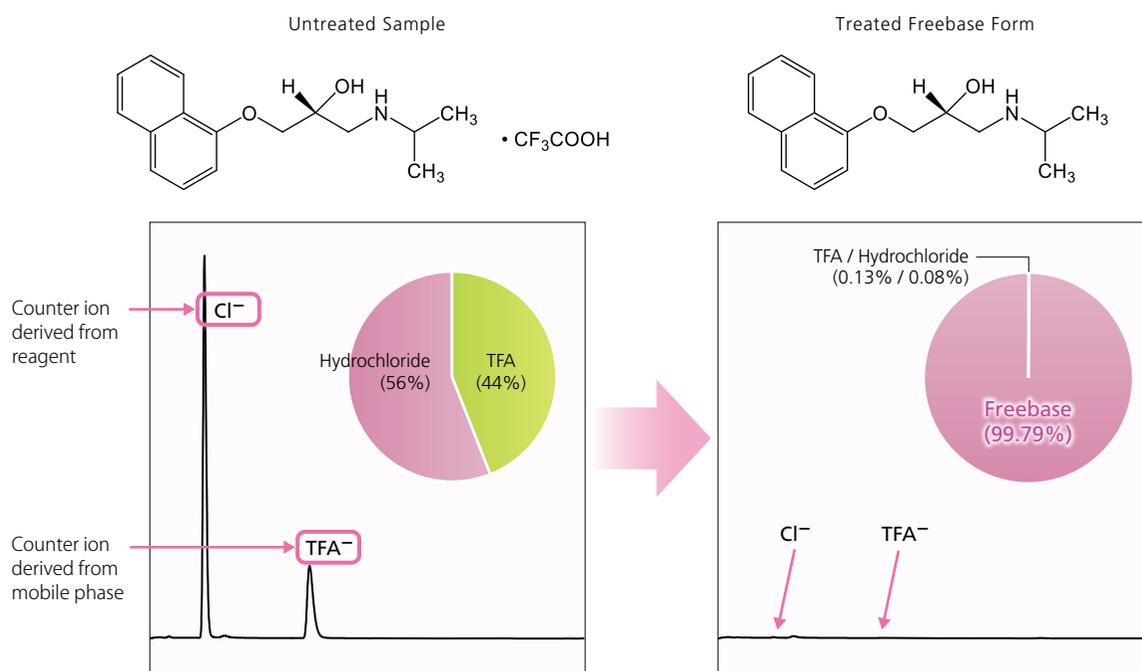
<sup>\*1</sup> Comparison of drying times when a centrifugation enrichment dryer is used  
<sup>\*2</sup> Time for drying the solution (20 mg) collected in one cycle



Comparison of Procedural Times for Typical Preparative LC and UFPLC

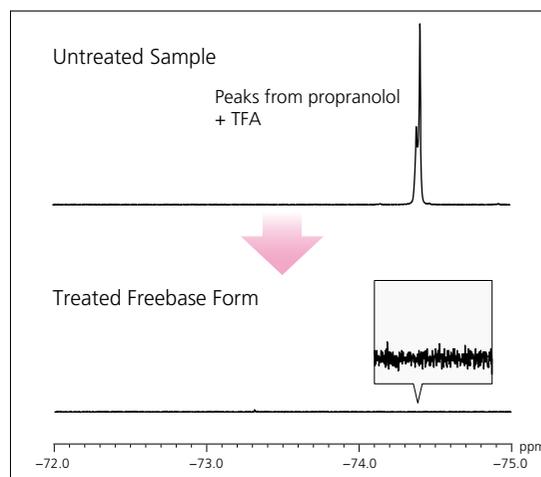
## Counter Ions Removal

In some cases, basic compounds can contain counter ions (such as trifluoroacetic acid, TFA) derived from both reagent and mobile phase. These components may remain as impurities, affecting the final purity. With Nexera UFPLC, the target component can be recovered as a high-purity free base (free base type) by using a trap column.



## Structural Analysis without Preprocessing

The  $^{19}\text{F}$  NMR spectrum of a 0.1% TFA solution containing propranolol after freebasing treatment is shown. Compared to the untreated sample, the TFA-derived peak in the fractionated sample is significantly smaller, confirming that TFA is effectively removed in the purification process using Nexera UFPLC.



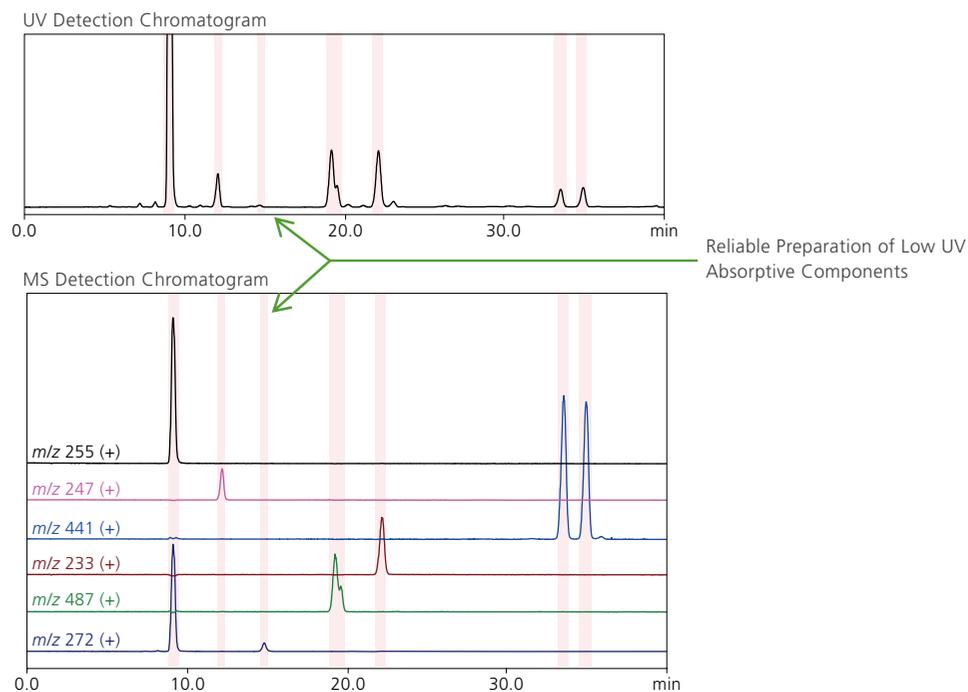
$^{19}\text{F}$  NMR Spectra of Peaks from TFA Bonded to Propranolol

# Preparative Work for Non-UV Absorptive Components

## Capable of High Purity Preparation Triggered by Up to Four Detector Channel Signals Nexera Prep LC/MS Preparative System

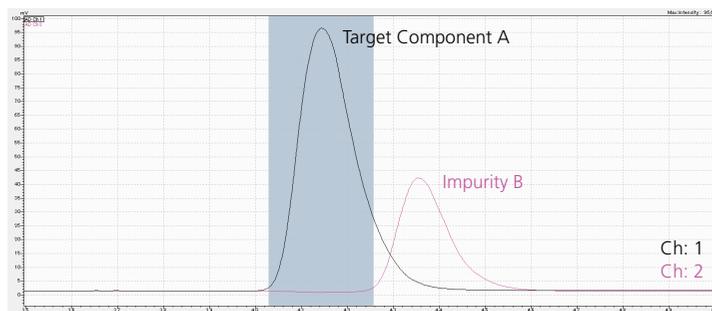
### Using MS Signal Triggers Enables Recovery with No Target Fraction Omissions

It can be difficult to prepare low UV absorptive components using just a UV signal as the trigger, so there is a risk that the fraction will be missed. By using the MS signal as the trigger, the preparative work can be performed simply, with nothing missed. By specifying the  $m/z$  of the target component, fractions can be collected with confidence. The LCMS-2050 mass spectrometer enables high-sensitivity and high-resolution detection for preparative work with no target components omitted.



### Purification of Un-separated Target Components

Two specific  $m/z$  values (from the target component and its impurity) were simultaneously used to obtain a "high-purity" fraction, even in the case of incomplete chromatographic separation.



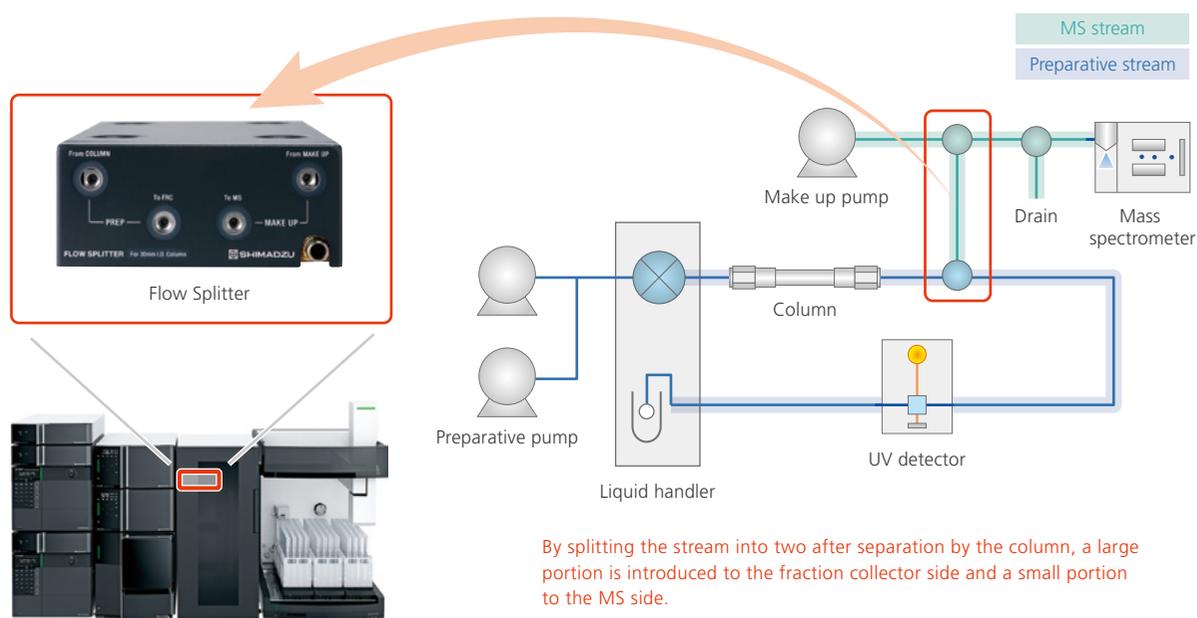
High Purity Recovery of Target Component A  
(Using two MS signals as triggers)

The MS signal that detects the target component A is used to trigger the start of the fractionation.  
The MS signal that detects impurity B is used to stop the fractionation.

## Flow Splitter for Fractionation Triggered by LC/MS Signals

For fractionation triggered by LC/MS signals, a portion of the sample must be introduced into the LC-MS.

The dedicated flow splitter splits a small portion of the flow from the preparative stream to the MS stream. This enables the use of LC-MS detection signals for triggering fractionation while maintaining a high recovery rate.



## Customized Detection Methods

Signals from various detectors can be used to trigger the fractionation. The optimal system configuration can be obtained for different samples and conditions.



UV-VIS Detector SPD-40  
PDA Detector SPD-M40



Refractive Index Detector  
RID-20A



Evaporative Light Scattering Detector  
ELSD-LT III



Mass Spectrometer  
LCMS-2050

# Increased Efficiency from Preparative Analysis Setup to Data Processing

## Open Solution Software for Preparative Systems

Open Solution is open access software that not only streamlines preparative purification operations, but also supports multi-user operation of preparative systems. Even inexperienced users can perform routine preparative operations easily with minimal efforts. The use of a network contributes to improved work efficiency.

## Easy Operation, Screening Using Multiple Conditions

After logging into Open Solution, analysis can be started from a single screen by simply selecting a pre-registered method and registering a sample. Screening analysis can be easily performed with the same procedure. While the system is performing an analysis, a different user can schedule the next analysis.

Open Solution software will automatically include washing steps between different user methods, reducing the system downtime.

The screenshots illustrate the following steps:

- Step 1. login:** The user enters their name and password. The interface shows a 'Ready, Ready, Ready' status and an empty sample queue.
- Step 2. Register samples:** The user registers a sample, indicated by a red circle around the sample registration button.
- Step 3. Select method (Screening is also available for condition study):** The user selects a method from a list, indicated by a red circle around the method selection area.
- Step 4. Start analysis:** The user starts the analysis, indicated by a red circle around the start button.

## Confirmation of Fractionation and Re-injection Analysis

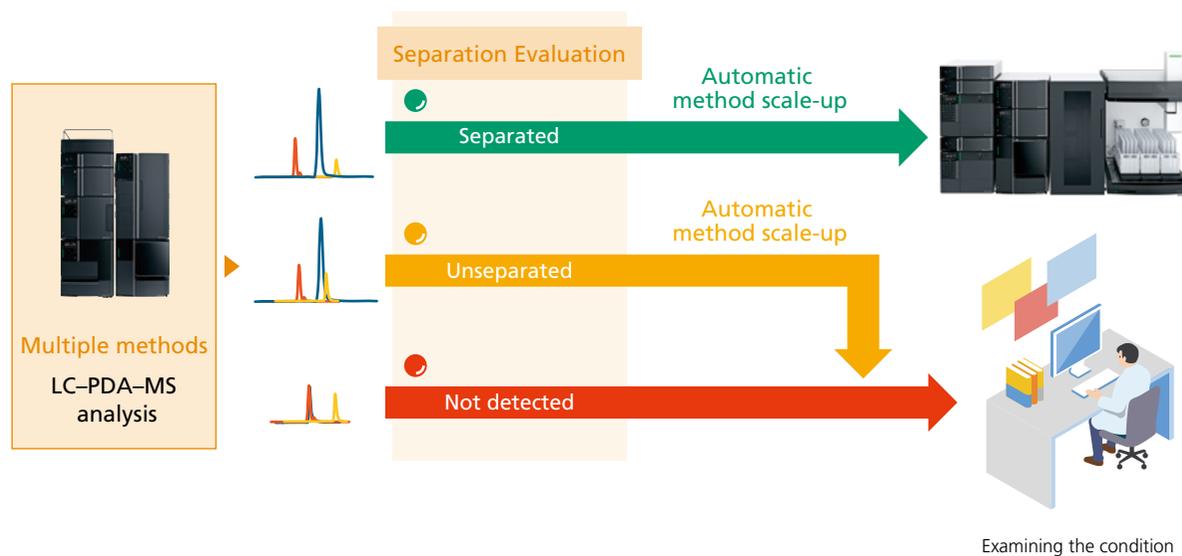
By selecting the vial displayed in the fraction collector diagram, the chromatogram, mass spectrum, and UV spectrum of that fraction can be easily confirmed. From the same screen, it is possible to directly check the purity of the fraction.

The Data Browser interface displays the following information:

- UV chromatogram:** Shows the UV spectrum of the selected fraction.
- MS chromatogram:** Shows the mass spectrum of the selected fraction.
- Fraction collector diagram:** Shows the fraction collector diagram with the selected vial highlighted.
- MS spectrum, UV spectrum:** Shows the mass spectrum and UV spectrum of the selected fraction.
- Fraction purity check button:** A button to check the purity of the fraction.

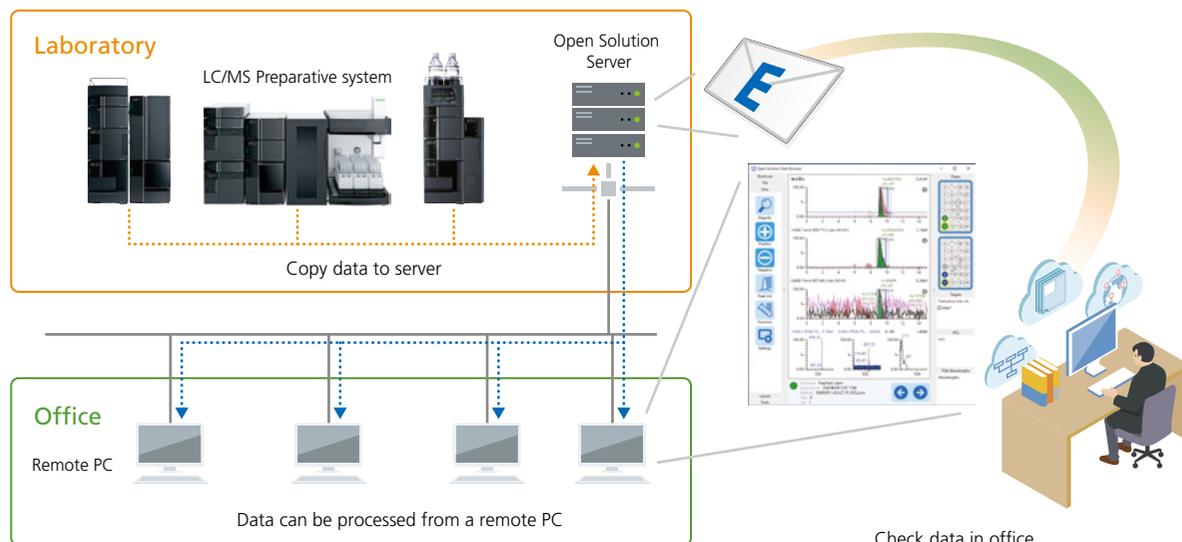
## Automatic Scale-up from Analytical to Preparative Scale

When screening analysis is performed to examine preparative conditions, the results are judged in three steps according to the degree of separation and MS spectral purity. If the judgment is acceptable, a preparative method is automatically generated. Therefore, the user can focus on examining conditions for samples with insufficient separation or aren't detected.



## Remote Data Processing

After data acquisition, the system sends an e-mail notification with a link to the data storage location and a report. Therefore, data processing can be performed immediately. In addition, data analysis can be performed from a remote PC by utilizing the network.



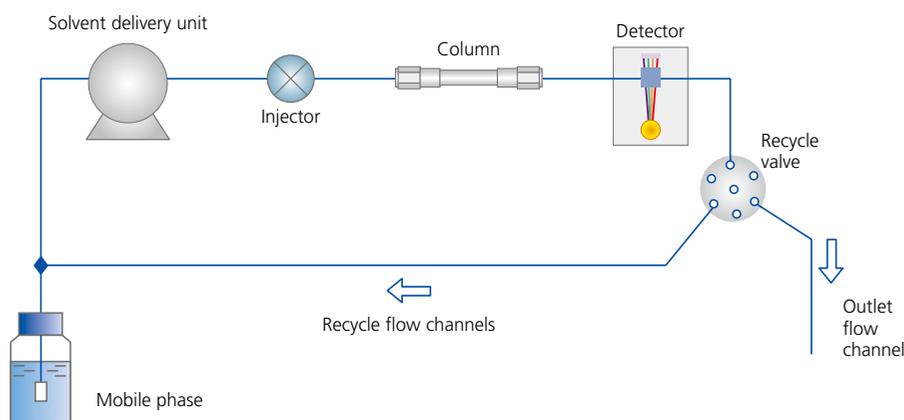
# High Separation via Preparative Recycling

## Components Difficult to Separate can be Recovered at High Purity Levels and at Low Cost Recycling Preparative System

### What is the Recycling Separation Method?

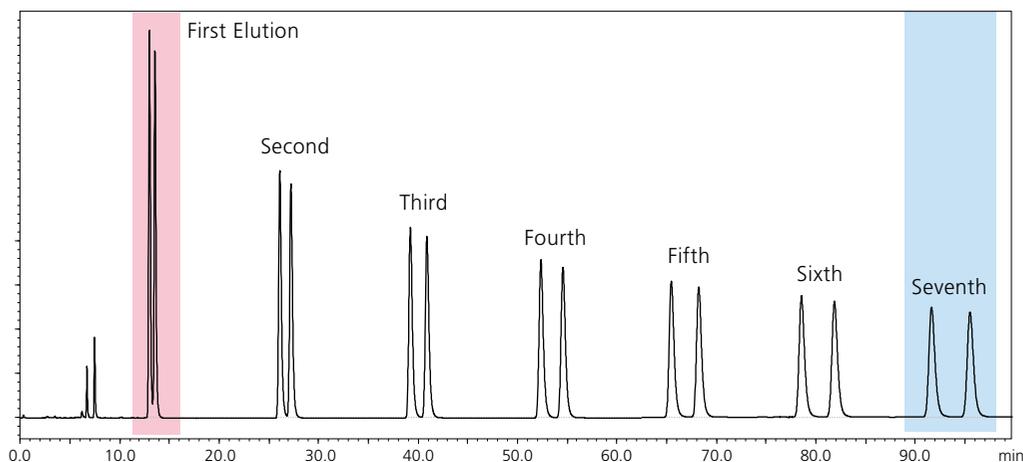
Because long preparative columns are expensive, there is a need to use comparatively lower cost short columns.

In the recycling separation method (closed valve recycling), the eluate liquid containing the target components that has eluted from the separation column is recycled into the column, enabling an equivalent separation capacity to that of a longer column.



Flow Lines for the Recycling Preparative System

The figure below shows the results of a seven-cycle recycling separation. In the first injection (typical separation), the separation of the two components is insufficient (red area). However, when the column eluate is returned to the column from the detector, it is separated a second time. If this recycling is repeated, the results obtained are equivalent to connecting a number of columns in series corresponding to the number of repetitions. In this example, a 4.0 or better resolution was ultimately obtained with seven recycling separation cycles (blue area).



Example of the improvement in separation by recycling: The coeluting peaks (red) are completely separated (blue).

Flowrate : 10 mL/min  
Detection wavelength : 254 nm  
Column : Shim-pack™ PREP-ODS(H) 20 mm I.D. × 250 mm L.  
Mobile phase : Water/methanol = 1/9 (v/v)  
Sample : Mixed 1% *n*-butylbenzene/*iso*-butylbenzene solution

## Recycle-Assist\* — Special Preparative Recycling Software

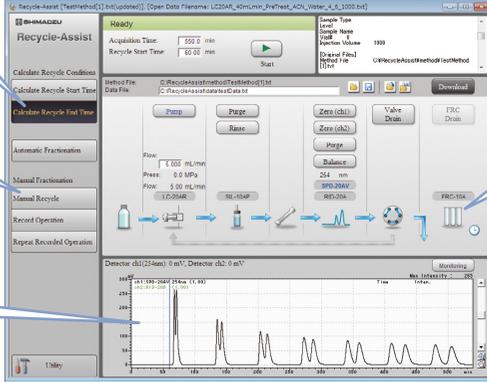
### Perform Automatic Preparative Recycling with a Simple GUI-Based Operating Environment

The graphical user interface (GUI) provides an environment where even novices to preparative recycling can perform operations simply and reliably. A single main window is used for the workflow from recycling to fractionation, thus reducing the risk of wasting precious samples through setting mistakes.

Configure settings for automatic fractionation using the intuitive wizard.

Manually time recycling and fractionation steps while viewing the chromatogram.

The chromatogram monitor enables confirmation of the current chromatogram and acquired data.



**Drain (initial state)**

**Recycling**

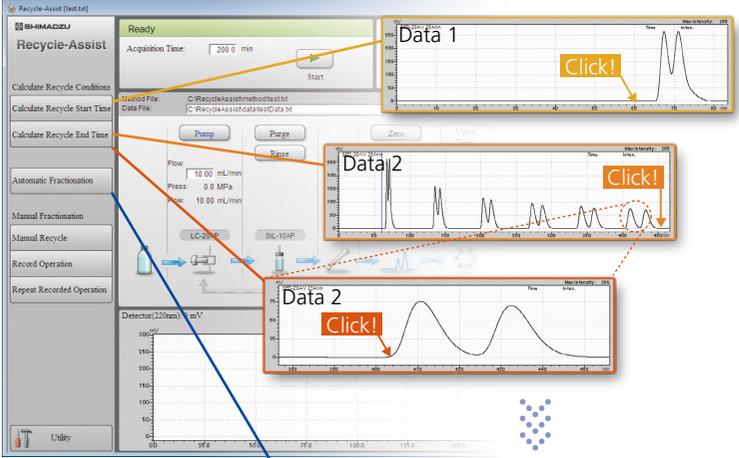
**Fractionation**

Visually identify current flow lines.

### Recycling Conditions are Completely Set in Three Steps

Just click three points corresponding to the recycling start, recycling stop, and automatic collection start point to complete the settings for the recycling preparation conditions.

Entering complicated numerical parameters is completely unnecessary, so recycling preparative work can start easily.



**Data 1** Click!

**Data 2** Click!

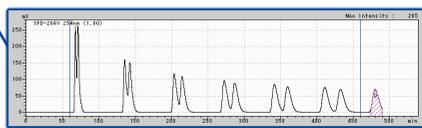
**Data 2** Click!

**Development of Recycling Conditions**

Click the recycling start point.

Click the recycling end point.

Click the fractionation start point.



The automatic preparative recycling method is created.

\* This is compatible with the FRC-10A

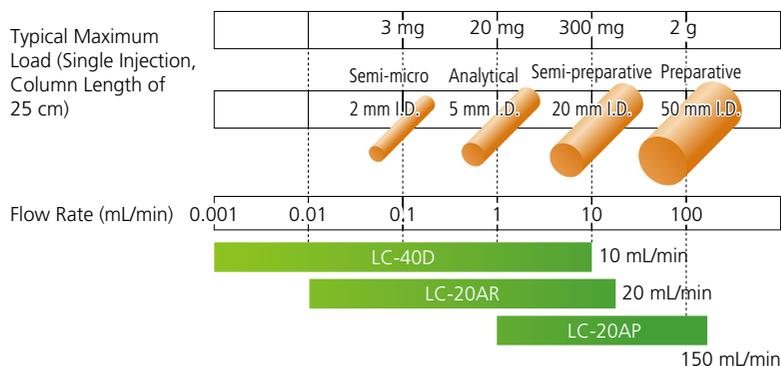
# Excellent System Expandability

## System Configuration Applicable to a Variety of Applications

Solvent Delivery Unit Accommodates a Wide Range of Recovery Volumes

### Guidelines for Preparative Scale and Maximum Load

The figure at right shows the guidelines for total component capacity with a 250 mm long column when the target component is highly soluble in the mobile phase, separates from impurities, and ions are suppressed. For isocratic elution, in principle, the total component capacity is proportional to the column volume.



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

- LC-40D**
- 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-20AR**
- This solvent delivery unit can handle flow rates used in semi-preparative scale (up to 20 mL/min).
  - Using a recycle kit enables semi-preparative recycling.



Supports Large-Scale Preparative Fractionation

- LC-20AP**
- High flow rates (up to 150 mL/min) enable highly efficient, large-scale preparative fractionation.
  - Large-scale prep solvent delivery fully supports the preparative fractionation workflow, including reinjection, to assess purity.
  - Combine with an FCV-200AL low-pressure gradient unit to perform gradient analysis using up to four mobile phases.



### Specifications

|                                    | LC-40D   | LC-20AR  | LC-20AP  |
|------------------------------------|--|--|--|
| Solvent Delivery Method            |  | Parallel-type double plunger   |  |
| Plunger Capacity                   | 10 $\mu$ L   | 47 $\mu$ L   | 250 $\mu$ L  |
| Maximum Discharge Pressure         | 44 MPa   | 49 MPa   | 42 MPa   |
| Flow Rate Setting Range            | 0.0001 to 5.0000 mL/min (1.0 to 44 MPa)<br>5.0001 to 10.0000 mL/min (1.0 to 22 MPa)            | 0.01 to 20.00 mL/min   | 0.01 to 150.00 mL/min                                      |
| Flow Rate Accuracy                 | No more than $\pm 1\%$ or $\pm 2 \mu$ L/min, whichever is greater (under specified conditions) | No more than $\pm 1\%$ or $\pm 10 \mu$ L/min, whichever is greater (0.1 to 5.0 mL/min) | No more than $\pm 1\%$ (1 mL/min, 10 MPa)                  |
| Flow Rate Precision                | No more than 0.06% RSD or 0.02 min SD, whichever is greater                                    | No more than 0.08% RSD or 0.02 min SD, whichever is greater                            | No more than 0.1% RSD or 0.02 min SD, whichever is greater |
| Constant Pressure Solvent Delivery |  | Supported  |  |
| Plunger Rinsing Mechanism          | Optional available   | Syringe or rinsing pump (228-39625-41)   | Syringe or rinsing pump (228-39625-41)                     |
| Operating Temperature Range        |  | 4 to 35°C  |  |
| Size and Weight                    | W260 x D500 x H140 mm, 10 kg   | W260 x D500 x H140 mm, 16 kg   | W260 x D500 x H210 mm, 19 kg                               |

## Shim-pack Scepter Columns

### Excellent Stability & Performance using a Wide Range of LC Conditions

Shim-pack Scepter LC columns, which are the next generation of organic silica hybrid-based columns, are designed for stability and performance in a wide range of mobile phase conditions. With different chemistry characteristics, Shim-pack Scepter columns are effective for method development/scouting under conditions that may compromise traditional silica-based columns.

With different particle sizes (1.9  $\mu\text{m}$ , 3  $\mu\text{m}$ , 5  $\mu\text{m}$ ) and different column dimensions, Shim-pack Scepter LC columns are fully scalable between UHPLC, HPLC and preparative LC, making method transfer seamless between different laboratory instrumentation.

|                        | Reversed Phase  |  |                  |                           |                                       |
|------------------------|---|--|------------------|---------------------------|---------------------------------------|
|                        | C18   | HD-C18                                 | C8               | Phenyl                    | PFPP                                  |
| Functional Group       | Trifunctional C18<br>Generic Purpose Type             | Trifunctional C18<br>High Density Type | Trifunctional C8 | Trifunctional Phenylbutyl | Trifunctional Pentafluorophenylpropyl |
| Particle               | Organic Silica Hybrid                                 |  |                  |                           |                                       |
| Particle Size          | 1.9 $\mu\text{m}$ , 3 $\mu\text{m}$ , 5 $\mu\text{m}$ |  |                  |                           |                                       |
| Pore Size              | 12 nm   | 8 nm                                   |                  | 12 nm                     |                                       |
| End Capping            | Proprietary   |  |                  |                           | None                                  |
| pH Range               | 1 – 12  |  |                  | 1 – 10                    | 1 – 8                                 |
| 100% Aqueous Condition | Yes   | No                                     | No               | Yes                       | Yes                                   |
| USP Classification     | L1  | L1                                     | L7               | L11                       | L43                                   |

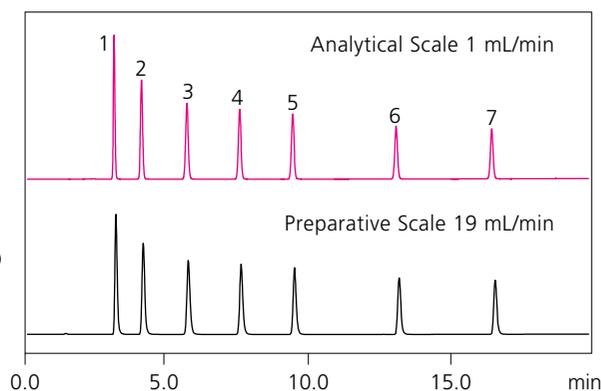


### Example of Scaling Up from Analytical to Semi-Preparative Work

This is an example of scaling up in which seven types of parabens are targeted using a 150 mm long column with a particle size of 5  $\mu\text{m}$ .

The gradient elution conditions investigated at the analytical scale are transitioned to the semi-preparative scale. A comparable chromatogram is obtained at both scales.

Column: Shim-pack Scepter C18-120 (4.6 mm  $\times$  150 mm, 5  $\mu\text{m}$ )  
 Column: Shim-pack Scepter C18-120 (20 mm  $\times$  150 mm, 5  $\mu\text{m}$ )



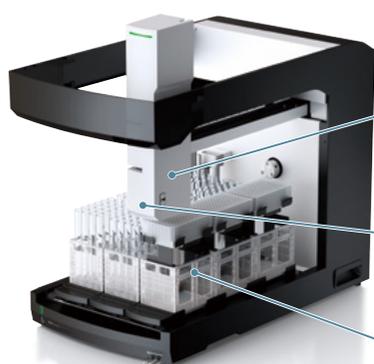
- 1: Methylparabene
- 2: Ethylparabene
- 3: Propylparabene
- 4: Butylparabene
- 5: Pentylparabene
- 6: Heptylparabene
- 7: Nonylparabene

Example of Scaling Up for Parabens

# Excellent System Expandability

## System Configuration Responds Flexibly to Applications

### The LH-40 Liquid Handler, Combination of Autosampler and Fraction Collector



#### Provides Both a Sample Injection Function and a Fraction Collection Function

A single unit can perform everything from sample injection to fraction recovery.

#### Suppresses Contamination

A proprietary injection method minimizes carryover, significantly limiting contamination to subsequent samples. (When a 4000 mg/L caffeine sample is injected, the carryover is 0.004 % or less.)

#### Capable of Injection from a Variety of Containers

With its long needle stroke, the system is compatible with containers of varying depths, including microtiter plates (MTP), vials, test tubes, and sample bottles.

## Options

### Syringe Kit 20 mL

This kit enables large-capacity injections of 2 mL or more at one time. The maximum injection volume is 20 mL.

### Washing Pump

This reduces the washing time for the injection needle, increasing throughput while reducing carryover.

### Multi-Liquid Handler Kit\*<sup>3</sup>

Up to six LH-40 liquid handlers can be connected, making it easy to inject the sample from all LH-40.

\*<sup>3</sup> Up to one LH-40 when FRC-40 fraction collectors are connected.

### Liquid Surface Detection Needle

This detects the liquid surface level, and automatically determines whether there is any sample present. As a result, only the remaining volume is injected, which prevents the injection of air into columns. Additionally, if no sample is present, the system can proceed to the next sample, reducing needless errors and lost labor.

### Analysis Kit

The recovered fraction can be reanalyzed to check the purity.

#### Autosampler

#### SIL-10AP

#### Sample Racks



#### Manual Injector

#### Rheodyne® 7725

#### Optional Sample Loops (Material: SUS)



#### Sample Coolers

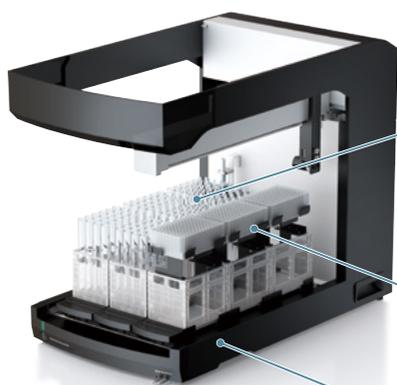
(Block Cooling/Heating: 4 to 70°C)

## Specifications

|                                      | LH-40  |         |                     |                       | SIL-10AP                          |         |
|--------------------------------------|--|---------|---------------------|-----------------------|-----------------------------------|---------|
| Maximum Injection Volume             | Up to 2 mL, up to 20 mL (Optional available) |         |                     |                       | Up to 5 mL                        |         |
| Cooling Function                     | None   |         |                     |                       | Yes (Optional available)          |         |
| Compatible Containers and Quantities | 10 mm O.D. test tube                         | 540 pcs | 1.5 mL vial         | 486 pcs* <sup>4</sup> |                                   |         |
|                                      | 12 mm O.D. test tube                         | 486 pcs | 4.0 mL vial         | 252 pcs               |                                   |         |
|                                      | 13 mm O.D. test tube                         | 360 pcs | 13 mL vial          | 108 pcs               | 1.5 mL vial                       | 100 pcs |
|                                      | 15 mm O.D. test tube                         | 252 pcs | 50 mL vial          | 54 pcs                | 4.0 mL vial                       | 80 pcs  |
|                                      | 17, 18 mm O.D. test tube                     | 216 pcs | 250 mL bottle       | 20 pcs                | 13 mL vial                        | 25 pcs  |
|                                      | 25 mm O.D. test tube                         | 108 pcs | 500, 1000 mL bottle | 12 pcs                |                                   |         |
|                                      | 30, 35 mm O.D. test tube                     | 54 pcs  | 96 well MTP/DWP     | 9 pcs                 |                                   |         |
| Size and Weight                      | W 390 x H 560 x D 730 mm, 40 kg              |         |                     |                       | W 260 x H 280 x D 320 mm, 18.5 kg |         |

\*<sup>4</sup> Available for injection sample container. Not available for fraction container.

## FRC-40, Highly Flexible Fraction Collector



### Accommodating Up to 3,240 Test Tubes

Large-scale fractions of the order of one liter can be accommodated, in addition to 96 well MTPs and a variety of test tubes. Up to six units can be connected, allowing users to customize the unit to their capacity needs.

### A Variety of Containers Can Be Selected

The system is compatible with various capacity racks to suit the volume needs of almost any workflow, reducing the work involved in switching containers.



### Space-Saving Design

With its small installation footprint, up to nine MTPs, standard vial racks, or test tube racks can be selected, contributing to the effective use of laboratory space.

## Options

### Sample Racks

A variety of containers can be placed including MTPs, vials, and various types of test tubes. Six colors are available, so a separate color can be apportioned to each user in order to avoid confusing samples.



### Multi Fraction Collector Kit

Up to six FRC-40 fraction collectors can be connected, making it easy to increase the number of fractions.



Compact Design for Small-Volume Samples

### FRC-10A

For smaller scale collection, or specialized applications that require enclosure and cooling, the FRC-10A is a compact fraction collector that provides time and signal-based triggering. A variety of programmable fractionation functions enable target components to be collected with high purity and high recovery.



## Specifications

|                                      | FRC-40  |         | FRC-10A                           |         |
|--------------------------------------|---|---------|-----------------------------------|---------|
| Maximum Flow Rate                    | 150 mL/min  |         |                                   |         |
| Fractionation Mode                   | Configured through a combination of basic mode (initial parameter mode) and time program mode (14 parameters) |         |                                   |         |
| Cooling Function                     | None  |         | Yes (Optional available)          |         |
| Compatible Containers and Quantities | 10 mm O.D. test tube  | 540 pcs | 4.0 mL vial                       | 252 pcs |
|                                      | 12 mm O.D. test tube  | 486 pcs | 13 mL vial                        | 108 pcs |
|                                      | 13 mm O.D. test tube  | 360 pcs | 50 mL vial                        | 54 pcs  |
|                                      | 15 mm O.D. test tube  | 252 pcs | 250 mL bottle                     | 20 pcs  |
|                                      | 17, 18 mm O.D. test tube  | 216 pcs | 500, 1000 mL bottle               | 12 pcs  |
|                                      | 25 mm O.D. test tube  | 108 pcs | 96 well MTP/DWP                   | 9 pcs   |
|                                      | 30, 35 mm O.D. test tube  | 54 pcs  |                                   |         |
| Size and Weight                      | W 390 × H 560 × D 730 mm, 40 kg   |         | W 260 × H 280 × D 320 mm, 18.5 kg |         |

# Options

## Suited to the Target Preparative Method

### Column Hub Column Holder Column Holder SLIM

Preparative columns with an I.D. of 20 mm to 50 mm as well as manual switching valves can be attached. The valves can be used for column switching.

### Specifications

|                    | Installable Valves                     | Installable Columns  | Size                     |
|--------------------|--|--|--------------------------|
| Column Hub         | Automatic Switching Valves Up to 4 pcs | Preparative Columns 2 pcs* <sup>5</sup> Analytical Columns 6 pcs* <sup>5</sup> | W 260 × H 560 × D 500 mm |
| Column Holder      | Manual Switching Valves Up to 4 pcs    | Preparative Columns 2 pcs Analytical Columns 1 pc                              | W 250 × H 465 × D 400 mm |
| Column Holder SLIM | Manual Switching Valves Up to 5 pcs    | Preparative Columns 2 pcs* <sup>6</sup> Analytical Columns 1 pc                | W 110 × H 625 × D 500 mm |

\*<sup>5</sup> When attaching three or more analytical columns or two preparative columns to the column hub, the optional "Column Bracket" is needed.

\*<sup>6</sup> If two preparative columns are attached using the Column Holder SLIM, the optional Column Clamp ASSY (P/N: 228-17701-94) is required.



Column Hub



Column Holder



Column Holder SLIM

For Multiple Detection Triggers

### A/D Conversion Board Kit

This is required for preparative work using multiple detector triggers. Expand the hardware to suit the number of detection trigger channels required.

Degassing Units

### DGU-403 / DGU-405

- A low-capacity degassing unit that uses a special fluoro resin membrane.  
DGU-403: 3 flow lines, DGU-405: 5 flow lines
- The maximum operating flow rate per flow line is 10 mL/min.
- Designed for use in analytical and preparative fractionation, this unit is used only when retention time reproducibility needs to be improved during analysis.



DGU-403

Note: When connecting to an LC-20AP, a connection kit must be obtained separately.

Note: LC-20AR connection kit is required when the operating flow rate is more than 10 mL/min.

Helium Degassing Unit

### DGU-10B

- Eliminates air bubbles, baseline undulation, drifting, etc. by purging dissolved air from mobile phases.
- The DGU-10B can be used to degas up to four mobile phase solutions with helium gas.
- This unit is switched ON/OFF from the solvent delivery unit or system controller.

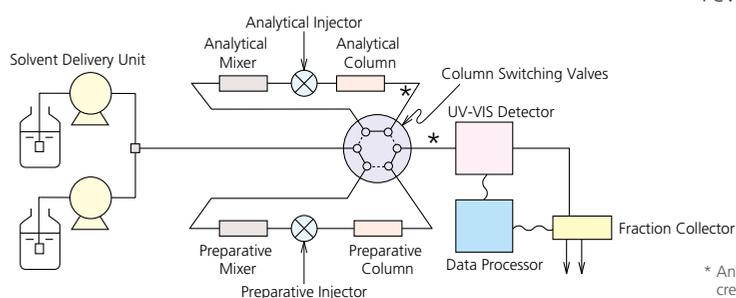


DGU-10B

### High-Pressure Flow-Line Selection Valves

## FCV-20AH<sub>2</sub> / FCV-12AH

- The valve position is controlled by event signal input.
- Valve type: 2-position/6-port rotary valve (recycle valve: 2-position/3-port valve)
- Maximum operating pressure: 34.3 MPa
- Operating pH range: pH 1 to 10
- Operating temperature range: 4 to 35°C
- Storing the FCV-12AH in the Option Box helps reduce the volume of preparative piping, including the recycling flow lines.

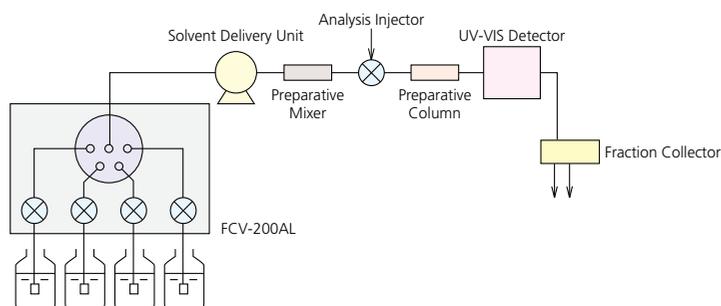


\* Analytical samples pass through piping created with 0.3 mm inner diameter tubes.

### Low-Pressure Gradient Unit

## FCV-200AL

- This low-pressure gradient unit is for the LC-20AP large-volume solvent delivery pump.
- A gradient can be produced with a single pump, enabling gradient preparative work at low cost.
- A single unit is capable of providing up to a four-liquid gradient as well as solvent switching, reducing the work involved in mobile phase investigations during method development.



### Reservoir Selection Valves

## FCV-11AL / FCV-11ALS

## FCV-230AL

- Capable of switching solvents using solenoid valves.
- The FCV-11AL/FCV-11ALS provide switching between two solvents. The FCV-11AL can supply up to three solvent delivery units, whereas the FCV-11ALS is used for one unit. It can be controlled from the LC-20AP/20AR front panel directly or through a system controller CBM-20A/20Alite and workstation software.
- The FCV-230AL provides switching between two solvents (optionally four solvents). It can be controlled from the LC-20AP/20AR front panel directly or through a system controller CBM-20A/20Alite and workstation software.



# System Selection Guide

What is the total amount of sample load?

How many samples are there?

What are the characteristics of the samples?

Up to 2000 mg

LC-20AP  
Shim-pack Scepter (I.D. 20–50 mm)



Up to 300 mg

LC-20AR  
Shim-pack Scepter (I.D. 10–20 mm)



Up to 20 mg

LC-40D  
Shim-pack Scepter (I.D. up to 4.6 mm)



Up to 252 samples\*<sup>7</sup>

LH-40



Up to 80 samples\*<sup>7</sup>

SIL-10AP



\*<sup>7</sup> When 4 mL vials are used.

UV Absorptive

SPD-M40 SPD-40/40V



Non-UV Absorptive

LCMS-2050



RID-20A



ELSD-LT III



Are there any other requirements?

Efficient  
post-treatment process



Nexera™ UFPLC System

Reduces time for evaporation by using an organic solvent for elution. Desalting and concentration can be performed automatically.

Multi sample capability  
Multiple fractions



Multi Liquid Handler/  
Fraction Collector System

This is the optimal system when there are many fractions. Up to six LH-40 units can be connected. It makes it easy to inject the sample from each LH-40.

What is the number of fractions?

Up to 540 samples\*<sup>8</sup>

LH-40



FRC-40



Up to 144 samples\*<sup>8</sup>

FRC-10A



\*<sup>8</sup> When test tubes with an O.D. of 10 mm are used

— Sample System Configuration —

LC Preparative System



This system supports a wide range of loads, injection volumes, and number of fractions. It can be used as an all-purpose system to support a diverse range of samples.

LC/MS Preparative System



Target components can be selectively prepared with no omissions using LCMS.

High separation at low cost



Recycling Preparative System

This is the optimal system for obtaining high separation at low cost.

Purity checks



Everything up to fraction purity checks after preparation can be performed with a single system.

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