C193-E034E

SHIMADZU
Excellence in Science

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 lineup for scale-up from analytical to preparative
- Time- and energy-savings 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 the Process of Establishing Conditions for Preparative Work — P. 4

Using a Nexera Prep system in combination with LabSolutions™ MD software can improve productivity and reduce labor costs by automatically evaluating the analysis parameter settings, scaling up the settings for preparative purification, and specifying fractionation settings.

Nexera Prep System, LabSolutions MD

Preparative Work for Target Components at High Purity Levels and High Concentrations — P. 8

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

Prep Solution is straightforward to operate even for inexperienced users, because the number of parameter settings characteristic of preparative work has been reduced to the utmost.

Prep Solution Software to Support the Examination of Preparative Conditions

High Separation via Preparative Recycling — P. 15

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.

Preparative Recycling 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 the Process of Establishing Conditions for Preparative Work

Fully Equipped with Functions to Reliably Prepare Target Components

Nexera Prep System

Specify Fraction Parameters Easily with an Intuitive User Interface

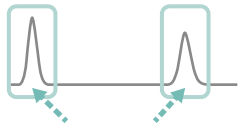
Preparative LC systems require configuring numerous parameter settings in order to accurately and appropriately fractionate samples. Because Nexera Prep systems are controlled by LabSolutions software, preparative LC systems can be operated in the same manner as regular Shimadzu LC systems.

Various Fractionation Modes

LabSolutions offers three fractionation modes. Systems can be used in combination with the respective fractionation modes to ensure target components are fractionated according to needs.

Automatic Fractionation Mode

Peaks are automatically recognized and fractionated according to automatic fractionation parameters. This mode is especially suitable if retention times fluctuate.



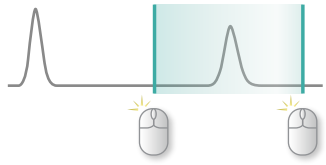
Automatic Recognition

Time-Specified Fractionation Mode

This mode collects fractions during pre-specified time intervals. It is ideal for routine preparative purification processes.

Manual Fractionation Mode

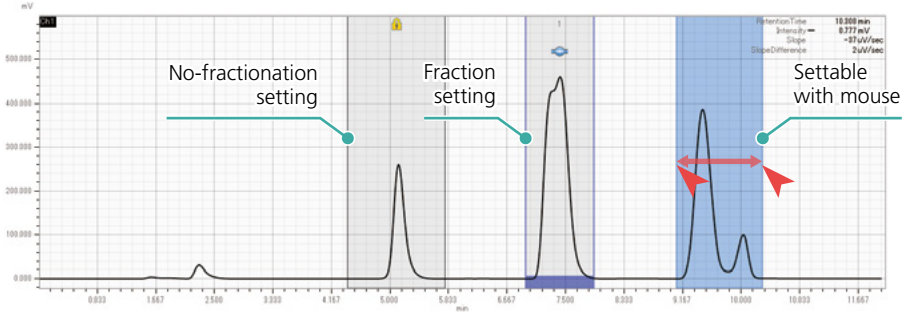
In this mode, peaks are selected for fractionation by clicking the [Valve Open] button while checking on-screen.



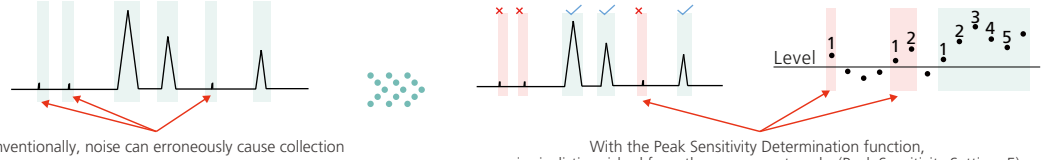
Significantly Reduces the Process of Setting Fractionation Parameters

Specify Fraction Area and Parameter Settings Easily Using Mouse Operations

It is easy to specify fraction parameters in LabSolutions. By using the fractionation simulator to specify the desired fraction peak range on the chromatogram, the system automatically collects the corresponding interval. This setting can also be used with the automatic fractionation mode, which can significantly shorten the time required for configuring fractionation settings.



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. To address this issue, Nexera Prep utilizes a newly developed algorithm that recognizes peaks from the number of data points consecutively exceeding the configured threshold value, helping to determine whether to fractionate.



Conventionally, noise can erroneously cause collection

With the Peak Sensitivity Determination function, noise is distinguished from the component peaks (Peak Sensitivity Setting: 5)

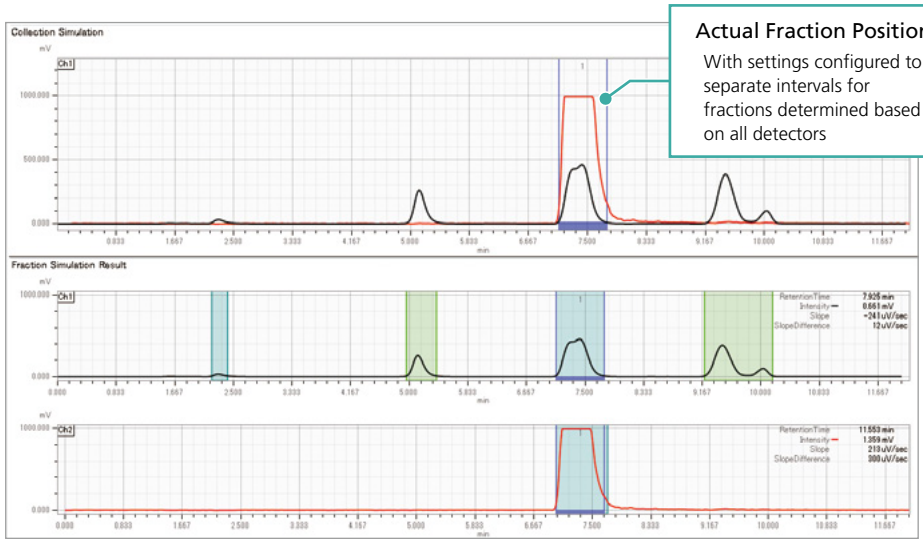
Easily Specify Fraction Triggers Even for Multiple Detectors

Settings can become complicated if multiple detectors are used for fraction triggers. LabSolutions displays chromatograms from all detectors in one view so that decisions can be made for each trigger. In addition, the trigger results obtained can be overlaid on chromatograms for use in simulating fractions.

Overlaid Simulation of Preparative Separation

UV detector trigger results

MS detector trigger results

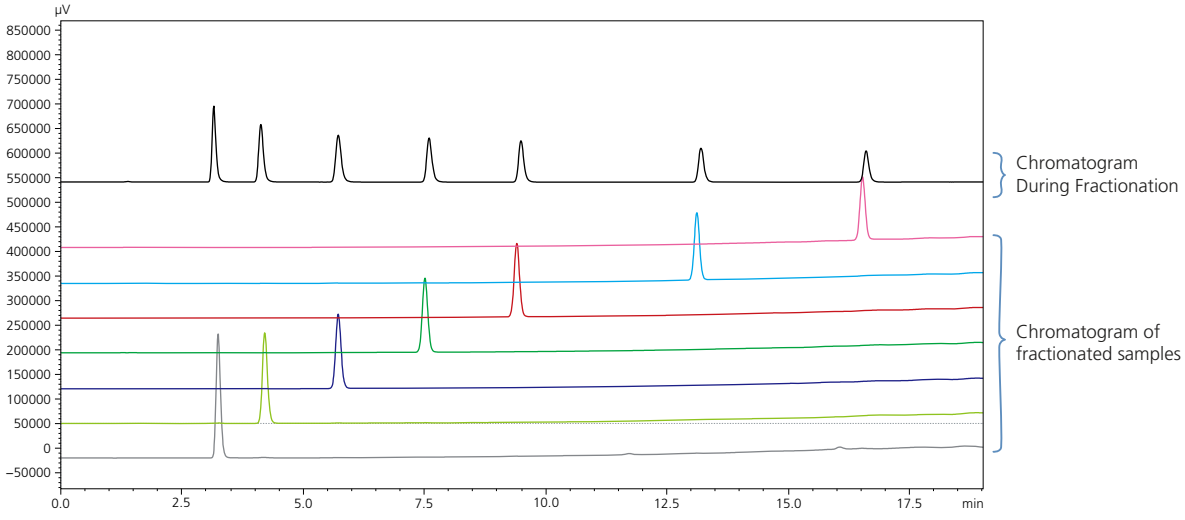


Actual Fraction Position

With settings configured to separate intervals for fractions determined based on all detectors

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.

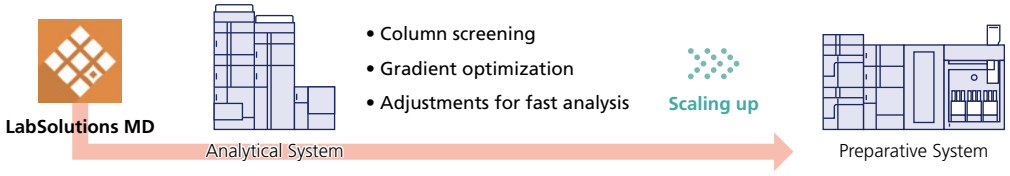
Streamline the Process of Establishing Conditions for Preparative Work

Reduces Labor Involved in Considering Parameter Settings for Scaling Up

LabSolutions MD Method Development Software

Process Flow for Developing a Preparative Purification Method

When considering parameter settings for preparative purification, it is recommended to first prepare a small-scale analytical system to determine the optimal mobile phase, column, and gradient parameters. LabSolutions MD software for HPLC method development provides support for selecting mobile phases and columns, optimizing gradient conditions, and scaling up settings for preparative purification.

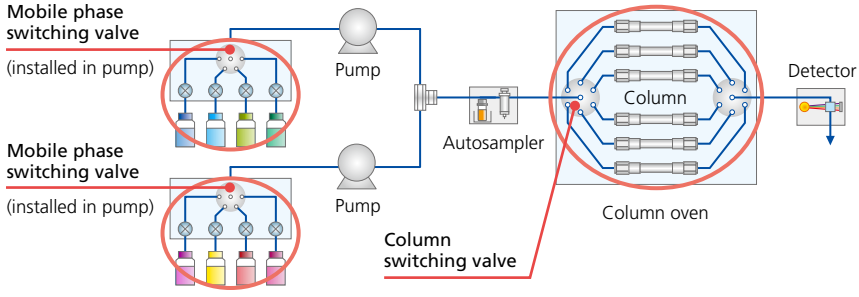


Automatically Screen Optimal Mobile Phase and Column Settings for Preparative Purification

During screening, it is important to determine the mobile phase and column that are optimal for separating target components. LabSolutions MD can automate the screening process by automatically switching between various mobile phase and column options.

Automated Screening with Automatic Switching Between Mobile Phases and Columns

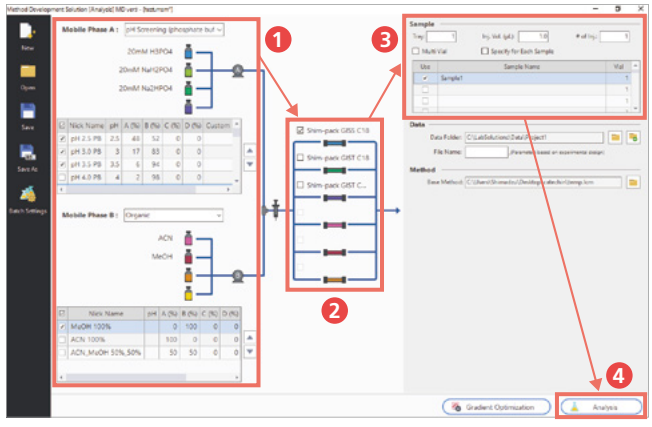
Screening can be automated by installing valves inside the pump and column oven to enable automatic switching between mobile phases and columns. That avoids the trouble of having to manually reinstall mobile phases and columns.



Automatic Mobile Phase and Column Switching

Easily Create and Execute Screening Analysis Schedules

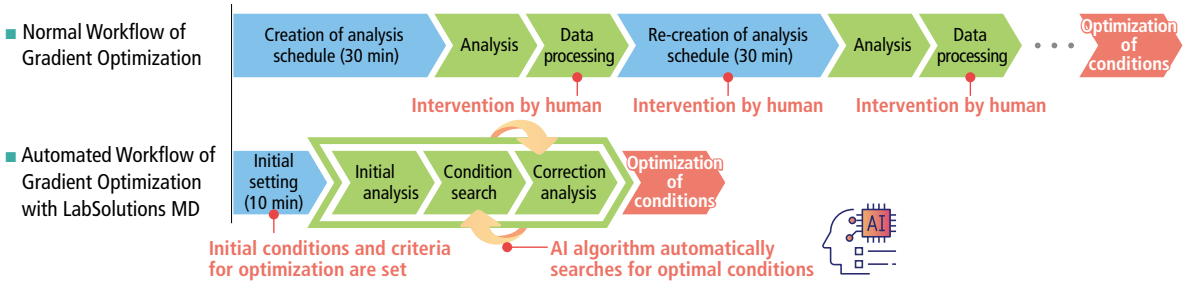
Many method files or analysis schedules can be quickly created by executing the 4 steps on the right. The ability to select the mobile phase and column with a single click can improve operating efficiency and reduce errors.



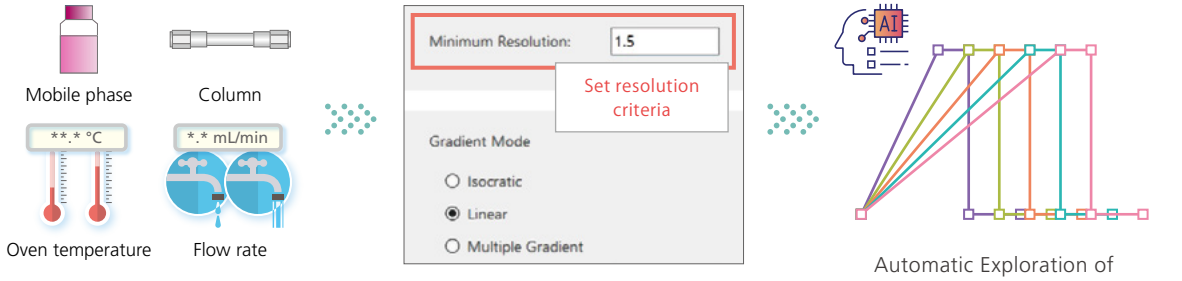
1. Select mobile phases
2. Select columns
3. Input sample information
4. Create analysis schedule

Gradient Conditions Optimized by Proprietary AI Algorithm

Gradient parameter settings for preparative purification are an important factor for efficiently separating target components. LabSolutions MD includes a unique AI algorithm that can automatically search for and optimize gradient parameter settings based on operating objectives.



By setting the desired separation level as a criterion, gradient parameter settings can be optimized automatically based on the mobile phase and column combinations determined from screening. After optimization, AI is used to automatically search for gradient parameter settings, allowing users without chromatography experience to easily search for parameter settings.

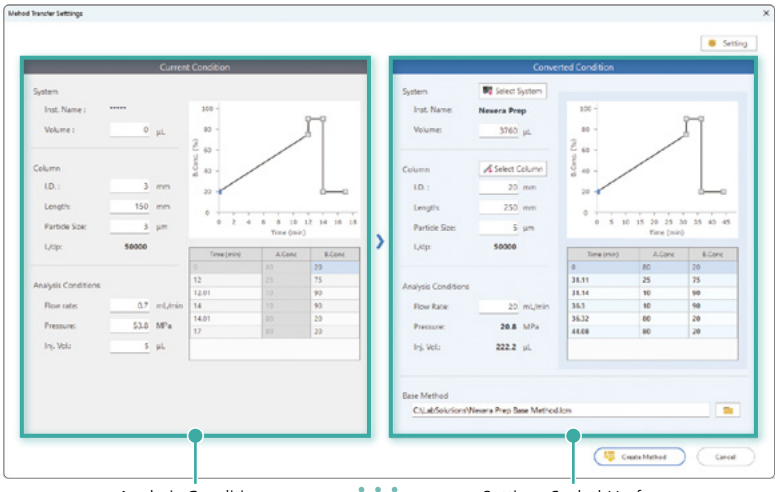


Setting of Initial Conditions

Setting of Criteria for Optimization

Automatic Exploration of Gradient Conditions Satisfying Criteria

Easily Scale Up Analysis Conditions with Method Transfer Functionality



Analysis Conditions

Settings Scaled-Up for Preparative Purification

Once parameter settings are determined for a small-scale analytical system, they must be transferred to a system appropriate for preparative purification. LabSolutions MD offers method transfer functionality that can easily convert parameter settings established for an analytical system into settings for a preparative system.

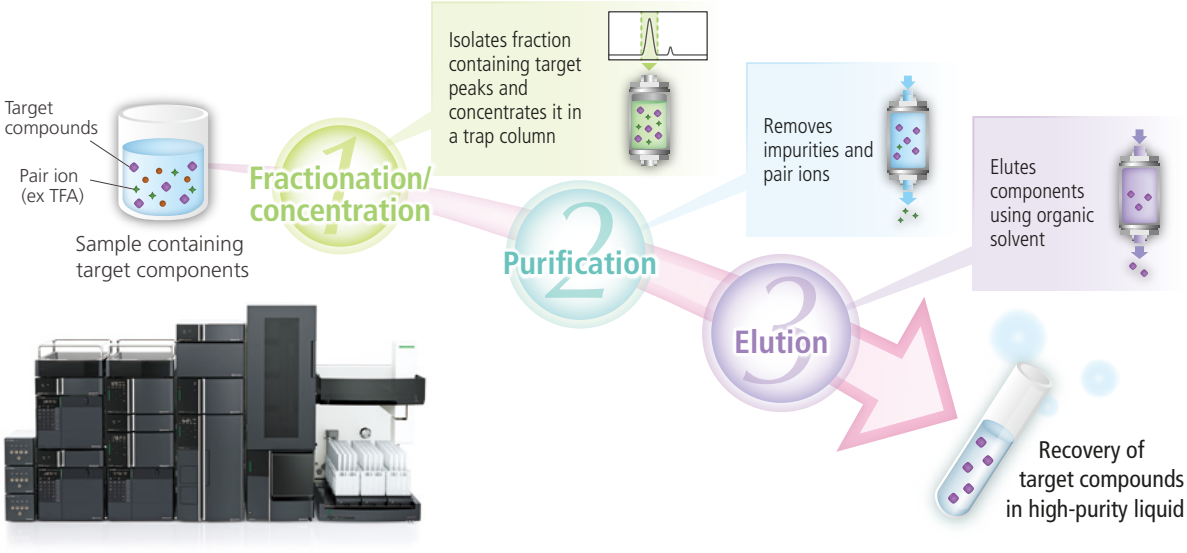
Preparative Work for Target Components at High Purity Levels and High Concentrations

Equipped with Technology for the Trap Enrichment of Target Components

Nexera UFPLC, Ultra Fast Preparative and Purification Liquid Chromatograph System

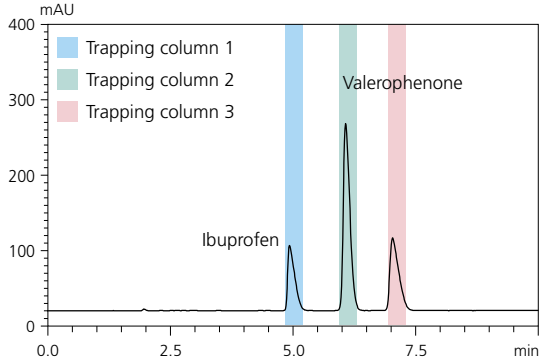
Significantly Reduces the Processes Involved from Separation to Purification (Free-basing Treatment) and Powderization

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.

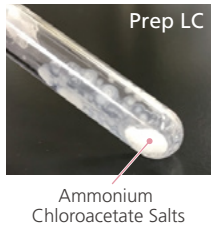


Automatic Removal of Non-volatile Salts

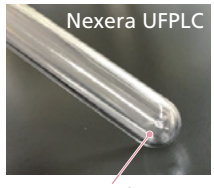
In conventional preparative LC, salts derived from the mobile phase are included in the recovered product. With Nexera UFPLC, salts derived from the mobile phase can be removed on the trap column.
In the picture below, Ibuprofen was prepared using a solvent containing ammonium chloroacetate, a non-volatile 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)



Ammonium Chloroacetate Salts



Ibuprofen

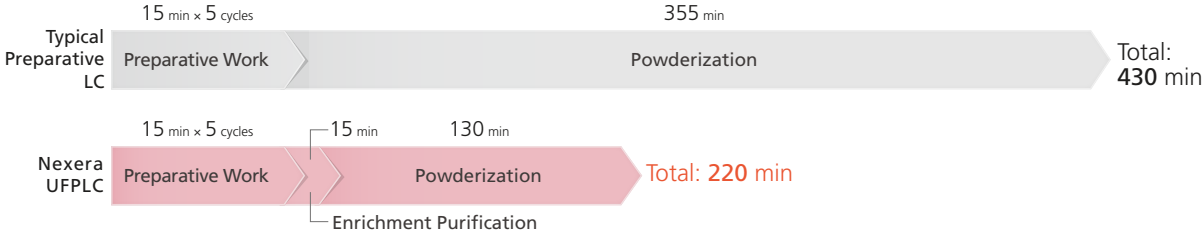
Concentration and Powdering of Target Ingredients in a Short Period of Time

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 *1 (min)
Typical Preparative LC	93.0	1.1	355 *2
Nexera UFPLC	9.1	11.0	130

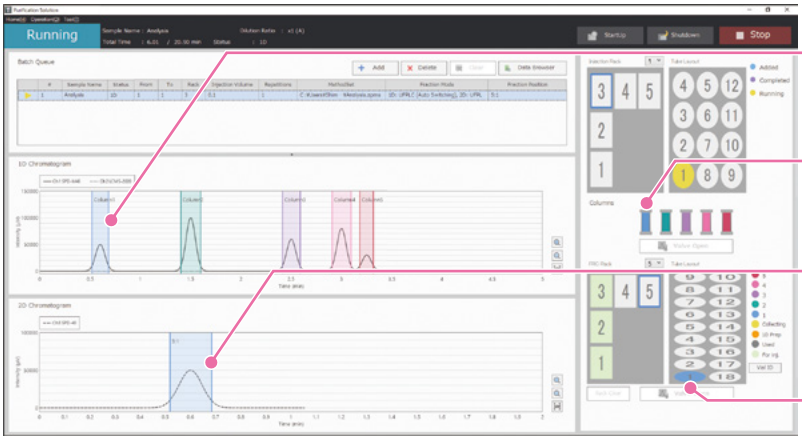
*1 Comparison of drying times when a centrifugation enrichment dryer is used
*2 Time for drying the solution (20 mg) collected in one cycle



Comparison of Procedural Times for Typical Preparative LC and UFPLC

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.



Separation chromatogram is displayed in real time.

Trap columns in which the peaks are trapped are displayed. Up to five trap columns can be used in one analysis.

The elution chromatogram is displayed.

The location of the final recovered vessels is displayed.

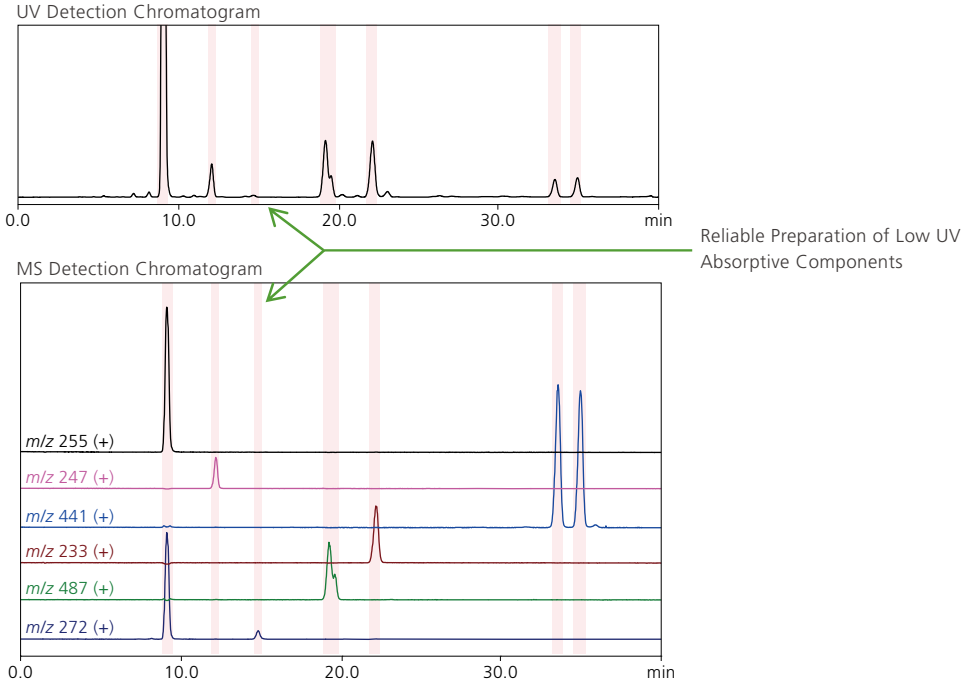
Preparative Work for Non-UV Absorptive Components

Capable of High-Purity Preparation Triggered by Up to Four Detector Channel Signals

Nexera Prep LC/MS Preparative System

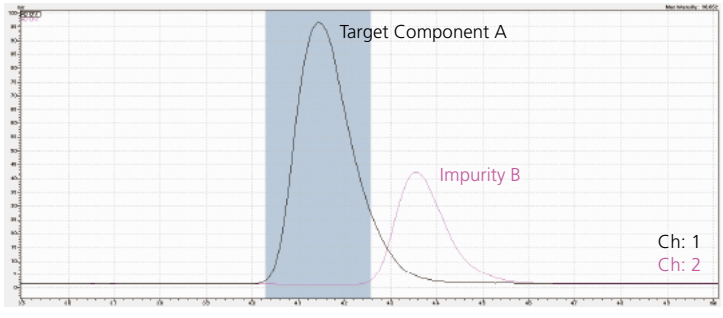
Using MS Signal Triggers Enables Recovery with No Target Fraction Omissions

If only a UV signal is used as the trigger, fractions that include components with low UV absorption may be overlooked. If an MS chromatogram signal from an LCMS-2050 mass spectrometer, which offers excellent sensitivity and selectivity, is used as the trigger, even components with no UV absorption can be recovered.
Furthermore, by using the trigger control mode based on MS molecular weight information, preparative fractions can be selectively obtained for only target components.



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.



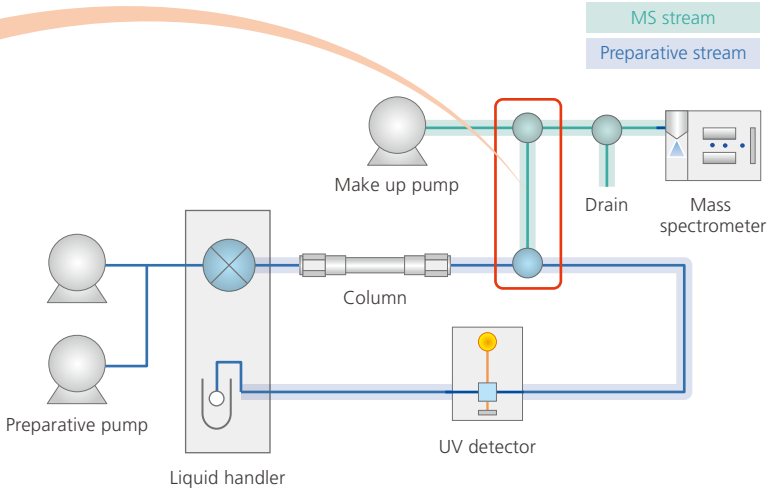
High-Purity Recovery of Target Component A (Using two MS signals as triggers)
The MS signal that detects target component A is used to trigger the start of the fractionation.
The MS signal that detects impurity B is used to stop the fractionation.

Flow Splitter for Fractionation Triggered by LC/MS Signals

If an LC–MS system is used as a preparative purification trigger, the column outflow must be split to use only a portion of the flow as input to the LC–MS system. Column outflows can be split reliably by using an easy-to-install dedicated flow splitter. Dedicated flow splitters can achieve high split ratios, helping to minimize target component losses while also preventing LC–MS system contamination.

Flow Splitter

Nexera Prep LC/MS Preparative System



By splitting the stream into two after separation by the column, a large portion is introduced to the fraction collector side and a small portion to the MS side.

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

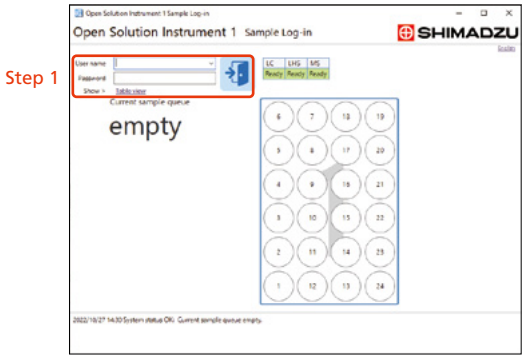
Increased Efficiency from Preparative Analysis Setup to Data Processing

Open Solution Software for Preparative Systems

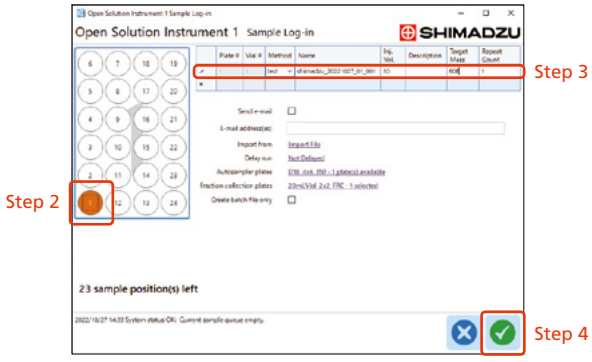
Open Solution is open access software that not only streamlines preparative purification operations, but also supports multi-user operation of preparative systems. Even inexperienced users can perform routine preparative operations easily with minimal effort. The use of a network contributes to improved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



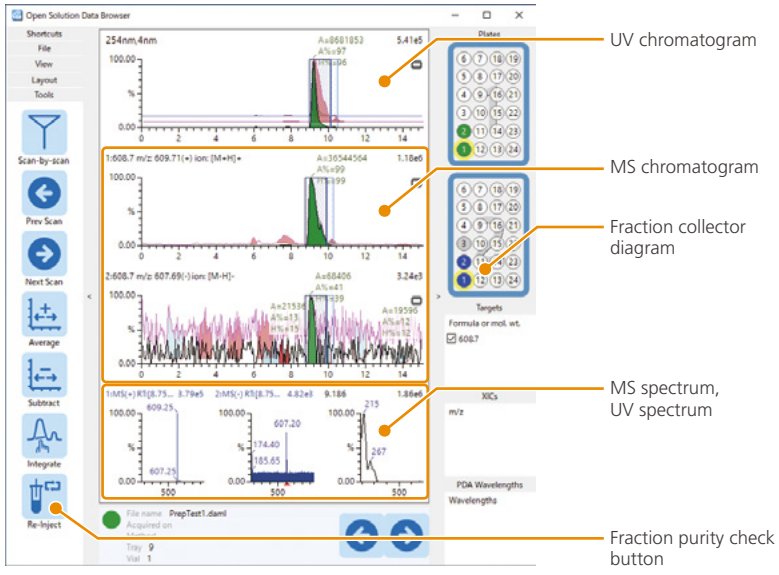
Step 1. login



Step 2. Register samples
Step 3. Select method (Screening is also available for condition study)
Step 4. Start analysis

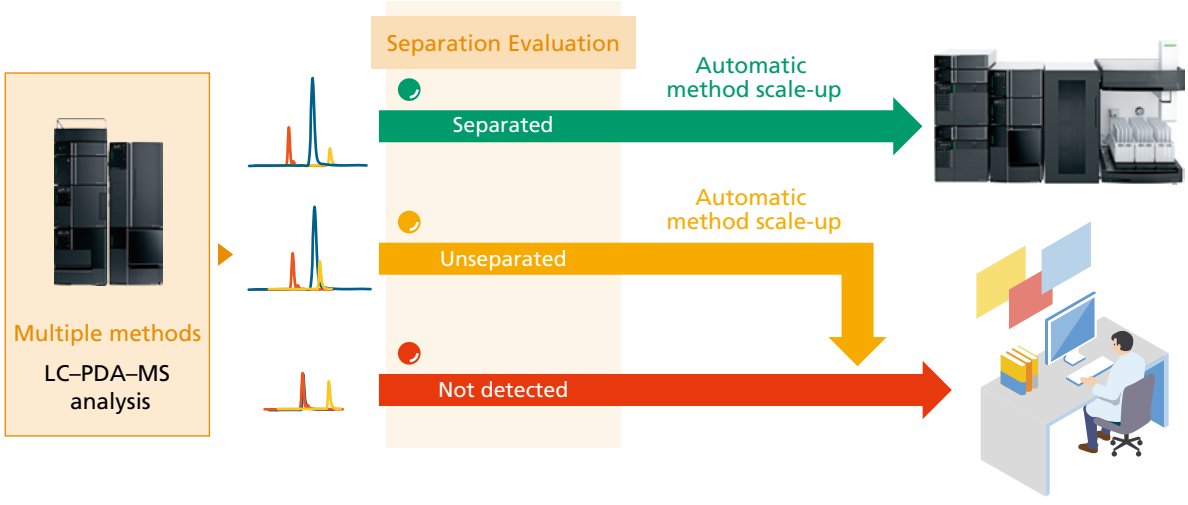
Confirmation of Fractionation and Re-injection Analysis

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.



Automatic Scale-up from Analytical to Preparative Scale

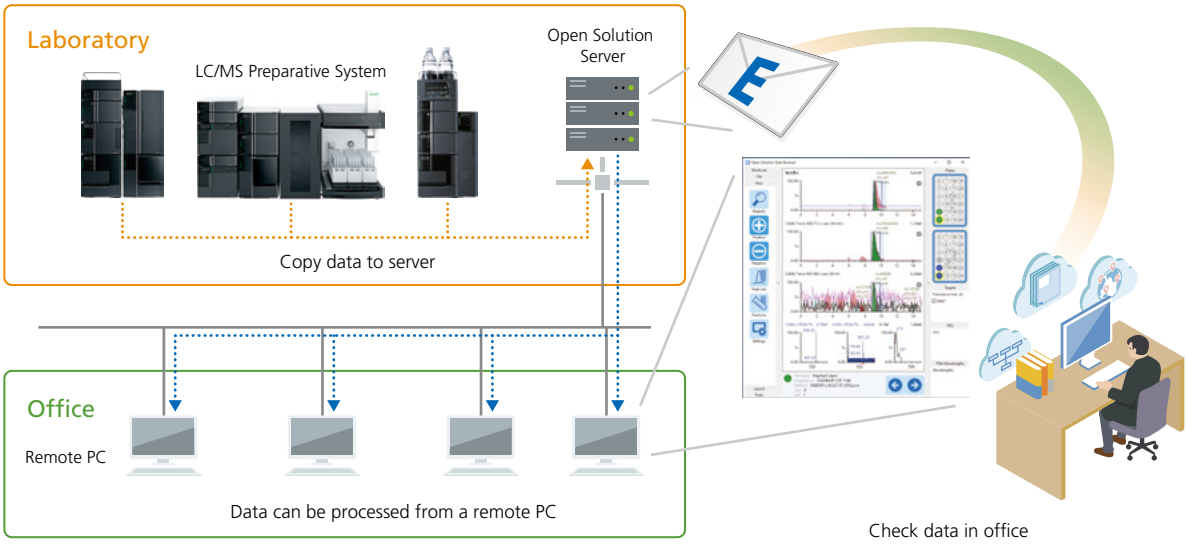
When screening analysis is performed to examine preparative conditions, the results are judged in three steps according to the degree of separation and MS spectral purity. If the judgment is acceptable, a preparative method is automatically generated. Therefore, the user can focus on examining conditions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



Examining the conditions

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.



Check data in office

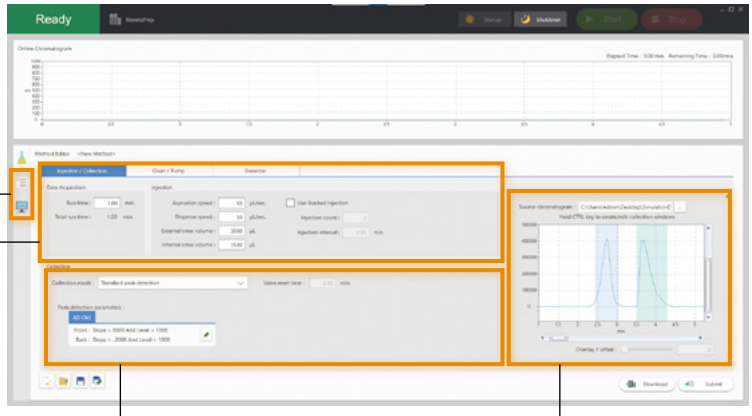
Increased Efficiency from Preparative Analysis Setup to Data Processing

Prep Solution Software to Support the Examination of Preparative Conditions

For preparative LC, in addition to scaling up settings from an analytical system, parameter settings may also need to be adjusted directly for the preparative system.
Prep Solution is dedicated preparative LC and preparative SFC software offering intuitive operation for users involved in preparative purification.

Easy to Understand Even for First-time Users

The parameter settings in Prep Solution are concise and intuitive, so that all users can operate the system with minimal training. This also avoids the risk of wasting samples due to human error.



Tabs to switch windows
Toggle between windows with a single click

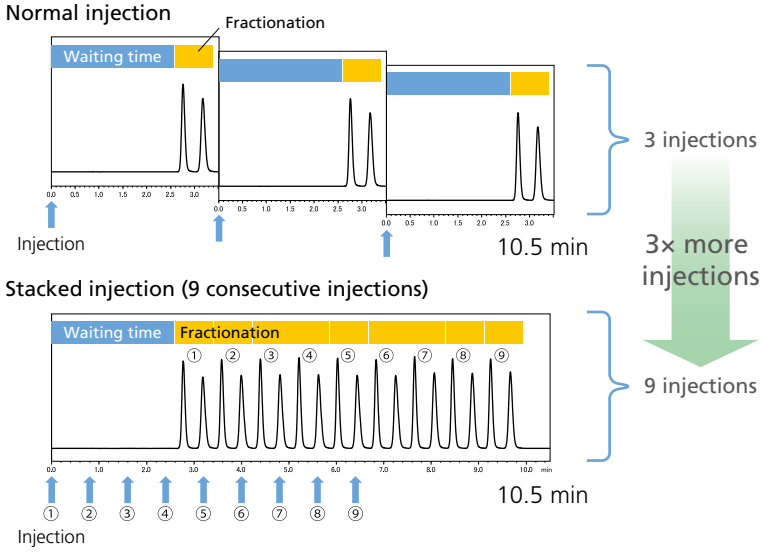
Parameter settings
Input parameters for injection, fractionation, etc.

The fractionation method can be selected from four options (manual fractionation, time fractionation, peak integration fractionation with/without time program) depending on the purpose of the analysis. Using the "peak integration mode", it is possible to assign individual slope and level values for fractionation start and end points, even for tailing peaks or other asymmetrical peaks.

Simulation window
Simulations reflecting various parameter settings can be displayed, or peaks from the window can be selected to apply their parameter settings to a new analysis.

Stacked Injection Function Eliminates Waiting Time[Note]

Normal injection wastes time between peak elutions. Using the stacked injection function, samples can be injected continuously without any waiting time, enabling more samples to be processed. Settings for this function can be specified easily in the dedicated Prep Solution software.



Note: Stacked injection is only available for fraction collection systems configured with a combination of LH-40 and FRC-40 units or a multi-liquid handler.

High Separation via Preparative Recycling

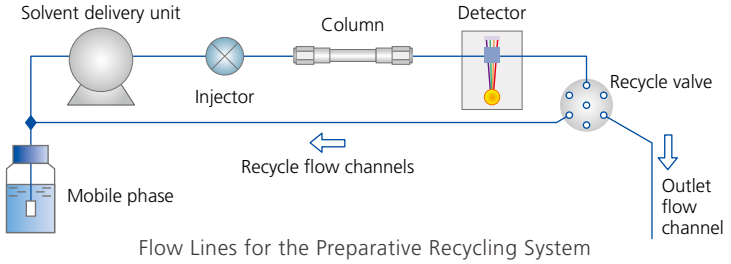
Components Difficult to Separate Can Be Recovered at High Purity Levels and at Low Cost

Preparative Recycling System

What is the Recycling Separation Method?

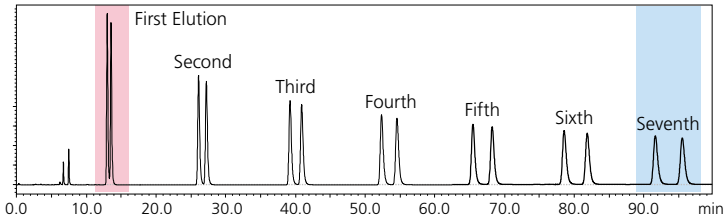
Because long preparative columns are expensive, there is a need to use lower cost short columns.

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 Preparative Recycling System

The figure at right 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

Configuring a Recycling System Suitable for a Purification Scale

To maximize separation performance during recycling separation, it is important to match the system scale to the intended column that will be used. Nexera Prep offers a wide variety of available recycling system configurations optimized for various purification-scale applications.

Analysis Scale Recycling System

Semi-Preparative Scale Recycling System

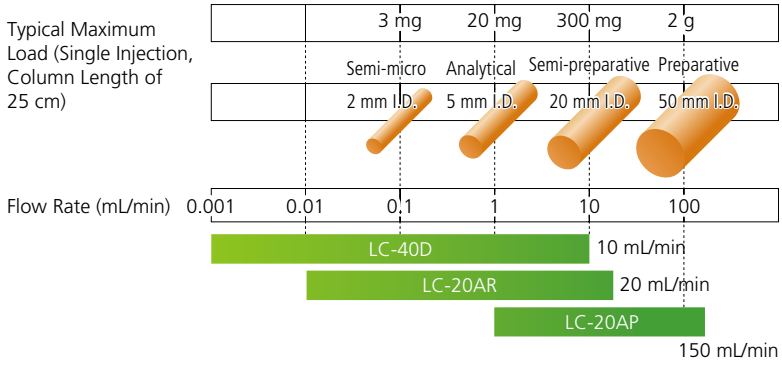
Preparative Scale Recycling System

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 µL	47 µL	250 µL
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) 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 ±1% or ±2 µL/min, whichever is greater (under specified conditions)	No more than ±1% or ±10 µL/min, whichever is greater (0.1 to 5.0 mL/min)	No more than ±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 × H140 × D500 mm, 10 kg	W260 × H140 × D500 mm, 16 kg	W260 × H210 × D500 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 µm, 3 µm, 5 µm) 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.

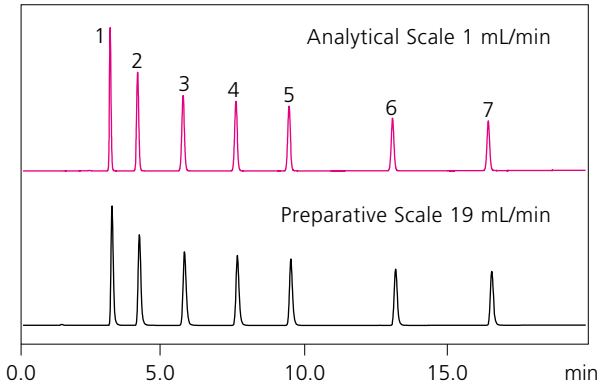
	Reversed Phase				
	C18	HD-C18	C8	Phenyl	PFPP
Functional Group	Trifunctional C18 Generic Purpose Type	Trifunctional C18 High Density Type	Trifunctional C8	Trifunctional Phenylbutyl	Trifunctional Pentafluorophenylpropyl
Particle	Organic Silica Hybrid				
Particle Size	1.9 µm, 3 µm, 5 µm				
Pore Size	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 µm.

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 × 150 mm, 5 µm)
Column: Shim-pack Scepter C18-120 (20 mm × 150 mm, 5 µm)



1: Metylparabene
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

This unit can perform both sample injection and 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 0.05 % 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*3

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

*3 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-40C

Manual Injector

Rheodyne® 7725

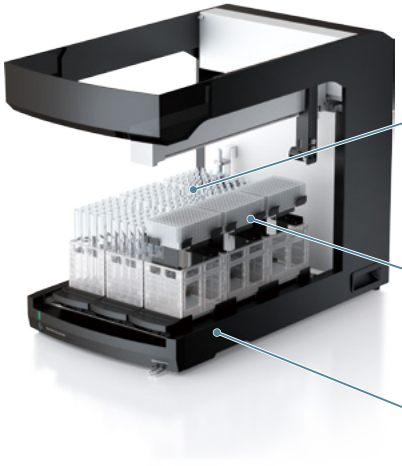
Optional Sample Loops
(Material: SUS)

Specifications

	LH-40	SIL-40/SIL-40C
Maximum Injection Volume	Up to 2 mL Up to 20 mL (Optional available)	Up to 2 mL
Flow Rate	Up to 150 mL/min	Up to 10 mL/min
Cooling Function	None	SIL-40: None SIL-40C: 4 to 45 °C (air temperature controlling system)
Compatible Containers and Quantities	10 mm O.D. test tube 540 pcs; 1.5 mL vial 486 pcs*4 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 15 mm O.D. test tube 252 pcs; 50 mL vial 54 pcs 17, 18 mm O.D. test tube 216 pcs; 250 mL bottle 20 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	288 (using microplates, 96 wells × 3 plates) 1152 (using microplates, 384 wells × 3 plates) 252 (using 1 mL sample vial plates, 84 vials × 3 plates) 162 (using 1.5 mL sample vial plates, 54 vials × 3 plates) 84 (using 4 mL sample vial plates, 28 vials × 3 plates) 36 (using 10 mL sample vial plates, 12 vials × 3 plates) 72 (using 1.5 mL microtube plates, 24 microtubes × 3 plates)
Size and Weight	W 390 × H 690 × D 730 mm, 40 kg W 390 × H 865 × D 730 mm, 53 kg (when an optional hood is attached)	W 260 × H 280 × D 500 mm (With the SIL-40C, the protrusion depth adds 140 mm) SIL-40: 17 kg; SIL-40C: 24 kg

*4 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. The optional exhaust hood (common for LH-40 and FRC-40) can be installed without changing the footprint.

Options

Sample Racks

A variety of containers, including MTPs, vials, and various types of test tubes, can be placed. 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 only in 4 mL vials)
Compatible Containers and Quantities	10 mm O.D. test tube 540 pcs 12 mm O.D. test tube 486 pcs 13 mm O.D. test tube 360 pcs 15 mm O.D. test tube 252 pcs 17, 18 mm O.D. test tube 216 pcs 25 mm O.D. test tube 108 pcs 30, 35 mm O.D. test tube 54 pcs 4.0 mL vial 252 pcs 13 mL vial 108 pcs 50 mL vial 54 pcs 250 mL bottle 20 pcs 500, 1000 mL bottle 12 pcs 96 well MTP/DWP 9 pcs	10 mm O.D. test tube 144 pcs 18 mm O.D. test tube 64 pcs 35 mm O.D. test tube 16 pcs
Size and Weight	W 390 × H 560 × D 730 mm, 30 kg W 390 × H 865 × D 730 mm; 43 kg (when an optional hood is attached)	W 260 × H 280 × D 320 mm, 18.5 kg

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 2 (manual switching valves/manual injectors not allowed)	I.D. 2.1 to 30 mm columns, 2 pc.	W 260 × H 560 × D 500 mm
Column Hub + Column Hub Kit	Automatic switching valves, up to 4 (manual switching valves/manual injectors not allowed)	I.D. 2.1 to 30 mm columns, 6 pc.	
Column Holder	Manual switching valves/manual injectors, up to 4	I.D. 20 to 50 mm columns, 2 pc.	W 250 × H 465 × D 400 mm
Column Holder SLIM	Manual switching valves/manual injectors, up to 5	I.D. 2.1 to 30 mm columns, 1 pc. + I.D. 20 to 50 mm columns, 2 pc.	W 110 × H 625 × D 500 mm

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 fluororesin 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-20AH2 / 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.

FCV-20AH2

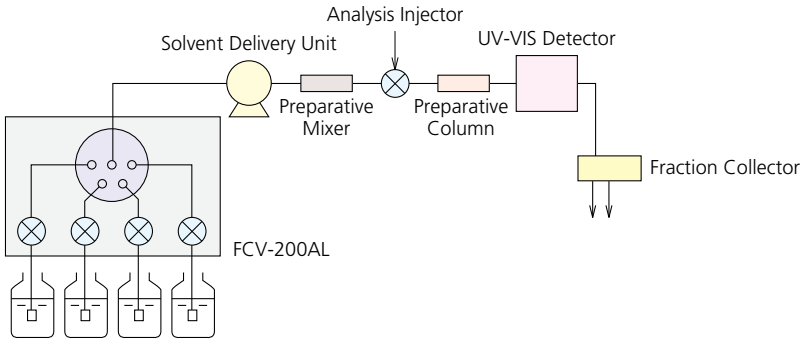
FCV-12AH

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 can provide up to a four-liquid gradient as well as solvent switching, reducing the work involved in mobile phase investigations during method development.

FCV-200AL



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 CBM-20A/20Alite system controller 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 CBM-20A/20Alite system controller and workstation software.

FCV-11AL

FCV-230AL

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*5

LH-40

Up to 84 samples*5

SIL-40C

*5 When 4 mL vials are used.

UV Absorptive

SPD-M40 SPD-40/40V

Non-UV Absorptive

LCMS-2050

RID-20A

ELSD-LT III

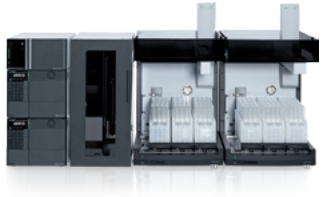
Are there any other requirements?

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*6

LH-40

FRC-40

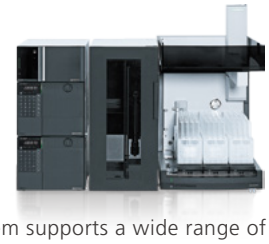
Up to 144 samples*6

FRC-10A

*6 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

Preparative Recycling 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.

Shimadzu Corporation
www.shimadzu.com/an/