

Semi-Preparative Supercritical Fluid Chromatography System

Nexera UC Prep



Unparalleled performance, unparalleled flexibility

The Nexera UC Prep is a new preparative supercritical fluid chromatography system that offers both the high basic performance developed for the previous Nexera UC model and original state-of-the-art preparative SFC technologies.

It resolves a number of issues in preparative tasks, reducing labor and improving efficiency while fitting into pre-existing workflows. Not only does the Nexera UC Prep achieve superior recovery rates for purification, it provides flexible system configurations in a compact design, requiring low installation space and allowing you to maximize lab resources.



Winner of the Pittcon 2019 Editors' Awards Gold Prize

Unique LotusStream separator technology achieves higher recovery rates

Unique gas-liquid separation technology is used to minimize the decrease in recovery rates from eluate scattering during carbon dioxide vaporization, achieving high recovery rates even for volatile compounds.

Simple operation fits seamlessly into preparative workflow

The dedicated software with intuitive preparative settings ensures peaks can be separated reliably by users of all experience levels.

Compact, benchtop design

This space-saving benchtop model includes a carbon dioxide pump that does not require an external chiller (cooling system for the heat source). In addition, one unit can handle a wide range of flow rates, lowering installation costs.

Add fractionation capabilities to the analytical SFC system

By adding a fraction collector to the analytical scale SFC, small volume fractionation is also possible. A complete workflow can be carried out seamlessly on one system, from method development to fractionation.



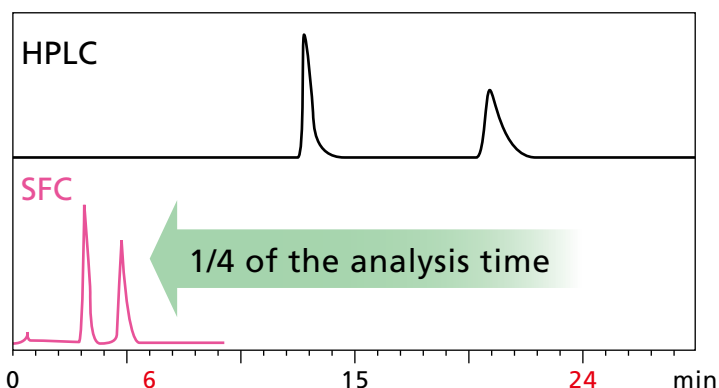
Supercritical fluid: A fluid that has surpassed the critical point, and has the characteristics of both a gas and a liquid such as low viscosity, high diffusivity and high solubility. Carbon dioxide is the most commonly-used supercritical fluid for analysis and preparative tasks.

Unique technology achieves higher recovery rates

In purification using SFC, the target compounds are recovered in high concentrations in an organic solvent, which saves time not only during analysis, but also during post-processing after preparative tasks are complete. The Nexera UC Prep maximizes fractionation output with its high recovery rates and ability to carry out continuous preparative work that further shortens the user's waiting time.

SFC shortens analysis times

Due to the low viscosity and high diffusivity of supercritical carbon dioxide, column pressure for SFC is low even at high flow rates which enables faster analysis without sacrificing column efficiency. This allows significantly shorter analysis times than HPLC.

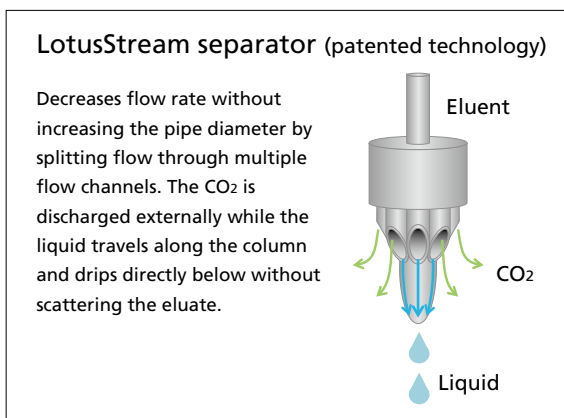


High recovery rates

In preparative SFC, one factor that results in lower recovery rates is increased scattering of the eluant when the CO₂ returns from a supercritical to a gaseous state. The Nexera UC Prep's patented gas-liquid separator, the LotusStream separator, successfully reduces sample scattering and carryover, while also achieving high recovery rates. These high recovery rates can be obtained regardless of flow rate or modifier concentration, even for volatile compounds such as the fragrance linalool.

Comparison for 1% linalool

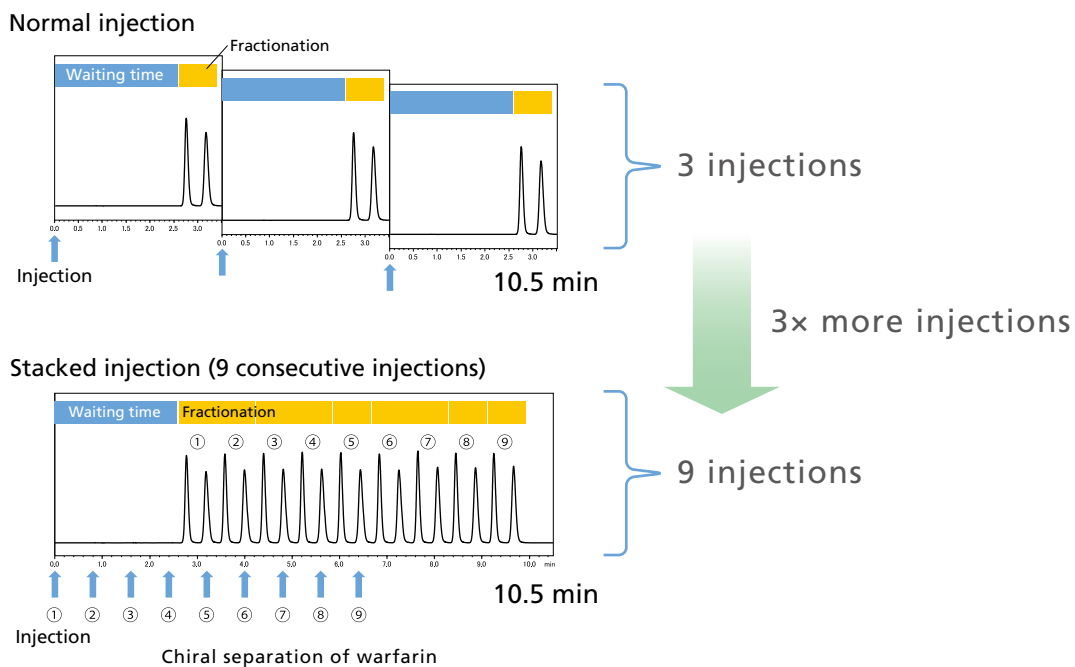
Equipment	Recovery rate
Conventional separator	78.0%
LotusStream Separator	96.7%





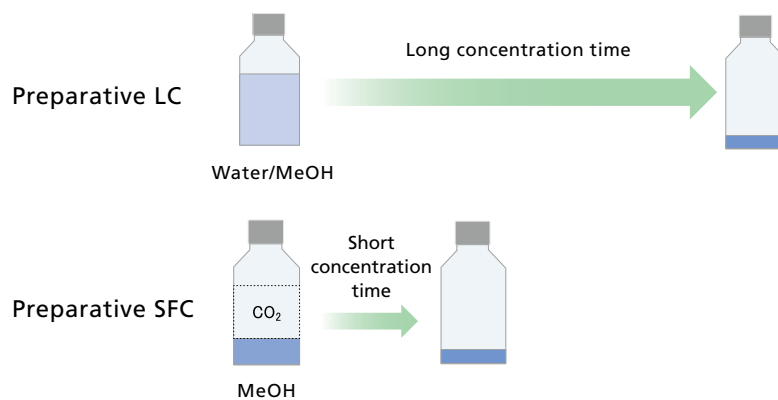
Stacked injection function eliminates waiting time

Normal injection wastes time between peak elutions. Using the Nexera UC Prep's 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 software.



Simple post-processing

Because most of the mobile phase is vaporized supercritical CO₂, only the organic solvent (modifier) added to change the polarity of the mobile phase remains after preparative work. Since there is no water content in the recovery fraction, the concentration time is significantly shorter.



Prep Solution enables a seamless preparative workflow

The dedicated software, Prep Solution, ensures that it is simple to scale up from an analytical to a preparative workflow, and makes it easy to configure parameter settings. It greatly increases the efficiency of preparative workflows.

Easy to understand even for first-time users

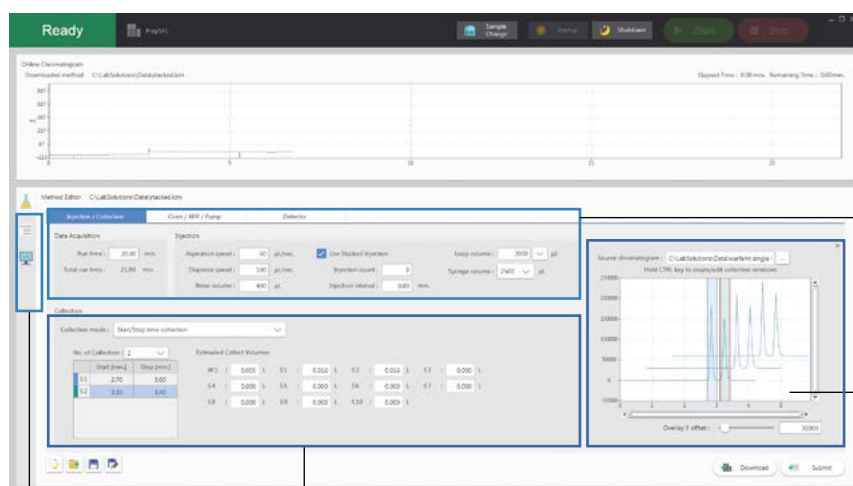
The parameter settings in Prep Solution have been kept as simple and intuitive as possible, so that all users can operate the system without confusion. This also avoids the risk of wasting samples through human error.

1 Single analysis (peak check)

A single analysis prior to fractionation confirms the peak shape and retention time. Analysis can be started by simply inputting basic parameters in the three onscreen tabs.

2 Simulation

The chromatogram obtained from the single analysis can be displayed in the simulation window, so that fraction ranges can be selected by eye using the mouse. These settings can be applied to methods automatically.



Parameter settings
Input parameters for injection, fractionation, etc.

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.

Tabs to switch windows
Toggle between windows with a single click

Stacked Fraction System

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 fractionation", it is possible to assign individual slope and level values for fractionation start and end points, even for tailing peaks or other asymmetrical peaks.

🕒 Easily isolate the target peaks

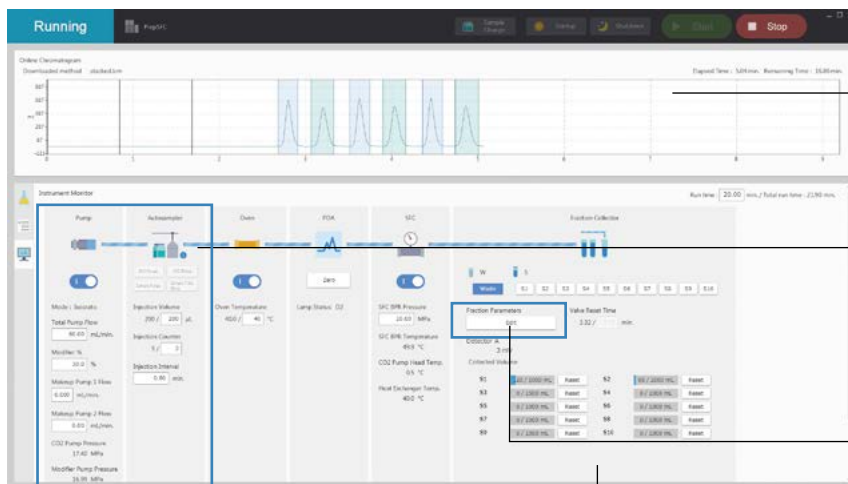
In case of peak shapes that are different from predictions or other unexpected situations, it is possible to change the preparative parameter settings while viewing the chromatogram. This eliminates the time and hassle involved in changing parameters and reanalyzing samples later on, as well as preventing the waste of valuable samples.

3 Fractionation

Samples are fractionated based on the user-selected parameters. The fraction range is displayed on the chromatogram, which can be checked in real time.

4 Adjust parameters during fractionation

Parameter settings for fractionation and injection can be adjusted during stacked injection ("on-the-fly" function).



The fractionation range is displayed on the chromatogram.

Parameters currently being applied to fractionation are displayed here. Settings for modifier concentration and stacked injection parameters (injection volume, number and interval) can be changed whilst viewing the chromatogram.

Fractionation time range and threshold values can be changed mid-analysis. In addition to a fractionation mode for target peaks, there is a mode for fractionation of "waste" intervals between peaks.

Stacked Fraction System

For the Multi-Fraction System, fraction collector racks are displayed here, with different display colors depending on the current status (recovery complete / in progress / not started).

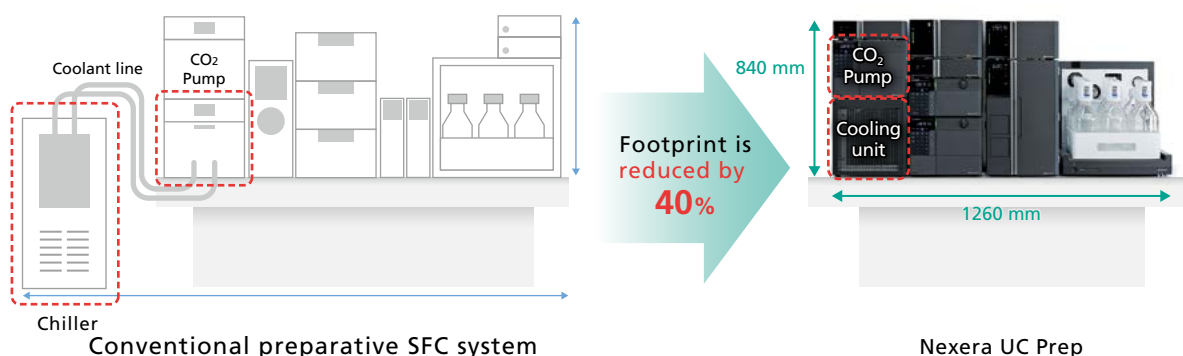


Compact, benchtop design

This space-saving benchtop model includes a carbon dioxide pump that does not require an external chiller (cooling system for the heat source). In addition, one unit can handle a wide range of flow rates, lowering installation costs.

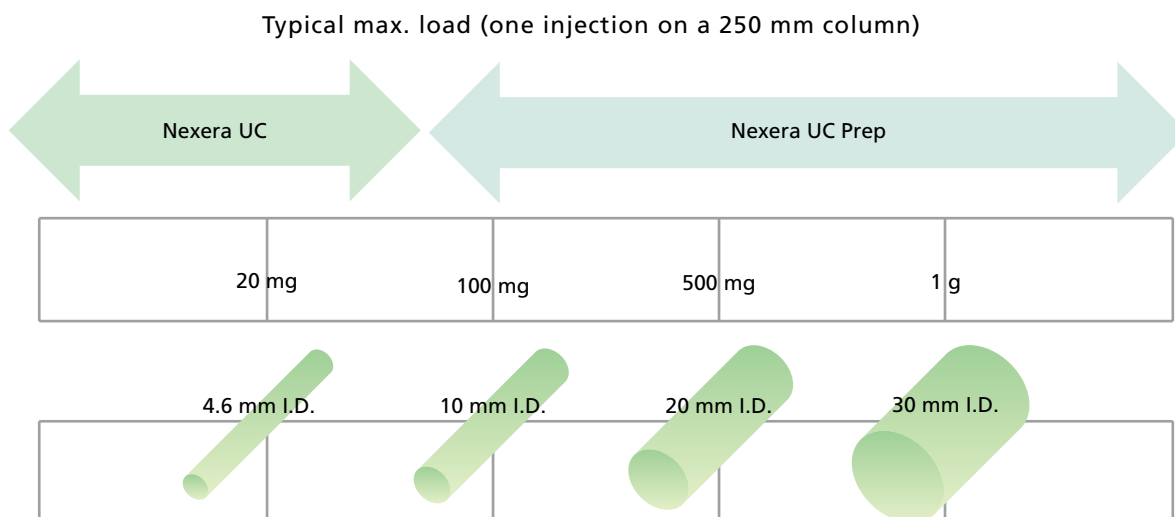
● Benchtop system that can be installed anywhere

Usually a chiller is required to cool the solvent delivery pump when pumping CO₂ at high flow rates. However, the Nexera UC Prep features a compressor-type cooling unit, reducing the size of the system and allowing it to be installed anywhere. Its footprint is equivalent to an analytical scale SFC system.



● Wide range of flow rates available

In a single system, the Nexera UC Prep can handle flow rates from 10–150 mL/min for fractionation of a range of volumes, from a few hundred mg up to a few grams.

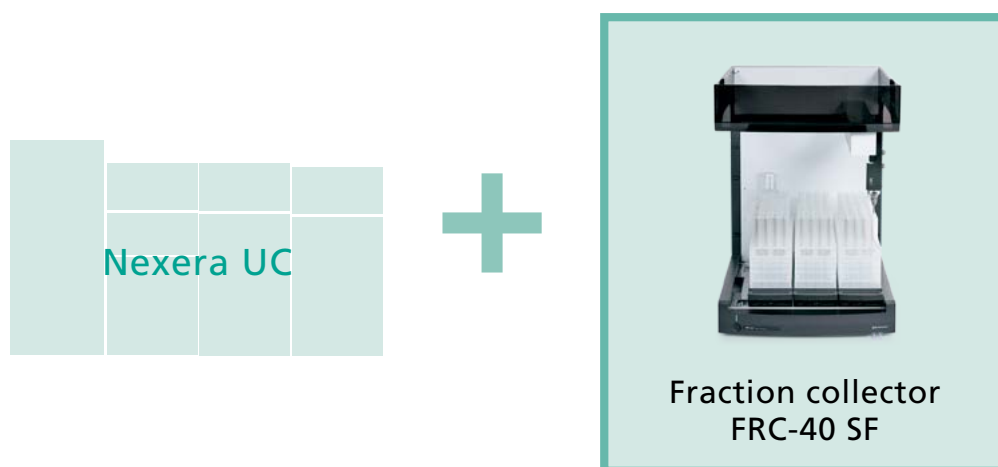


Add fractionation capabilities to the analytical SFC system

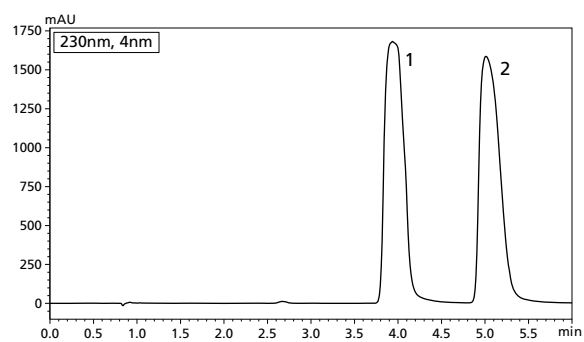
By adding a fraction collector to the analytical scale SFC system, it is possible to upgrade to a small volume preparative system. A complete workflow can be carried out seamlessly on one system, from method development to fractionation.

Upgrade to Analytical Fraction System

By adding a fraction collector to the analytical scale SFC, small volume fractionation is also possible. A complete workflow can be carried out seamlessly on one system, from method development to fractionation.



Shimadzu's unique LotusStream separator allows fractionation of small volumes, such as into 1.5 mL vials, without scattering of the solvent.



Separation of optical isomers of *trans*-stilbene oxide

Peak	Recovery rate
Peak 1	98%
Peak 2	93%

Extensive column lineup opens up analysis options

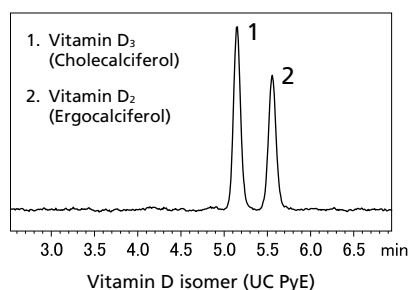
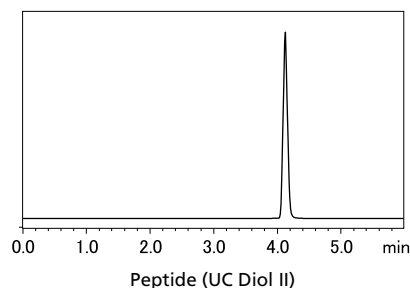
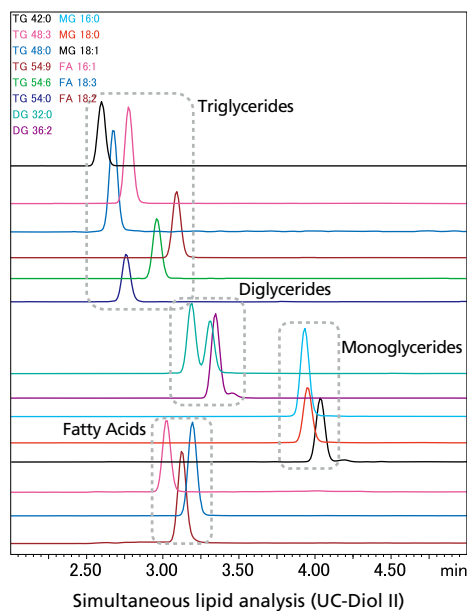
Shim-pack UC series columns are designed specifically for Nexera UC series SFC systems. When using supercritical fluids for analysis, retention behavior can vary significantly depending on the type of stationary phase. To optimize separation, a variety of columns should be used to determine the parameter settings. The extensive choice of column sizes available means that operations can be scaled up seamlessly from analytical SFC to preparative SFC.

	Functional group	4.6 × 250 mm	10 × 250 mm	20 × 250 mm	28 × 250 mm
Shim-pack UC-Diol II	Diol	227-32606-02	227-32606-03	227-32606-04	227-32606-05
Shim-pack UC-Sil II	—	227-32607-02	227-32607-03	227-32607-04	227-32607-05
Shim-pack UC-HyP	3-hydroxyphenyl	227-32600-02	227-32600-03	227-32600-04	227-32600-05
Shim-pack UC-Py	Pyridinyl	227-32601-02	227-32601-03	227-32601-04	227-32601-05
Shim-pack UC-PBr	Pentabromobenzyl	227-32602-02	227-32602-03	227-32602-04	227-32602-05
Shim-pack UC-Choles	Cholesteryl	227-32603-02	227-32603-03	227-32603-04	227-32603-05
Shim-pack UC-PyE	Pyrenylethyl	227-32604-02	227-32604-03	227-32604-04	227-32604-05
Shim-pack UC-Triazole	Triazole	227-32605-02	227-32605-03	227-32605-04	227-32605-05

■ Choosing a column

Since normal phase separation is the main separation mode used for SFC, normal phase UC-Diol II columns are commonly used. UC-Diol II columns can be used for analyzing a wide variety of compounds, from phospholipids to highly-polar peptides. UC-Py columns exhibit similar behavior to ethylpyridine-based columns, and also display very versatile performance.

In addition, UC-HyP columns can uniquely separate lipids by class. Columns with multiple interaction modes can improve separation of isomers or compounds that are difficult to separate by LC. Prime candidates include the UC-Choles, which contains a cholesteryl group, the UC-PyE, with strong π - π interactions, and the UC-PBr, which applies a dispersion force to Br.

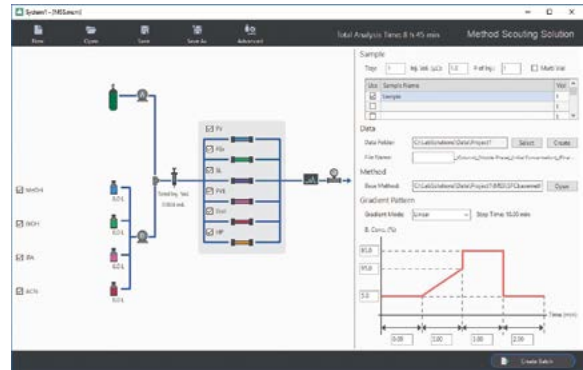


■ Successive analysis without changing the mobile phase

In HPLC analysis, water-based mobile phases are generally used for reverse phase analysis, and non-water based mobile phases for normal phase analysis. However, in SFC analysis a mixture of supercritical carbon dioxide and a modifier (an organic solvent such as methanol) is used as the mobile phase, regardless of the stationary phase. This means the same mobile phase composition can be used for successive analysis with all columns.

Method scouting for optimization of separation conditions and scaling up to preparative size

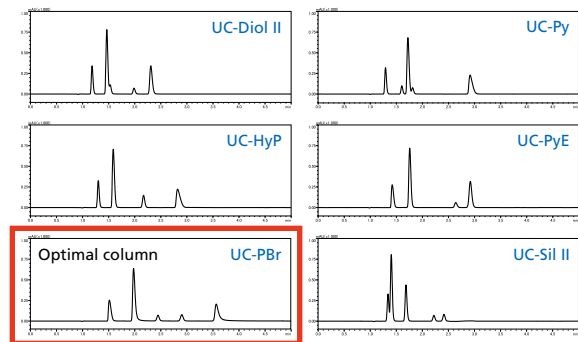
For high-purity isolation, target peaks need to be adequately separated, for which the user must determine optimal column and separation parameter settings (method scouting). The Nexera UC chiral screening system and dedicated Method Scouting Solution software can be used to screen columns more quickly and accurately (Step 1). Once the optimum column has been identified, smoothly scale up to preparative scale flow rates, preserving the peak separation while increasing the mass load (Step 2).



Method Scouting Solution Ver. 2

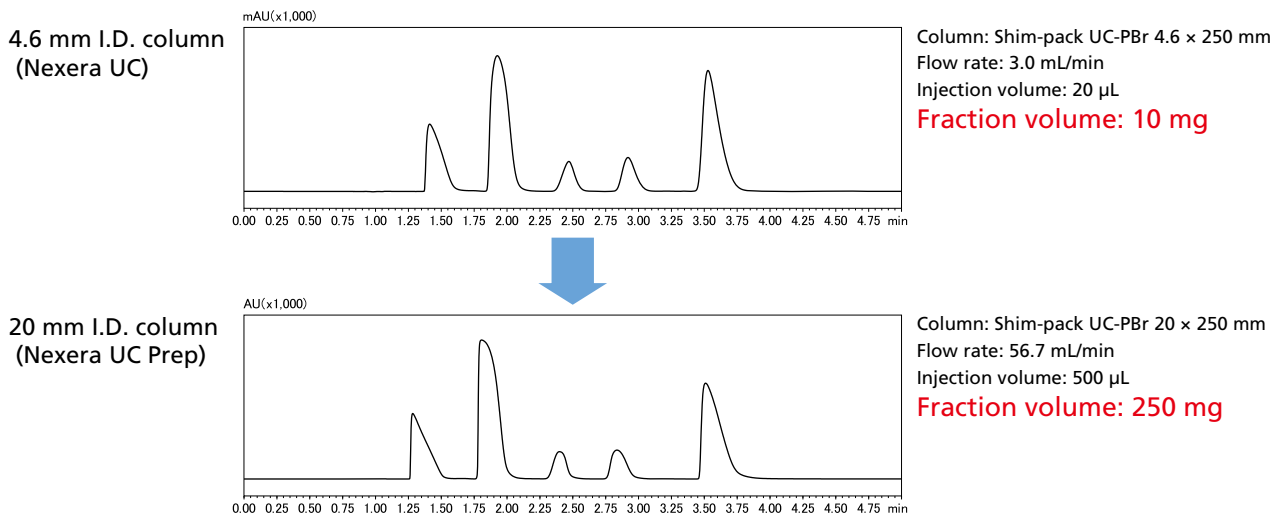
Step 1 Method scouting at analytical scale

Method scouting is easy even for first-time users — simply execute the batch table generated automatically by the dedicated software. The system can automatically switch between different settings to run the scouting process continuously day or night, even for multiple modifiers and columns. Various types of data can be displayed in the data browser and multi-data reports generated with resolution values for all data to assist in evaluating separation conditions.



Step 2 Scaling up

Using a Shim-pack UC series column enables you to increase mass load while maintaining separation performance. The optimal preparative column determined from Step 1 can be used to scale up the column size, flow rate and injection volume based on the desired fraction volumes.



Choose the optimal configuration for your application

☀ Stacked Fraction System: supports injection volumes up to 20 mL for large volume fractionation

This system is optimized for large volume fractionation involving repeated injection of samples which may contain several compounds. The FRS-40 unit includes both injector and fraction collector functionality, so that the same unit can be used for repeated sample injections and gram-level preparative work. It supports injection volumes up to 20 mL* and collection of ten fractions. Compatible with flow rates from 10 to 150 mL/min and 10 to 30 mm I.D. columns.

*optional



☀ Multi-Fraction System: for multiple peak fractionation of impurities and natural products

This system is suitable for preparative tasks involving samples with many peaks detected, such as impurities in pharmaceutical compounds. Volumes of up to 2 mL* can be injected using an autosampler that holds up to 162 samples (using 1.5 mL vials). Three rack types can be selected for the FRC-40 SF fraction collector, which can recover up to 540 fractions (using 10 mL vials). With support for flow rates from 10 to 150 mL/min, columns with an internal diameter from 10 to 30 mm can be used.

*optional



Analytical Fraction System: analysis & small volume fractionation compatibility in one system

This system is intended for analytical scale fractionation only requiring fraction volumes up to a few mg (used to check synthesized compounds). By connecting an FRC-40 SF fraction collector to the Nexera UC system, the system can seamlessly perform everything from analysis to preparative work. With a flow rate range of up to 5 mL/min, analytical scale columns can be used.

Key Features

	Stacked Fraction System	Multi-Fraction System	Analytical Fraction System
Flow rate range	10.0 – 150.0 mL/min		0.0001 – 5.0 mL/min
Supported columns	I.D.: 10–30 mm Length: up to 250 mm		I.D.: 2.0–4.6 mm Length: up to 250 mm
Injection unit	No. of samples processed: 1 Max. injection volume: 2 mL (optional: 20 mL)	No. of samples processed: 252 (with 1 mL sample vial plate) 162 (1.5 mL sample vial plate) 84 (4 mL sample vial plate) 36 (10 mL sample vial plate) 72 (microtube plate) 288 (96-well microplate) 1,152 (384-well microplate) Max. injection volume: 500 µL (optional: 2 mL)	No. of samples processed: 175 (with 1-mL sample vial plate) 105 (1.5-mL sample vial plate) 50 (4-mL sample vial plate) 192 (96-well microplate) 768 (384-well microplate) 192 (96-well deep-well plate) 768 (384-well deep-well plate) Max. injection volume: 5 µL (optional: 20 µL)
Recovery	Supported containers: Bottles (screw-top: GL45) Quantity: 1000 mL x 10, 2000 mL x 5 Recovery method: Valve switching (10 collection + 1 waste or 5 collection + 5 waste)	Supported containers: Test tubes Quantity: 540 10-mL, 20 250-mL, or 12 500-mL test tubes Test tube I.D.: From 10 mm Recovery method: Arm action	
Volume recovered per analysis (approx.)	Up to 1 g (for 30 mm I.D. column)		Up to 20 mg (for 4.6 mm I.D. column)
Sample temperature control range	No temperature control	4–45°C	4–40°C
Support functions	Dedicated preparative software, stacked injection, parameter changing during analysis		Dedicated preparative software, parameter changing during analysis

Compatible with multiple detectors (max. 4 channels)

If only the UV signal is used as a trigger in the preparative workflow, compounds with low UV absorption are difficult to fractionate and there is also a risk of accidentally fractionating unseparated compounds in the same detection channel. By using the MS signal as the trigger, high-purity fractions can be recovered simply by specifying the *m/z* value of the target compounds.

Specifications Semi-Preparative SFC System Nexera UC Prep Dedicated Units

LC-40P SF solvent delivery unit for semi-preparative SFC system

CO₂ cooling unit for semi-preparative SFC system



Solvent delivery unit

Pump type		Parallel double-plunger reciprocating
Solvent delivery method		Constant flowrate delivery
Constant flow rate delivery	Flowrate setting range	10.0 to 150.0 mL/min
	Max. solvent delivery pressure	44 MPa (10.00 to 100.00 mL/min) 33 MPa (100.01 to 150.00 mL/min)
	Flowrate accuracy	±2 % (water at 30 mL/min and 10 MPa)
	Flowrate precision	Max. 0.2 % RSD or 0.04 min SD, whichever is greater
Pump head	Cooling method	Refrigerant recirculation (using 60 % aqueous ethylene glycol solution)
	Temperature accuracy	±2°C
	Temperature precision	2°C
Pressure limiter function		Upper/lower limit values
Line filter		2 µm
Time Programs		Ten flowrate, event, and loop (repeats program) files with total of 320 steps
Pressure display accuracy		Within ±2 % or ±1 MPa, whichever is greater
Plunger rinse flow channels		Automatic rinsing kit included standard
Operating temperature/Humidity range		4 to 32°C and 20 to 85 % RH
Dimensions		W 260 × D 600 × H 210 mm, excluding protrusions
Weight		28 kg
Power supply		100 to 240 V AC, 400 VA, 50/60 Hz

Cooling unit

Cooling method	Compressor-type recirculation
Refrigerant	R407C
Operating temperature/Humidity range	4 to 32°C and 20 to 85 % RH
Dimensions	W 260 × D 600 × H 280 mm, excluding protrusions
Weight	39 kg
Power supply	100 to 240 V AC, 900 VA, 50/60 Hz

SFC-40P back-pressure regulator for semi-preparative SFC system



Pressure setting range	1 MPa – 40 MPa (0.01MPa step)
Pressure control precision	0.3 MPa (100% CO ₂)
Pressure capacity	40 MPa
Temperature control range	0 to 70°C (1°C steps)
Operating temperature/Humidity range	4 to 32°C and 20 to 85 % RH
Dimensions	W 260 × D 500 × H 140 mm, excluding protrusions
Weight	17 kg
Power supply	100 to 240 V AC, 900 VA, 50/60 Hz

HEX-40 mobile phase temperature control unit for semi-preparative SFC system



Max. pressure capacity	44 MPa (10.00 – 100.00 mL/min) 33 MPa (100.01 – 150.00 mL/min)
Temperature setting range	20 to 70°C (1°C steps)
Operating temperature/Humidity range	4 to 32°C and 20 to 85 % RH
Dimensions	W 260 × D 500 × H 70 mm, excluding protrusions
Weight	8 kg
Power supply	100 to 240 V AC, 600 VA, 50/60 Hz

For Stacked Fraction System

FRS-40 injection and recovery unit



Sample injection as well as fraction recovery

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

Supports a wide range of injection volumes

Switch easily between different sample loops and syringes to change the injection volume.

Two fractionation modes available

Choose either a mode for dealing with up to 10 fractions or one for 5 fractions and recovery between all peaks.

Max. pressure capacity	Injection system: 44 MPa Recovery system: 8 MPa
Number of samples	1
Number of fractions	10 max.
Injection method	Loop injection
Injection volume range	0.01 – 2 mL
Area reproducibility	RSD ≤3 % (for 1 mL injection)
Injection volume accuracy	Within ±3 % (for ten 1 mL injections)
Operating temperature/Humidity range	4 to 32°C and 20 to 85 % RH
Dimensions	W 390 × D 680 × H 410 mm, excluding protrusions
Weight	39 kg
Power supply	100 to 240 V AC, 150 VA, 50/60 Hz

For Multi-Fraction System

FRC-40 SF fraction collector



Holds up to 540 test tubes

Supports not only 96-well MTPs and a variety of test tubes, but also flasks and other large containers suitable for large-scale preparative works for processing liters of samples.

Compatible with a variety of containers

Various racks can be used to reduce labor in transferring containers e.g. different capacities can be chosen based on the fraction volumes or the post-fractionation processing steps.



Space-Saving Design

Even with its small installation footprint, the unit can hold up to nine standard MTP sample vial racks or test tube racks, which contributes to using laboratory space more effectively.

Fraction vials	MTP/DWP 96-well 4.0 mL vials 10, 12, 16, 18, 25, or 35 mm diameter test tubes 250, 500, or 1,000 mL bottles
Operating temperature/Humidity range	4 to 35°C and 20 to 85 % RH
Dimensions	W 390 × D 680 × H 560 mm, excluding protrusions
Weight	30 kg
Power supply	100 to 240 V AC, 100 VA, 50/60 Hz

Optional parts

Additional items are available as options based on the requirements of the preparative method.

A/D conversion board kit for multiple detection triggers (P/N:228-5519-41)

This kit is required for preparative processes using multiple detection triggers.
Install additional hardware based on the number of detection trigger channels required.

Syringe Unit

This is a syringe unit for the SIL-40. It is compatible with injections up to 2 mL.



High-pressure flow channel switching valve

FCV-20AH₂ (P/N: 228-45025-41)

FCV-12AH (P/N: 228-45013-57)

The valve position is controlled based on the event input signal.
Max. operating pressure: 34.3 MPa
Operating pH range: pH 1 to 10
Operating temperature range: 4 to 35 °C



FCV-20AH₂



FCV-12AH

Reservoir switching valve

FCV-11AL (P/N: 228-45048-58)

FCV-11ALS (P/N: 228-45049-58)

FCV-230AL (P/N: 228-45163-58)

Switches between solvents using a solenoid valve. The FCV-11AL can switch between two solvents for up to three solvent delivery units (LC-20AT/20AR) or the FCV-11ALS for one solvent delivery unit. The FCV-230AL can switch between two solvents (or optionally four solvents) for one solvent delivery unit (LC-20AR/20AP)



FCV-11AL



FCV-230AL

Sample rack

The sample rack can hold a wide variety of containers, such as MTPs, various sample vials, or various test tubes. Six colors are available, so a separate color can be assigned to each user to avoid confusing samples.



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