Analytical SFC System

SFC-4000 Series

Performance
Innovation
Reliability

The SFC-4000 Analytical SFC System provides flexible configurations for any type of separation. The SFC-4000 can be set-up for use as a single column/single detector system or as a multi-column/multi-detector system for rapid method development. ChromNAV is an easy to use data system with a user-friendly interface and comprehensive automated data analysis. The ChromNAV Method Scouting add-in program is used for fast column and solvent screening.

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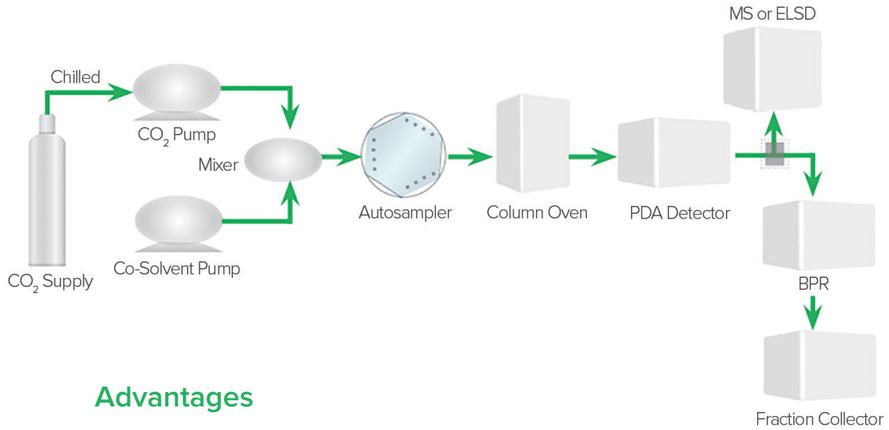
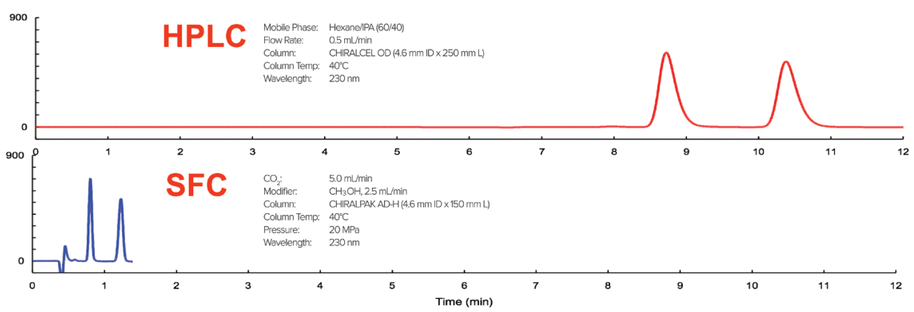
SFC Advantage

Supercritical Fluid Chromatography requires a supercritical fluid (most commonly CO_2) as the primary component of the mobile phase. The intrinsic characteristics of low viscosity and high diffusivity of supercritical CO_2 makes SFC faster and more efficient than traditional HPLC. SFC achieves faster flow rates with shorter analysis times without the requirement for higher pressures like UHPLC. As in reverse phase HPLC, an alcoholic co-solvent or modifier can be combined with the CO_2 to increase the solvation strength and can be used isocratically or as a gradient. The components in a SFC system are the same that can be found in any HPLC system, with the addition of a high pressure flow cell for the detector and a back pressure regulator (BPR). The BPR applies a carefully controlled pressure to the outlet of the column to maintain accurate supercritical conditions, and is an integral part of the performance of the system.

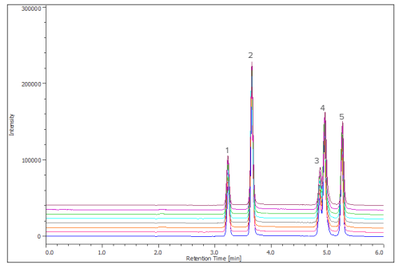


Advantages

1. Faster analysis times
2. Higher selectivity with longer and smaller particle columns
3. Reduction in total solvent consumption
4. More environmentally-friendly solvents
   a. CO_2 replaces hexane or heptane
   b. Alcohols typically used as co-solvents
5. Longer column lifetimes
6. Orthogonal to HPLC methods
7. Easy removal of mobile phase after preparative fractionation
8. Reduction in waste disposal

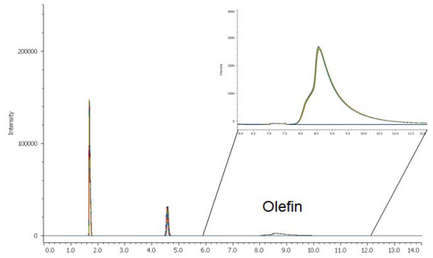


Performance

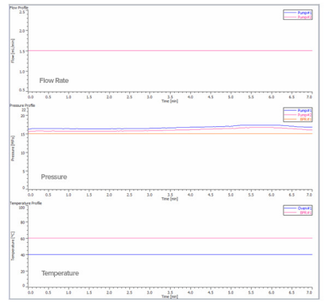


	Peak 1	Peak 2	Peak 3	Peak 4	Peak 5
% RSD	0.09	0.07	0.09	0.1	0.1

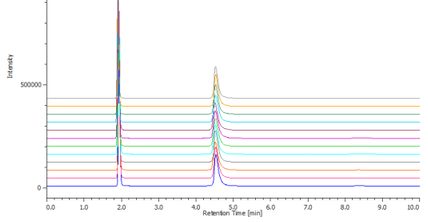
Excellent isocratic and gradient retention time reproducibility ≤ 0.1% RSD



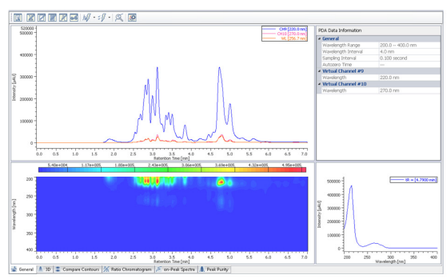
Injection reproducibility ≤ 0.5% RSD (20 overlaid injections)



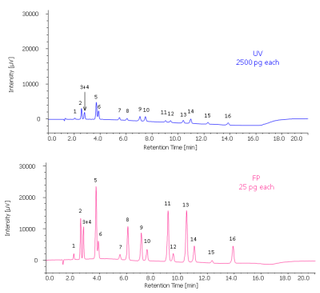
Extremely stable and accurate flow control and back pressure



Outstanding reliability for worry-free operation injection after injection



PDA provides all wavelengths, peak purity, spectra searching and 3D plots



World's first and only FP detector for SFC providing sensitivity up to 2-3 orders of magnitude higher than UV

SFC

The CO_2 pump includes peltier cooling (with pump-head temperature monitoring) to control the density of the mobile phase for accurate CO_2 flow with excellent retention time reproducibility.

Automatic, shut-off valves close the CO_2 inlet and outlet (and co-solvent pump) to isolate the pumps for quick and simple priming when flow is not pumping.

- The autosampler has a sample capacity of up to 180 – 2mL samples with both full-loop and variable-loop injection up to 100µL. For increasing throughput, towards the end of the current separation, the next sample is pre-loaded into the loop to eliminate the loading time between injections.
- A variety of column ovens are available for single or multiple columns with options for built-in column selection valves to ensure temperature equilibration for both columns and valves to minimize band broadening in the peaks.
- The patented back pressure regulator has unmatched pressure regulation precision and accuracy with an extremely low noise baseline and excellent retention time reproducibility.

Detectors

UV-4070/4075
UV-Visible Detector
Wavelength ranges:
UV-4070: 190-900nm
UV-4075: 190-600nm

MD-4010/4015/4017
PDA Detector
Wavelength ranges:
MD-4010: 190-900nm
MD-4015: 200-600nm
MD-4017: 200-400nm

CD-4095
Circular Dichroism Detector
Wavelength range:
220-460nm

FP-4020/4025
Fluorescence Detector
Wavelength range:
200-700nm
(200-900nm optional)

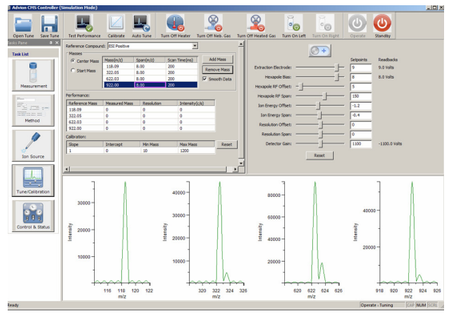
SFC-MS

The SFC-4000-MS combines all of the advantages of SFC with the selectivity and sensitivity of a mass spectrometer.

- The CMS single quadrapole mass-spectrometer is a perfect complement to SFC. As CO_2 passes out from the BPR it depressurizes and expands to a gas at a rate of 1:500, which assists with the nebulization at the ion source.
- Multiple source options include; ESI, APCI and ASAP, with positive/negative ion mode switching for the high range detection of M/Z up to 2000 AMU.
- The ChromNAV-MS add-in program includes full control and acquisition of the CMS, with auto-calibration and auto-tuning for easy optimization.

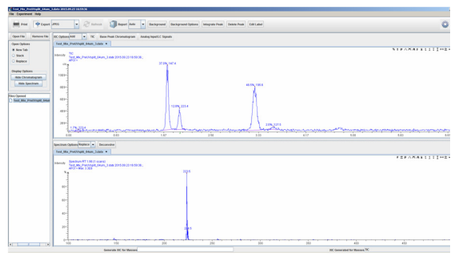
Control

Auto-Tuning and Performance Checks can be made easily and routinely.

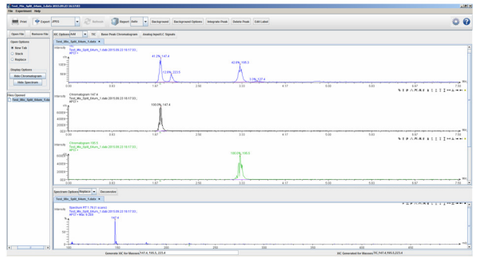


Data

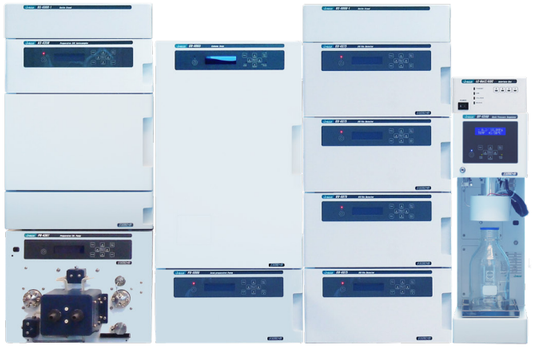
ChromNAV-MS system control with convenient access to all MS data.



Explore the MS spectra, and extract ion chromatograms with just a few clicks.

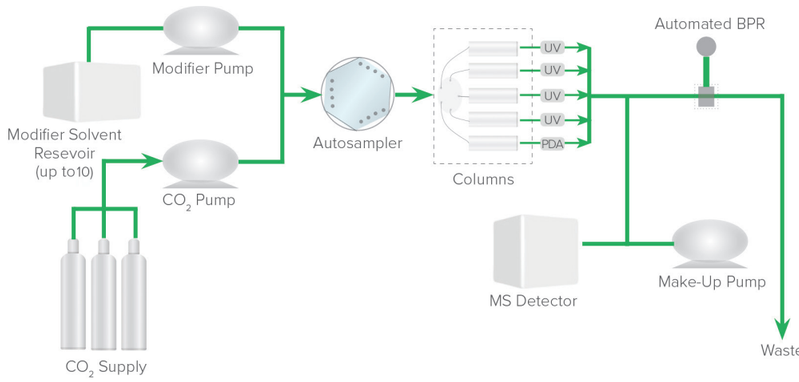


Parallel SFC



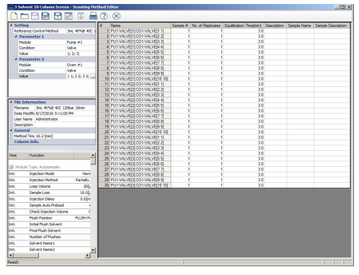
The Parallel SFC provides the highest throughput in column and solvent screening for chiral and achiral compounds.

- The system provides simultaneous elution on 4 or 5 columns for up to 5 times the throughput of traditional SFC.
- Up to 10 columns and 10 solvents will cover a wide range of column-solvent combinations to achieve the best pair.
- Single column-solvent optimization is then performed to obtain the best separation for scaling up to preparative purification.



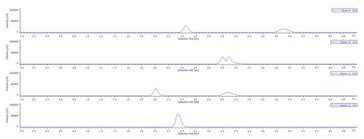
Control

ChromNAV-MS system control with The screening sequence of up to 10 columns and 10 solvents can be setup in just a few clicks.

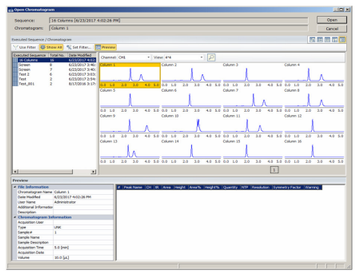


Data

The simultaneous elution view provides live evaluation of the separation.



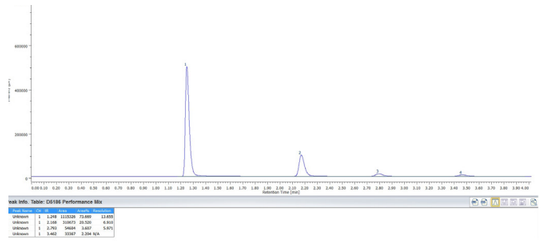
The screening results previewer allows for quick determination of the best column-solvent combination.



ChromNAV Software

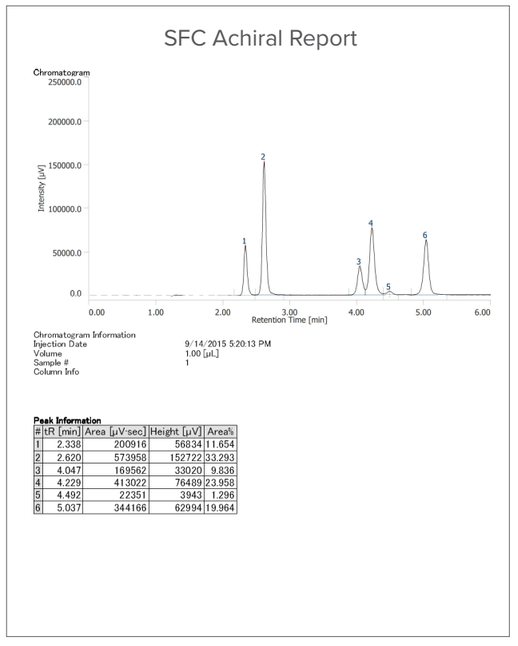
Instrument Control

ChromNAV uses methods and sequences for quick and easy set-up of sample analysis. The autosampler sample pre-load feature eliminates the sample loading time between injections further increasing throughput of the system. The sequence includes peak integration, peak table, calibration and fully customizable reports for complete automation from sample analysis to report printing. Each component in the system is subject to performance monitoring and the information is recorded with the acquired data file together with the method for a complete history of operation.

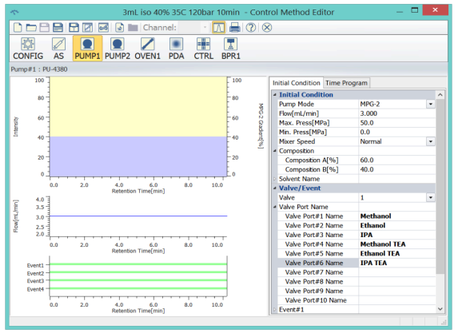


Data Acquisition

Chromatograms can be monitored and acquired simultaneously from multiple detectors including; UV-visible, 3D PDA, fluorescence, CD, SIM, XIC, TIC and mass spectrum. The mass spectrum can also be analyzed after acquisition to identify unknown peaks. ChromNAV has many features for data analysis and processing, both automatically during the run and extensively post run. Raw data and peak calculation results can be exported automatically in several formats including CSV (for Microsoft Excel).

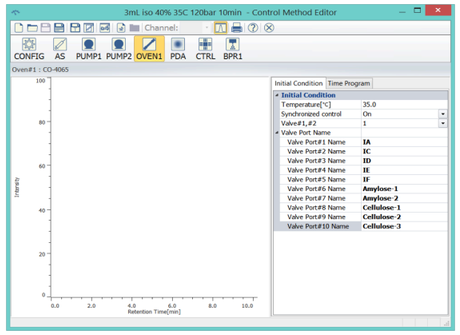


Method Development



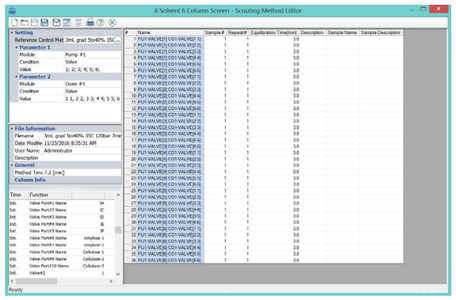
Solvent Selection

Solvent selection valve, built into the co-solvent pump (Options 1, 6 or 10). Solvents can be named in the method and are saved with the data.



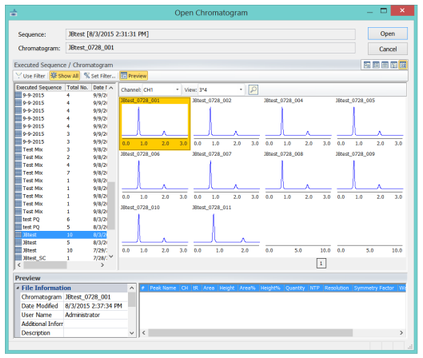
Column Selection

Column selection valve, built into the column ovens (Options 1, 6 or 10). Columns can be named in the method and are saved with the data.



Method Scouting

The method scouting module includes a workflow for building a simple sequence to screen up to 10 solvents and 10 columns without having to develop a method for each separation. At the end of a method scouting the optimal separation can be selected and a method is created ready for use.



Chromatogram Selection

Up to 48 chromatograms can be previewed and compared together in a single view to identify and select the optimal combination of solvent and column for the separation.

Specifications

SFC System		
Pump	CO_2 Flow rate	0.5 - 10mL/min
	Co-Solvent Flow Rate	0.5 - 10mL/min
	Flow Rate Accuracy	±1% or ± 2µl/min
	Flow Rate Precision	0.05% RSD
	Solvent Selection	10 solvents
Autosampler	Injection Volume Range	0.1 - 100 µL
	Number of Samples	up to 180 (2mL vials)
	Injection Accuracy	± 0.1% or less
	Injection Precision	0.25% RSD or less
	Carryover	0.01% or less
	Optional Autosampler Rack Temperature Control	4 - 40°C
Column Oven	Column Temperature Range	Ambient -15°C - 90°C
	Column Selection	up to at least 10 columns
Back Pressure Regulator	Maximum Pressure	500 bar
	Pressure Display Accuracy	±5% or ±10 bar
	Pressure Stability	±2% or ±2 bar

UV-Visible and Circular Dichroism	UV-4070	UV-4075	CD-4095
Wavelength Range	190 - 900 nm	190 - 600 nm	220 - 460 nm
Noise Level	± 0.2 x 10^{-5} AU (at specified conditions)		0.04 mdeg (at specified conditions)
Drift	± 1 x 10^{-4} AU/h (at specified conditions) At constant room temperature		0.1 mdeg/h (at specified conditions) At constant room temperature
Data Output	100 Hz		
Flow Cell	Temperature controlled, tapered, path length 10 mm		Tapered cell, path length 20 mm

Photo Diode Array	MD-4010	MD-4015	MD-4017
Wavelength Range	190 - 900 nm	200 - 600 nm	200 - 400 nm
PDA Elements	1024 ch	512 ch	
Slit Width	1, 4, 8 nm	4 nm	
Data Acquisition Rate	100 spectra/sec		20 spectra/sec
Flow Cell	Path length 10 mm		

Fluorescence	FP-4020	FP-4025
Light Source	Xenon short arc lamp	
Wavelength Range	200 - 700 nm, Option up to 900nm	
Sensitivity	Raman peak of water S/N > 2300	Raman peak of water S/N > 1400
Data Output	100 Hz	
Temperature Control	OFF, ambient -10°C - 40°C	-

Mass Spectrometer	CMS-S	CMS-L
Ion Source	ESI, APCI & ASAP	
Mass Range	Up to 1200 m/z	Up to 2000 m/z
Polarity	Positive and Negative switching in same analysis	
Sensitivity	100pg reserpine (FIA – 5µL injection at 100µL/min S/N 100:1 (RMS) with SIM	
Acquisition Rate	10,000 m/z units/sec	
Accuracy	0.1 m/z units	
Stability	0.1 m/z over a 12 hour period (18-24°C operating temperature)	

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CE

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