C196-E061T

SHIMADZU
Excellence in Science

High-Performance Liquid Chromatograph

Prominence

High Performance Liquid Chromatograph

Prominence

How HPLC Should Be

High-performance liquid chromatography (HPLC) is widely used in diverse fields such as pharmaceuticals, and biochemistry to chemistry, the environment, and food products.
The Shimadzu Prominence high-performance liquid chromatograph achieves an exceptional level of performance in each of these fields.
Prominence HPLC offers exceptional reliability and great expandability to support diverse applications from ultra-fast liquid chromatography to preparative LC, gel permeation chromatography (GPC), ion chromatography, and LC/MS.

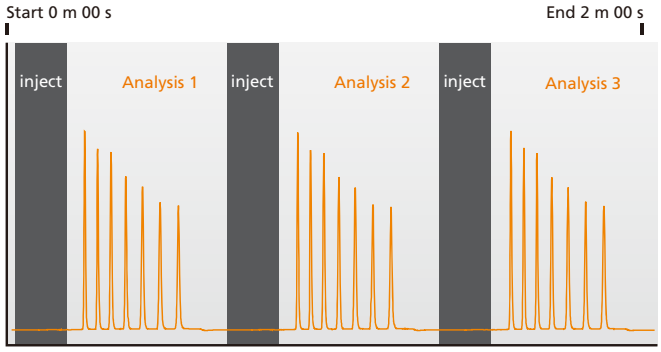

CBM-20A
DGU-20A
LC-20AD
SPD-20A
SIL-20AC
CTO-20AC

Superb Performance and Expandability

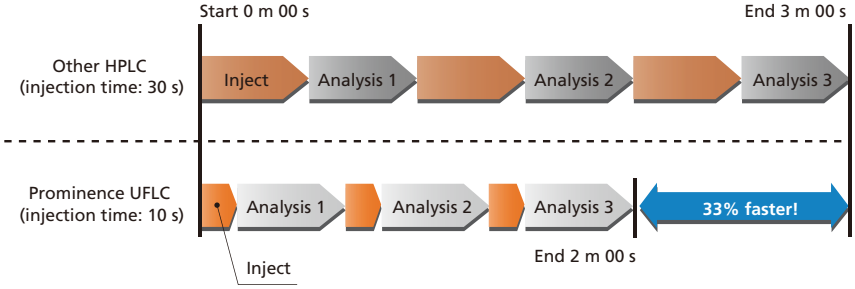
Genuine High Throughput

Reduced total analysis time

The SIL-20A Series autosamplers achieve unparalleled speed, with a sample injection movement of just 10 seconds. Prominence reduces the total analysis cycle time, not simply the time for the HPLC analysis itself. The optional rack changer permits the serial analysis of up to 4,068 samples.
Prominence is an HPLC system that offers genuine high throughput.



Ultra-fast analysis of 7 components in 30-second cycles

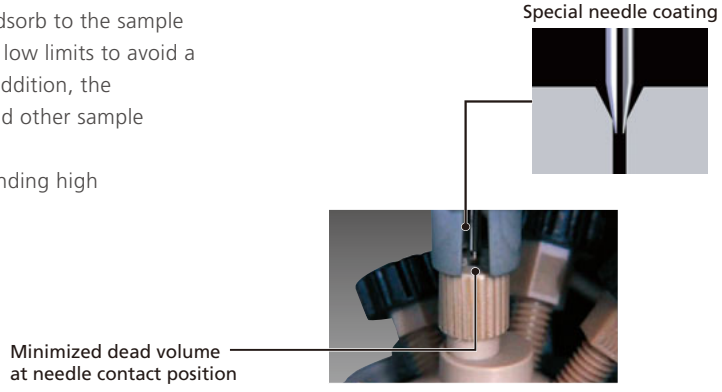


Comparison of total analysis times for 3 analyses by UFLC.
* Example using 30 sec analysis time for each analysis

Extremely Low Sample Carryover

Resolves a major problem with high-sensitivity analyses

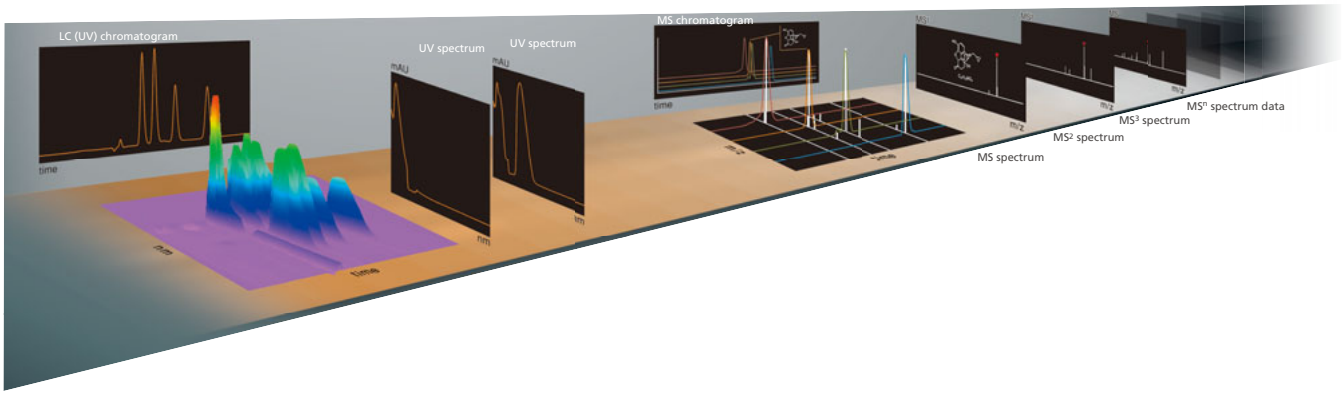
Basic compounds and hydrophobic compounds readily adsorb to the sample path. Prominence restricts sample carryover to extremely low limits to avoid a variety of problems that such compounds can cause. In addition, the multi-rinse mode achieves optimal rinsing for proteins and other sample components that are difficult to wash away.
Prominence offers the optimal system for analyses demanding high sensitivity, such as impurity analysis and LC/MS.



Hardware Expandability

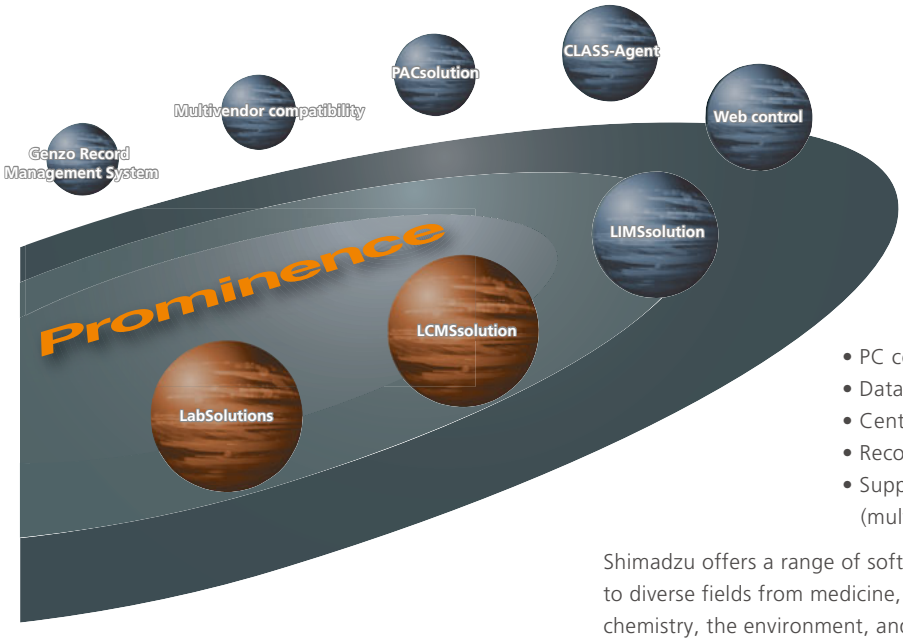
Flexibly accommodates customer needs from ultra-fast analysis to dedicated analysis systems

Prominence allows configuration of the optimal analysis system for any application.
The conventional HPLC is the typical system, and features simple operation.
The UFLC system achieves a high level of separation at ultra-high speeds. The UFLC system and the LC/MS system maintain this ultra-high speed but offer higher separation performance.
This great expandability allows Prominence to meet the challenges of new applications.



Software Expandability

Apply the Prominence's excellent basic performance to a variety of fields



- PC control and data acquisition
- Data acquisition by Chromatopac and PC
- Central control of analytical instruments data
- Record management and LIMS
- Support for other vendors' software (multivendor compatibility)

Shimadzu offers a range of software environments to apply Prominence to diverse fields from medicine, pharmaceuticals, and biochemistry to chemistry, the environment, and food products.

Solvent Delivery Units

LC-20AD

Superior Solvent Delivery Performance

The LC-20AD offers the fastest solvent delivery performance in the world. With an automatic pulsation-correction mechanism and high-speed micro plunger driving, it achieves pulse-free solvent delivery. Thanks to improvements in solvent-delivery control firmware, solvent-delivery performance in the micro-flow-rate range below 50 µL/min has been significantly improved.

LC-20AB

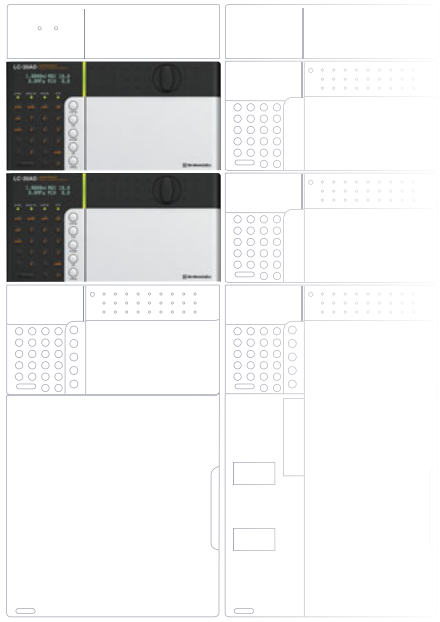
Binary Solvent Delivery Unit

The LC-20AB is a binary, high-pressure gradient solvent delivery unit that incorporates two sets of LC-20AD systems. Its space-saving design can be used to create a two-solvent high-pressure gradient.

LC-20AT

Superior Maintainability

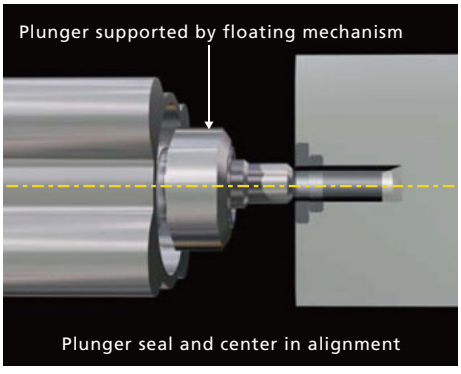
The LC-20AT possesses a high level of maintainability while delivering high performance. The ability to remove bubbles has been improved by modifying the pump-head structure and the flow line.



Low-Pressure Gradient Unit

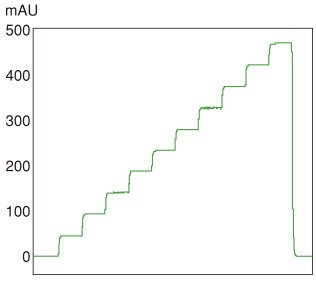
The optional low-pressure gradient unit can be incorporated in the LC-20AD/20AT, enabling gradient elution in a compact space with a small void volume. Automatic matching adjustment of the solenoid valve and pump gives concentration accuracies of ±1.0%.

A new type of plunger made with a technique that reflects consideration of the material structure and a precise plunger-holding mechanism help to increase the service life of plunger seals and enable stable solvent delivery over long periods.



Accurate Gradient Solvent Delivery

By harmonizing two solvent delivery systems, the LC-20AB delivers solvent with an accurate concentration across a wide range from the micro flow rate region to the conventional flow rate region.



Set value (%)	Measured value (%)
10	9.98
20	20.05
30	30.09
40	40.03
50	50.03
60	60.02
70	70.01
80	80.00
90	90.05

Continued Improvements to Solvent Delivery Specifications

The flow rate accuracy and precision in the micro flow rate region have been improved thanks to the adoption of a new type of check valve and modifications to the solvent-delivery control method. Nonpolar organic solvents, such as hexane, can be delivered stably.

Flow-Rate Accuracy

Set value (mL/min)	Measured value, n=6 (mL/min)
0.010	0.010
0.050	0.050
0.200	0.201
1.000	1.000

Flow-Rate Precision

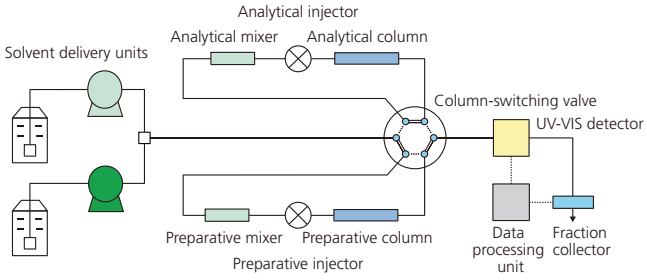
Set value (mL/min)	Flow-rate reproducibility, n=6 (RSD%)
0.010	0.49
0.050	0.08
0.200	0.08
1.000	0.01

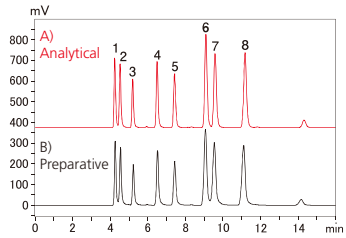
LC-20AP

Supporting Analytical and Preparative Scales

The high solvent delivery performance of the LC-20AP permits an accurate and efficient environment for scaling up, in both the preparative and analytical flow rate ranges. The Prominence preparative system supports both analysis and fractionation (including gradient analysis and fractionation), which permits efficient scaling up with a single instrument and single operating environment. Combining the LC-20AP with a dedicated FCV-200AL low-pressure gradient unit allows gradient fractionation to be performed in a single unit, thereby saving equipment costs.

Single System Supports Parameter Investigation and Scaling Up





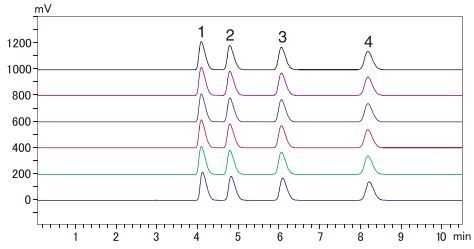
1: Benzoic acid
2: 2-naphthol
3: Benzene
4: Naphthalene
5: Biphenyl
6: Phenanthrene
7: Anthracene
8: Fluoranthene

Column:
A) 250 mmL. × 4.6 mmI.D.
B) 250 mmL. × 20 mmI.D.
(5 µm, same packing material)

Example of Scale-up with the Column of the Same Packing Material

High-Precision Delivery Performance

A redesigned plunger actuation mechanism and improved pulse correction and check valves offers significantly improved flow rate accuracy and flow rate precision. High retention time reproducibility for analytical flow rates improves reliability when scaling up and verifying purity.



Samples
(retention time at %RSD n = 6)

1: Methylparaben
(0.015%RSD)

2: Ethylparaben
(0.011%RSD)

3: Propylparaben
(0.008%RSD)

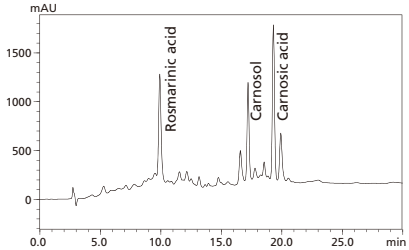
4: Butylparaben
(0.010%RSD)

Flow rate: 1.0 mL/min

Retention Time Reproducibility for Analytical Flow Rates

LC-20AP Quaternary Enables Fractionation as a Low-Pressure Gradient System

The LC-20AP Quaternary flow rate range is 1 to 50 mL/min and the instrument can handle up to four mobile phases simultaneously. It considerably reduces the effort required to investigate mobile phases during method development.



Column	Shim-pack PREP-ODS 250 mmL. × 20 mmI.D., 15 µm
Mobile phases	A: Water B: Methanol C: 2 % aqueous formic acid solution
Gradient program	B. Conc. 30 % (0 min) to 95 % (15 to 30 min) C. Conc. 5 %
Column temperature	Room temperature
Injection volume	200 µL
Flow rate	20.0 mL/min
Detection	UV 230 nm
Sample	Rosemary extract

Degassing Units DGU-20A3R / 20A5R

The DGU-20A3R/20A5R is an on-line degassing unit that uses fluoroethylene membrane. The internal capacity is small at 0.4 mL, only 1/25th of that for existing Shimadzu models, and the waiting time at mobile-phase replacement or stabilization can be significantly reduced. The degassing efficiency has also been improved, ensuring thorough degassing even at high flow rates.

- Number of degassed solvents for DGU-20A3R : 3
- Number of degassed solvents for DGU-20A5R : 5

Prominence
High Performance Liquid Chromatograph

Autosamplers

SIL-20A / 20AHT

Supporting High-Throughput Analysis

The SIL-20A is a total-volume injection-type Autosampler that enables high-speed injection and multi-sample processing. It was designed to ensure greater stability, with improved durability attained through modifications in valves and sample loops.

SIL-20AC / 20ACHT

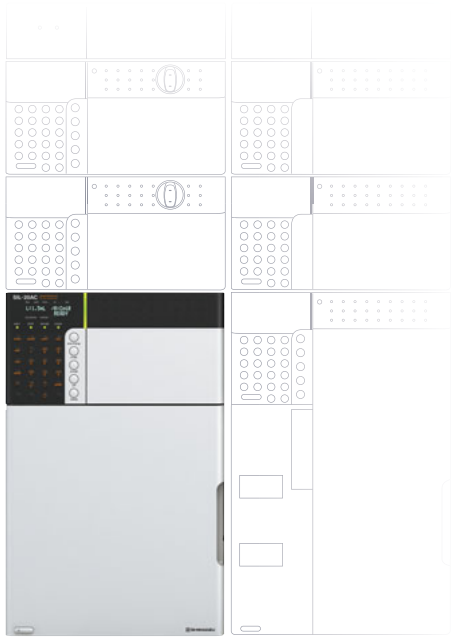
Equipped with Cooling Function

The SIL-20AC is equipped with a sample cooler that incorporates a dehumidifying function. Samples can be maintained at a fixed temperature in the range of 4 to 40°C. The high cooling speed makes it possible to keep easily decomposed sample constituents in a stable condition.

Rack Changer II

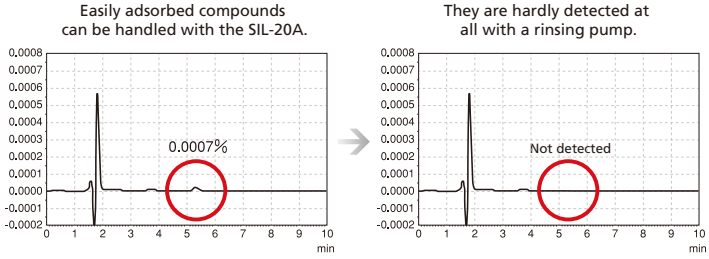
Supporting Multi-sample Processing

Maximum 12 microplates can be set. The robot arm in the rack changer automatically loads both micro-plates and racks for standard 1.5 mL vials into the autosamplers. It is a powerful tool for the analysis of a large number of samples.



Sample Carryover Reduced to an Absolute Minimum

Adsorption of sample constituents has been reduced to an absolute minimum by using a special processing technology for the sampling needle (patent pending) and rethinking the structure of the needle seal and the materials used in flow-line parts. As a result, there is hardly any sample carryover. Also, the adoption of a PEEK rotor seal allows use over a wide pH range, from strongly acidic conditions to strongly basic conditions. Using the optional rinse kit (228-43042-91) makes it possible to rinse the sampling needle with two different solvents, selected in accordance with the purpose.

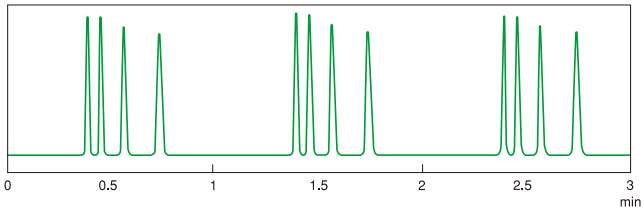


Cross-contamination Test for Chlorhexidine

High Throughput

Only 10 seconds* are required for sample injection. High-speed vertical motion of the needle enables ultra-high-speed sample processing, which was considered impossible with conventional autosamplers. Using in combination with a high-speed separation column makes an analysis cycle of less than one minute a reality.

*Specified condition



Precise Sample Injection

Greater accuracy has been attained by incorporating a high-performance sampling device that can measure out the samples with high precision. The design reflects an emphasis on basic performance as well as functionality. Also, using direct injection means valuable samples are not wasted.

Injection-Volume Accuracy

Set value (µL)	Measured value (µL)
1	0.99
2	1.99
5	5.01
10	10.00
20	19.92
50	49.90
100	99.70

Injection-Volume Precision

Injection volume (µL)	Area reproducibility (%RSD)
1	0.43
2	0.25
5	0.06
10	0.04
20	0.03
50	0.10
100	0.11

Rack Changer: Increasing the Number of Processed Samples

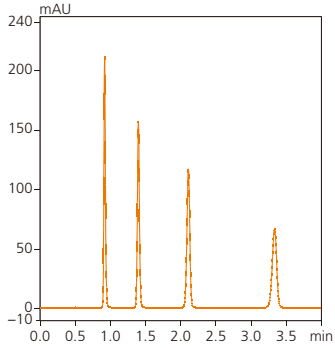
A rack changer is an optional product that can be used to change the microplates in the autosampler's racks and thereby facilitate serial analysis. Up to 12 plates can be mounted in the rack changer.
This model incorporates a cooling function. When the samples have been prepared, simply set them in the rack changer to perform continuous sample processing.

- Rack changer II (228-45164-XX)

Compatible plates: 96-well MTPs, 96-well DWPs
384-well MTPs, 384-well DWPs
1.5 mL vial plate (54 vials)
Number of processed plates: 12
Sample cooler: Block cooling/heating, used together with dehumidifying function, 4 to 40°C

Prominence UFLC Offers Ultra Fast HPLC Analysis

The SIL-20AHT / 20ACHT autosamplers used with the Prominence UFLC system permit ultra-fast analysis while maintaining the injection accuracy and durability requirements demanded of an HPLC system. As shown in the right, the retention time reproducibility and injection volume reproducibility are within 0.3 % after endurance testing over 100,000 cycles, results similar to those achieved with standard HPLC.



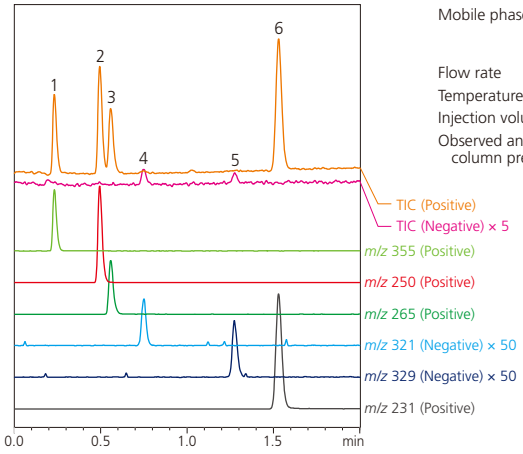
Repeatability for 4 Alkyl Phenones
After Finishing 100,000 Cycle Endurance Test

Components	Retention Time		Area	
	Average	%RSD	Average	%RSD
Acetophenone	0.916	0.089	312,670	0.059
Propiophenone	1.398	0.058	315,739	0.045
Butyrophenone	2.111	0.030	336,428	0.063
Valerophenone	3.341	0.031	296,609	0.040

(5 µL injection, n=6)

Combination with LCMS for Ultra Fast Analysis

Combining Prominence UFLC with a Shimadzu mass spectrometer, which features ultra-fast polarity switching between positive/negative ion modes (UFswitching), superb sensitivity due to the newly-developed Qarray™ ion optical system (UFsensitivity), and an ultra-fast scanning speed (UFscanning), enables ultra-fast analyses that produce peak widths in just a few seconds and highly reliable data.



Ultra-High-Speed Analysis of 6 Pharmaceutical Ingredients

Detection : ESI-Positive mode; LCMS-2020
Column : Shim-pack XR-ODS (30 mmL. × 3.0 mmI.D.)
Mobile phase : A) 0.1% aqueous solution of formic acid
B) Acetonitrile
B.Conc.: 20% (0 min.) → 35% (2.0 min.)
Flow rate : 0.5 mL/min.
Temperature : 50°C
Injection volume : 1 µL
Observed analysis column pressure : 14 MPa

Peaks
1: Yohimbine, $[M+H]^+$ *m/z* 355
2: Alprenolol, $[M+H]^+$ *m/z* 250
3: Tetracaine, $[M+H]^+$ *m/z* 265
4: Chloramphenicol, $[M-H]^-$ *m/z* 321
5: Furosemide, $[M-H]^-$ *m/z* 329
6: Isopropylantipyrine, $[M+H]^+$ *m/z* 231

Extension Modules

A modular LC, Prominence can be combined with a system controller, column oven, and detector. This offers great flexibility; for example, a multi-oven function allows individual temperature control of multiple columns and simultaneous data acquisition using an absorbance detector and a fluorescence detector.

System Controllers
CBM-20A / 20Alite

Detectors
SPD-M30A / M20A
SPD-20A / 20AV / 20AUFLC
RF-20A / 20Axs
RID-20A
CDD-10Avp
ELSD-LT II

Column Ovens
CTO-30A
CTO-20A / 20AC

Fraction Collector: FRC-10A
LCMS: LCMS-2020 / 8030 / 8040 / 8050 / 8080
LCMS-IT-TOF

Application Systems

Prominence was developed to improve the efficiency of analytical work and enhance data reliability.
These HPLC systems offer outstanding functions and performance in comparison with conventional instruments, including web-based control, high-speed sample injections, and highly sensitive detection.

Shimadzu's application systems, based on the Prominence series, incorporate the company's instrument analysis experience cultivated jointly with customers.

- Amino Acid Analysis System
- Organic Acid Analysis System
- Reducing Sugar Analysis System
- Carbamate Analysis System
- Iminoctadine Analysis System
- Synthetic Antimicrobial Analysis System
- Bromate Analysis System
- Cyanide Analysis System
- Anionic Surfactant Analysis System
- Aldehyde Analysis System
- GPC System
- GPC Cleanup System
- Preparative System
- Co-Sense Series

Foods
Food components Additives Residual pesticides Fragrances

Chemical Industry
Plastics Solvents Paints Fiber and paper

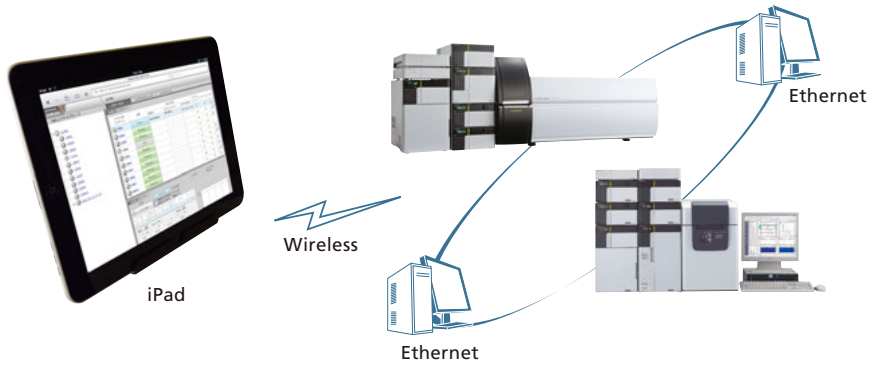
Environment
Atmosphere Drinking water Soil Biofuels

Pharmaceuticals
Drug ingredients Antibiotics and antimicrobials
Herbal medicines, natural products Veterinary pharmaceuticals

System Controllers

Web Server Functionality Allows the HPLC System to Directly Create a Network.

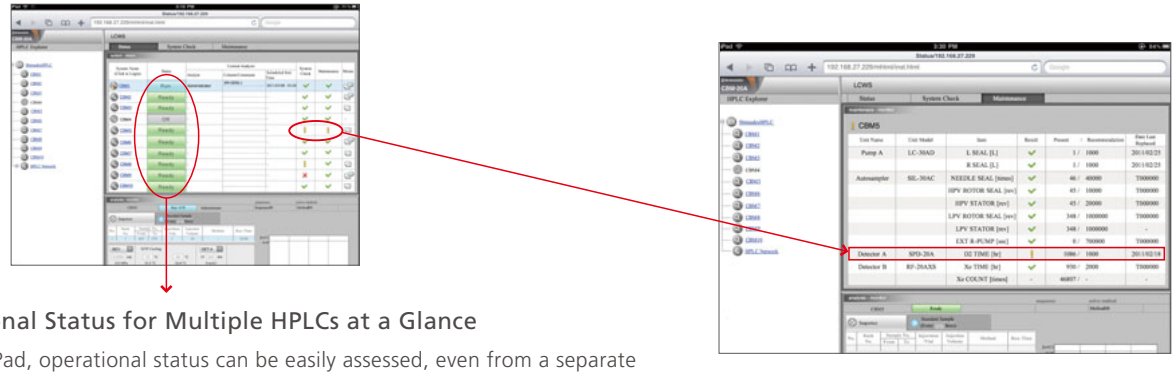
CBM-20A/20Alite is connected to a computer by Ethernet. The LAN cable connections allow the instrument and computer to be located in separated positions. Monitoring, simple operation control, and confirmation of the operation status can be performed on a mobile device.



- Simultaneously monitor multiple systems on the same network
- Maintenance data on consumables can be acquired without impeding analysis
- Using an Apple® iPad, monitor and use simple HPLC controls from anywhere

Assess the Status of Lab Instruments in Real Time

Instrument maintenance data can be assessed at a glance. If parts in use exceed their control lifetimes, they are flagged with a "!" mark. Even more detailed information can be confirmed by logging in to the corresponding instrument.

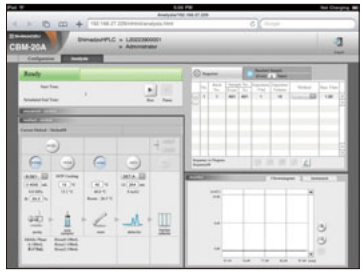


Operational Status for Multiple HPLCs at a Glance

Using an iPad, operational status can be easily assessed, even from a separate room. Having an iPad at your desk allows you to devote yourself to other projects with peace of mind, knowing that you can quickly retrieve information about completed analyses or errors that have occurred, all without visiting the lab.

Control over a Network

Maintaining a clean LC system and analysis column is important in order to obtain highly reliable data. The Shimadzu LC system Web server functionality provides a control environment in addition to system monitoring. Remotely control column cleaning and conditioning from your iPad or desktop PC.



Column Ovens

The column oven precisely controls the temperature around the column to support stable analysis that is unaffected by changes in ambient temperature.
It can contain various units and parts in addition to the column, including a manual injector (CTO-20A/20AC), gradient mixer, high-pressure flow-line selection valves (any two: 2-position/6-port, 6-position/7-port), cell block of an electric conductivity detector (CTO-20A/20AC), and a reaction coil (CTO-20A/20AC).

CTO-30A

Supports high-temperature analysis up to 150°C

The CTO-30A is a block-heating type column oven. It offers temperature control up to 150°C and the intelligent heat balance mechanism extracts maximum performance from a high-efficiency column.

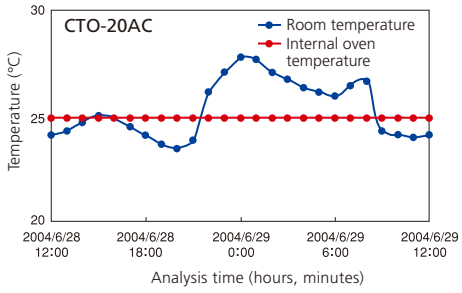
CTO-20A / 20AC

Accommodates multiple columns

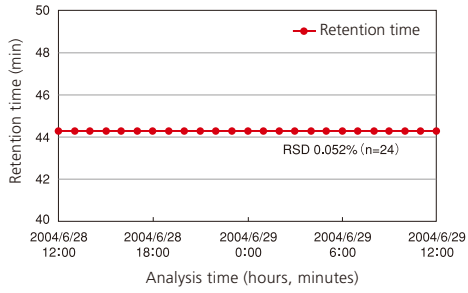
The CTO-20A is a forced-air circulation-type column oven. It offers temperature control from 10°C below room temperature to 85°C.
It allows setting of complex temperature programs, such as linear-wise or step-wise heating and cooling. The CTO-20AC incorporates a cooling function. This electronic cooler offers temperature control from –10°C below room temperature to 85°C.

Precise Temperature Regulation

The interior of the oven is precisely regulated with a high-performance thermistor. Also, the temperature is calibrated at two different temperatures to ensure a high level of accuracy.



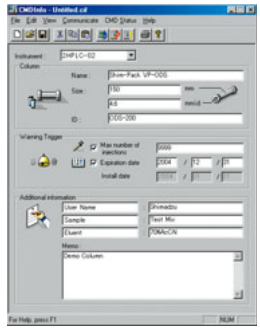
Changes in Room Temperature and Internal Oven Temperature in One Day



Changes in Room Temperature and Stability of Retention Time for Vitamin A Acetate in One Day

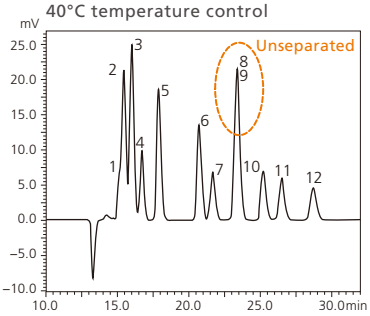
Installation of CMD (Option)

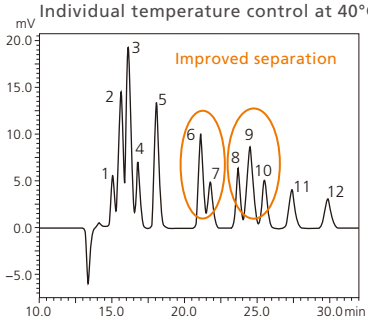
This product supports installation of the CMD (Column Management Device), which can be used to record information about the way the column is used, such as the number of injections, the amount of mobile phase that flows, and the composition of the last mobile phase used. This information can be managed at an LC workstation (LCsolution) or a PC in the network using the Web-control function.



Analysis with Individual Temperature Control of Multiple Columns (Multi-Oven Function)

The improved functions of the LabSolutions* workstation support up to four column ovens per system.
This allows analysis with individual temperature control of two columns.





1: Phosphoric acid
2: α-ketoglutaric acid
3: Citric acid
4: Pyruvic acid
5: Malic acid
6: Succinic acid
7: Lactic acid
8: Formic acid
9: Fumaric acid
10: Acetic acid
11: Levulinic acid
12: *L*-pyroglutamic acid

* Use the following versions
LC/GC Ver. 5.54 SP2
DB Ver. 6.11 SP1
CS Ver. 6.11 SP1

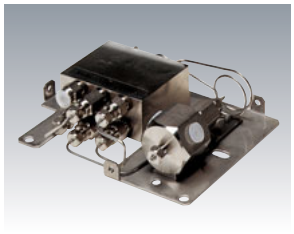
Column	Shim-pack SCR-102H (two connected)
Solvent	5 mmol/L p-toluenesulfonic acid
Flow rate	1.0 mL/min

Built-In Flow-Line Selection Valves

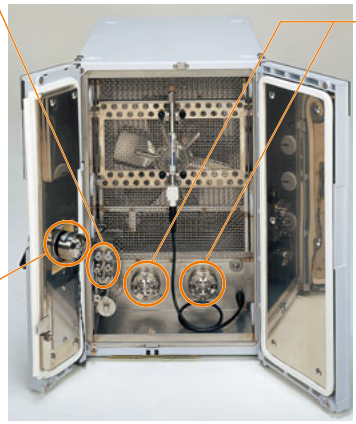
The CTO-20A/20AC can incorporate up to two flow-line selection valves, a manual injector, and a gradient mixer.
The CTO-30A can also incorporate a flow-line selection valve and gradient mixer.

Incorporation of Flow-Line Selection Valve

Mixer



Manual injector

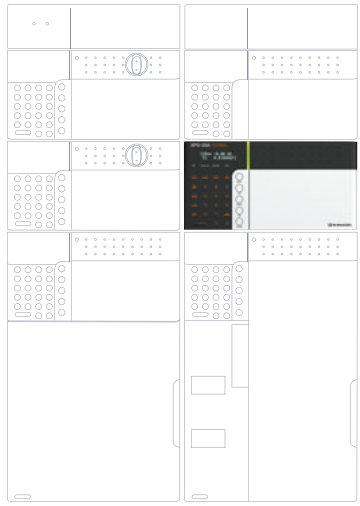


The FCV-12AH/14AH/32AH/34AH high-pressure flow-line selection valve can be incorporated and controlled. Position display is also possible.

Flow-line selection valve

UV-VIS Detectors / Photodiode Array Detectors

The lineup includes SPD-20A/20AV dual-wavelength absorbance detectors and SPD-M20A/M30A photodiode array detectors. The SPD-M30A incorporates a new type of capillary cell to offer higher sensitivity and lower dispersion. All models offer temperature control for increased baseline stability with respect to temperature fluctuations and improved data reliability.



SPD-M30A Photodiode Array Detector

Supports diverse applications from HPLC to UHPLC

This detector achieves a 0.4×10^{-5} AU noise level. The SR-Cell (Sensitivity and Resolution Cell) significantly cuts peak dispersion. This model supports analysis from conventional LC to ultra-fast and UHPLC analysis. The optional high-sensitivity cell has an 85 mm optical path length and is able to detect trace components that were conventionally difficult to detect. The TC-Optics function further improves baseline stability.

SPD-M20A Photodiode Array Detector

General-purpose model

The SPD-M20A is a general-purpose model incorporating a deuterium lamp. The light-source compensation function achieves a noise level of 0.6×10^{-5} AU. Cell temperature control ensures baseline stability.

SPD-20A / 20AV UV-VIS Detectors

Offering dual-wavelength mode

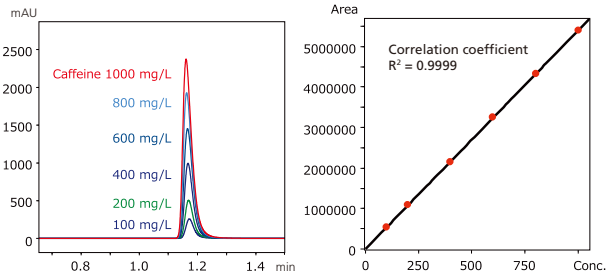
These UV-VIS detectors can measure two wavelengths simultaneously. The SPD-20AV offers a mode that lights the deuterium lamp and tungsten lamp simultaneously and permits highly sensitive wavelength-programming detection across the ultraviolet and visible regions.

Extensive Range of Linearity

Superior signal processing technology maintains the detector linearity to the ASTM standard:

- SPD-20A/20AV : 2.5 AU
- SPD-M20A/M30A : 2.0 AU

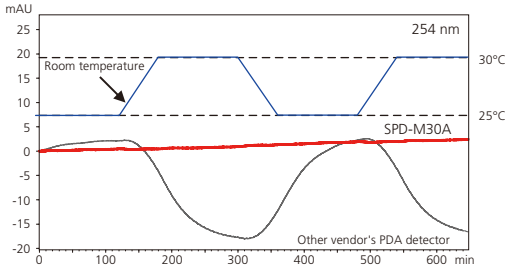
This range is a powerful attribute for batch analysis demanding a wide range of linearity, such as the purity testing of reagents.



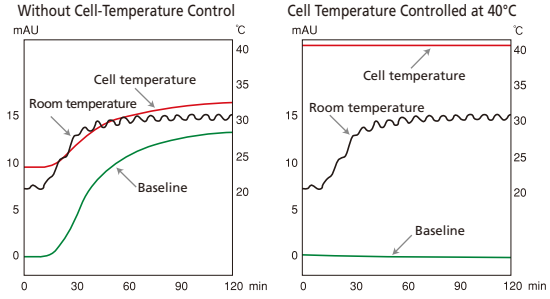
Linearity Data for SPD-M30A

Temperature Control Provides Baseline Stability and Reliable Analysis Data

The SPD-M30A detector employs TC-Optics (temperature-controlled optics) and uses SR-Cells (low-dispersion cells optimized for heat transfer at the cell inlet). This successfully achieves the low peak dispersion required for ultra-fast analysis and rapid baseline stabilization. The M20A cell temperature control function also provides baseline stability with respect to temperature fluctuations.



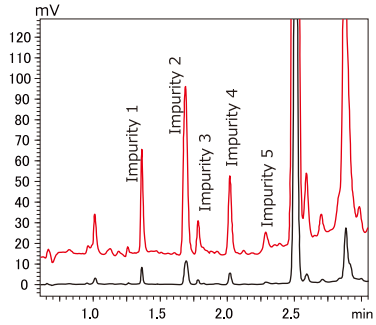
Effect of SPD-M30A TC-Optics



Effect of SPD-20A/20AV/M20A Cell Temperature Control

High-Sensitivity Cell (Option)

A high-sensitivity cell with an 85 mm optical path length is available as an option for the SPD-M30A. It enables detection of trace impurities that were conventionally difficult to detect and can be used for a wide range of analyses, from general analysis to ultra-fast and UHPLC analysis.



Impurity Analysis on Cefazolin Sodium (SPD-M30A)

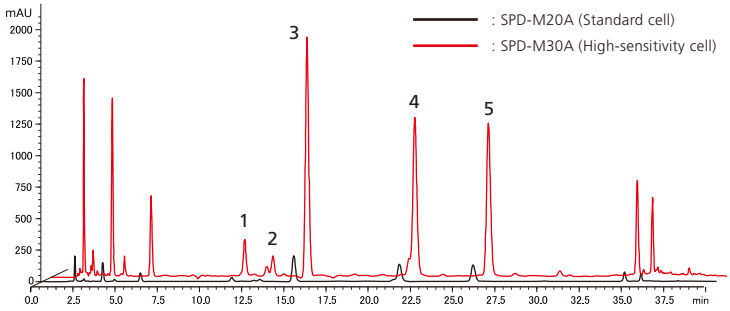
Signal Intensity

	High-sensitivity cell	Standard cell
Impurity 1	49109	7931
Impurity 2	81339	11438
Impurity 3	16345	2290
Impurity 4	37922	5548
Impurity 5	7726	968

: Standard cell (Optical path length: 10 mm)
: High-sensitivity cell (Optical path length: 85 mm)

85 mm Optical Path Length Significantly Enhances Sensitivity

The SPD-M30A high-sensitivity cell is also effective under HPLC conditions. The analysis below shows a comparison of measurements of caffeine in a commercial soft drink using the SPD-M20A and SPD-M30A. It is apparent that the SPD-M30A improves the S/N ratio by up to eleven times.

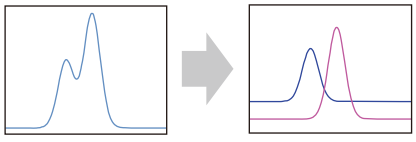


	SPD-M20A (Standard cell)	SPD-M30A (High-sensitivity cell)	S/N Relative Ratio
1	2794	26814	9.60
2	1527	15021	9.84
3	16153	179070	11.09
4	10894	118523	10.88
5	10394	113870	10.96

Mobile phase A: 0.1% aqueous solution of phosphoric acid
Mobile phase B: Acetonitrile
Flow rate: 1 mL/min
Column: Shim-pack VP-ODS 150 mmL. × 4.6 mmI.D.

New Analytical Techniques to Better Utilize PDA Detector Data

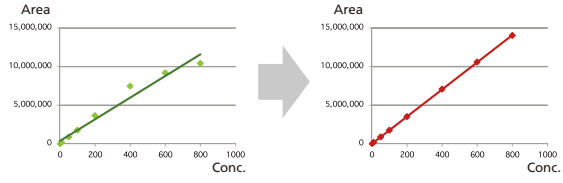
Separation of Unseparated Peaks (***i***-PDeA*)



This technique fully separates unseparated peaks and visualizes small peaks hidden by a principal component. It is convenient when poor separation occurs under conditions for accelerated analysis and for quantitation of small peaks overlapped by a principal component peak.

* ***i***-PDeA: Intelligent Peak Deconvolution Analysis

Extending the Dynamic Range (***i***-DReC**)



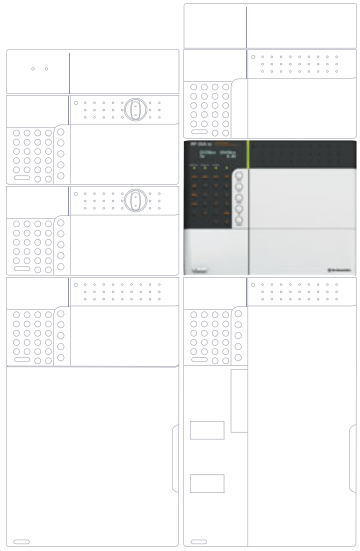
This powerful technique permits quantitation of samples in the high-concentration range. It enables the simultaneous analysis of high- and ultra-low-concentration samples and the creation of calibration curves across a broad concentration range.

** ***i***-DReC: Intelligent Dynamic Range Extension Calculator

See the separate technical reports for more details about ***i***-PDeA and ***i***-DReC.

Fluorescence Detectors

The RF-20A/20Axs fluorescence detectors offer world-leading sensitivity* and ease-of-maintenance. The RF-20Axs is a high-sensitivity model that incorporates a temperature-controlled cell with a cooling function as standard.



RF-20A

Standard model

The RF-20A, which offers best-in-class sensitivity, features a water Raman S/N ratio of at least 1200, as well as excellent ease-of-use with such features as maintenance from the front panel and adoption of a long-life lamp.

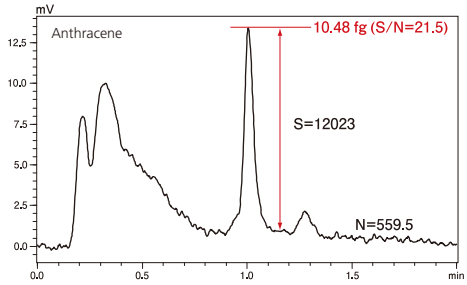
RF-20Axs

Achieves World-Leading Sensitivity*

Offering world-class levels of sensitivity* and easy maintenance, the RF-20Axs features a water Raman S/N ratio of at least 2000 and a temperature-controlled cell with a cooling function. This maintains a constant detector cell temperature, even if the room temperature fluctuates significantly, to ensure superb reproducibility with no drop in sensitivity. In addition, the RF-20Axs incorporates an automatic wavelength accuracy check function using an internal low-pressure mercury lamp to provide simple confirmation of the wavelength accuracy for validation.

Achieves World-Leading Sensitivity*

A powerful tool for the detection of ultra-trace components, the RF-20Axs achieved a 21.5 S/N ratio for an injection of 10.48 fg anthracene. This is equivalent to an approx. 1.5 fg detection limit (S/N ratio = 3) and indicates superb sensitivity.

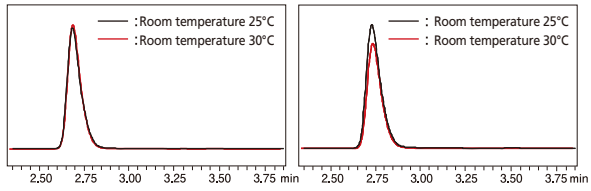


High-Sensitivity Analysis of Anthracene

* As of August 2009, Survey by Shimadzu

Cell Temperature Control Further Enhances Reproducibility (RF-20Axs)

The fluorescence intensity drops as the temperature rises. A fluctuation of about 1°C near room temperature may result in approximately 5% intensity fluctuations for some compounds.
To prevent this, the RF-20Axs features a temperature-controlled cell with a cooling function. It maintains a constant detector cell temperature, even if the room temperature fluctuates significantly, to ensure superb reproducibility with no drop in sensitivity.



With cell temperature control | No cell temperature control

Effect of Temperature-Controlled Cell (Acridine)

	Rate of Change (%)	%RSD
RF-20Axs (With cell temperature control)	0.64	0.29
RF-20A (No cell temperature control)	–17.45	6.30

%RSD	Consecutive analysis is performed while changing the room temperature from 25°C to 30°C, and the %RSD value is determined from the analysis data (n = 6). It is used to confirm the effect of room-temperature fluctuations during the analysis.
Rate of Change	Consecutive analyses are performed at 25°C and 30°C room temperature. The rate of change shows the change in the peak area, taking the average peak area value at 25°C as 1. It is used to confirm the effect of long-term fluctuations in room temperature due to the passage of the seasons.

Easy Maintenance

The Xenon lamp and flow cell can be replaced at the front panel. No positional adjustment is required when replacing the Xenon lamp, and no tools are required to replace the flow cell. The standard flow cell or semimicro flow cell can be rapidly switched. In addition, the Xenon lamp life has been extended to 2000 hours, four times longer than previous Shimadzu lamps.

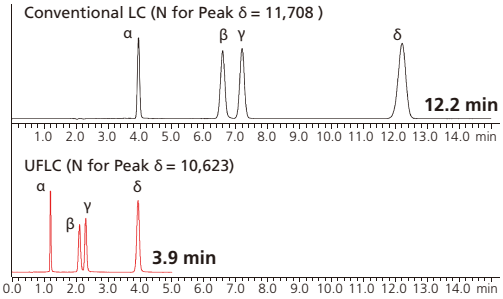
Support for Ultra Fast Analysis

Switch from Conventional LC to Ultra Fast LC

Fast response is required to follow the sharp peaks obtained in ultra fast LC analysis. The 10 ms response of the RF-20A/20Axs permits ultra fast LC analysis with no loss of separation. In this analysis example, the analysis time was reduced by a factor of more than three, while maintaining the separation.

Analysis Conditions

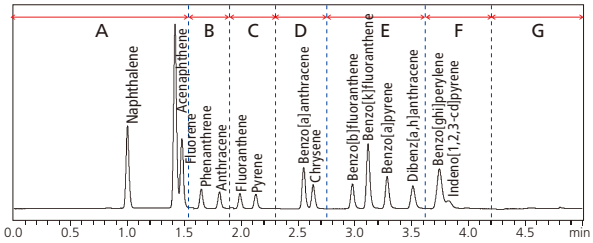
Mobile phase	Hexane / 2-propanol = 100 / 0.5 (v/v)
Flow rate	1.0 mL/min (Conventional) 0.8 mL/min (UFLC)
Column	Shim-pack CLC-SIL(M) (150 mmL. × 4.6 mmI.D., 5 µm: Conventional) Shim-pack XR-SIL (75 mmL. × 3 mmI.D., 2.2 µm: UFLC)
Temperature	30°C
Detection	298 nm excitation wavelength, 325 nm emission wavelength



Switching from Conventional LC to UFLC Analysis of α-, β-, γ-, δ-Tocopherols

Multi-Component, High-Sensitivity UFLC Analysis

The highly sensitive simultaneous analysis of multiple components requires detection at the optimal wavelengths.
The RF-20A/20Axs permit ultra fast, high-sensitivity multi-component analysis using wavelength switching by time program.



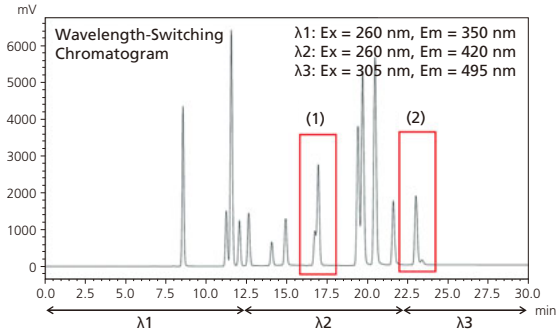
Ultra Fast Simultaneous Analysis of 15 Polycyclic Aromatics

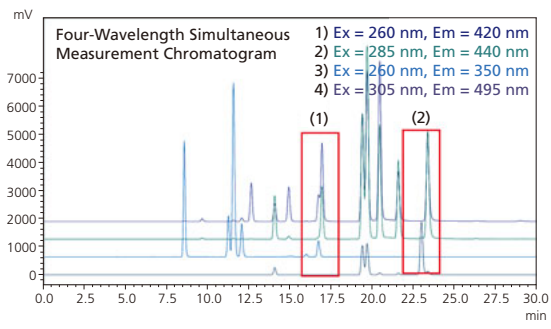
A	270 nm excitation wavelength, 330 nm emission wavelength
B	250 nm excitation wavelength, 370 nm emission wavelength
C	330 nm excitation wavelength, 430 nm emission wavelength
D	270 nm excitation wavelength, 390 nm emission wavelength
E	290 nm excitation wavelength, 430 nm emission wavelength
F	370 nm excitation wavelength, 460 nm emission wavelength
G	270 nm excitation wavelength, 330 nm emission wavelength

Support for Improved Quantitative Analysis Accuracy

Utility of Four-Wavelength Measurement Function

Using detection at a single wavelength when performing multicomponent simultaneous analysis of components with different optimal detection wavelengths necessitates sacrificing sensitivity for certain components.
The RF-20A/20Axs detectors eliminate this issue by incorporating a four-wavelength measurement function that permits detection of each component at the optimal wavelength.
Detection using wavelength switching in the left-hand diagram exhibits incomplete separation in area (1) and one peak of reduced size in area (2). In such a case, setting up to four optimal wavelengths enhances the quantitative analysis accuracy by reducing the effects of adjacent peaks and improving sensitivity.



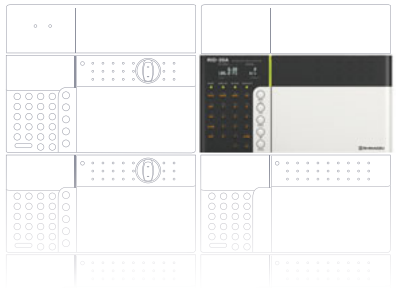


Analysis of Polycyclic Aromatics by Four-Wavelength Simultaneous Measurement (Elution sequence shown in previous diagram)

Refractive Index Detector

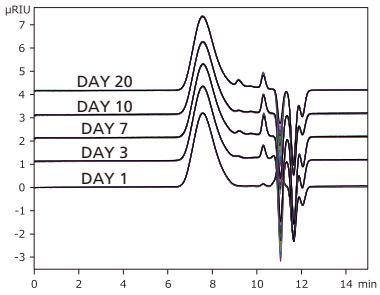
RID-20A

The RID-20A incorporates an auto purge function of the reference cell and a validation support function, inheriting the stability and expandability of Prominence HPLC series.



Excellent Reproducibility in Molecular Weight Distribution Analysis

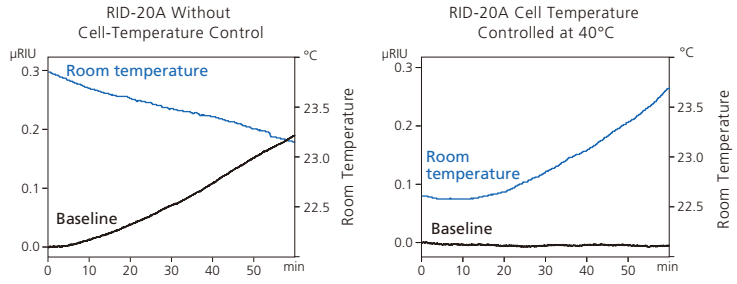
The RID-20A differential refractive index detector allows productivity improvements in GPC analysis.



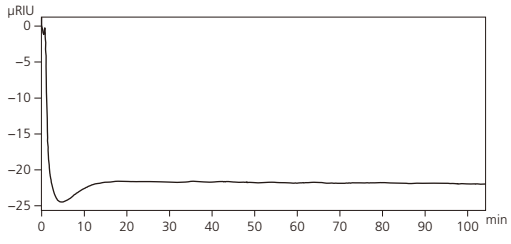
	Retention time	Retention time reproducibility (%RSD)
DAY 1	7.575	0.023
DAY 3	7.577	0.020
DAY 7	7.576	0.029
DAY 10	7.593	0.041
DAY 20	7.587	0.041
Ave.	7.582	0.031

Excellent Baseline Stability

Generally speaking, differential refractive index detectors tend to be easily affected by changes in room temperature. The optical system of the RID-20A, however, has a dual temperature control function that absorbs the effects of changes in room temperature, which ensures excellent stability. The RID-20A achieves shorter baseline stabilization time after turning ON the power through improved dual-temperature control of the optical system and superior lamp performance.



Excellent baseline stability during changes in room temperature

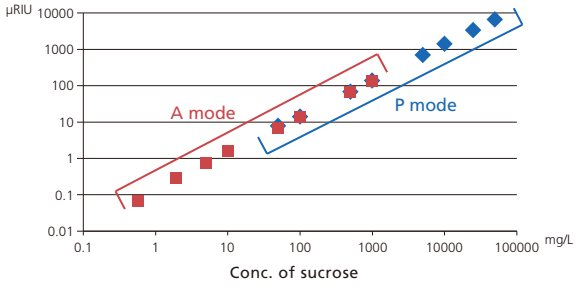


Elapsed time after power ON

Shimadzu's Proprietary Technology Supports Highly Sensitive Analysis to Preparative Analysis Applications

The four-partition photodetector in the RID-20A allows a wide refractive index range (0.01 to 5000 μRIU). The single detector supports all applications from highly sensitive measurements to preparative measurements using the three operation modes shown below.

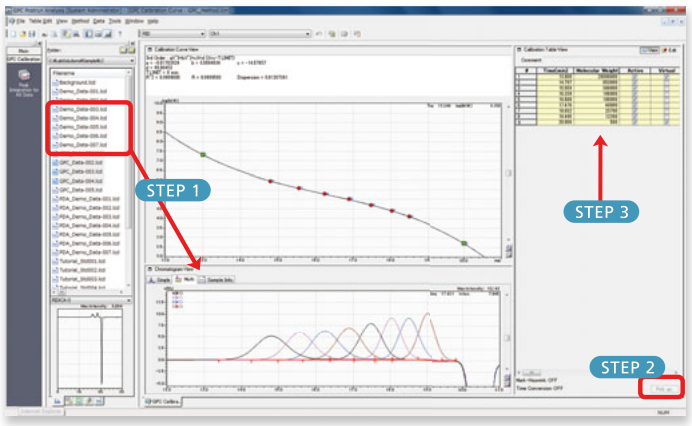
A (Analytical) Mode	High-sensitivity to general-purpose analysis
P (Preparative) Mode	High-concentration analysis, semi-preparative analysis (up to 20 mL/min)
L (Large-scale prep.) Mode	Flow selection block allows large-volume preparative analysis. (up to 150 mL/min)



LabSolutions GPC Software

Easy Analysis of Molecular Weight Distribution via Graphical Interface

Create a Calibration Curve in Just Three Steps



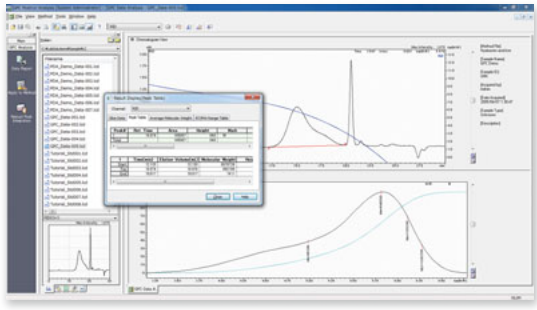
STEP 1 Drag and drop standard-sample data into the window.
STEP 2 Load the retention times.
STEP 3 Enter the molecular weight of the standard sample.

A maximum of 64 data points are available. Virtual points are also easy to set, and calibration curve appropriateness can be checked visually while choosing from a wide variety of approximation equations. Calibration curves can be corrected using the Mark-Houwink equation, and other correction methods based on Q-factors or degree of polymerization are available.

Graphical GPC Data Analysis Window

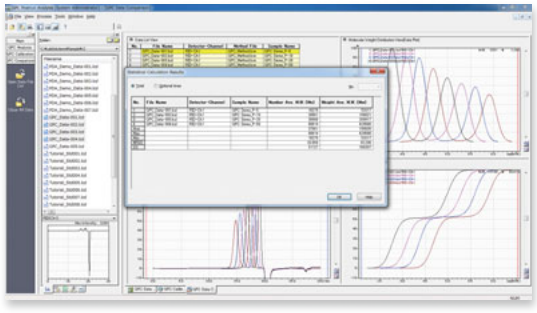
- Manipulation of peak integration possible by means of the graphical interface
- Management of data from multiple detectors within a single file

Because the molecular weight distribution curve is updated whenever peak integration is performed, results for mean molecular weight, intrinsic viscosity, polydispersity, and other parameters can be confirmed immediately. Time and detector sensitivity can also be corrected based on an internal standard peak or control sample.



The Data Comparison Window Allows Simultaneous Evaluation of Multiple Samples

- The elution curves and derivative and integrated molecular weight distribution curves for up to 10 samples can be overlaid on a graph.
- Statistical results can be displayed for mean molecular weight, intrinsic viscosity, and polydispersity.

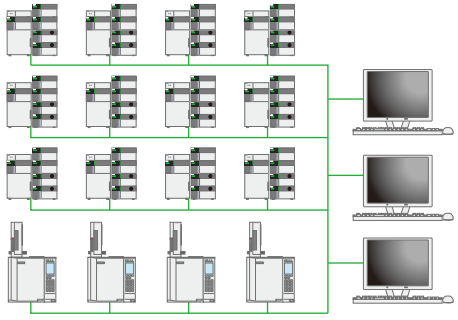


Chromatography Workstation

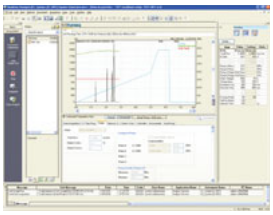
LabSolutions

Flexible Instrument Access

With LabSolutions, LCs and GCs can be operated via the same interface, and up to four LC and/or GC systems can be controlled simultaneously on a single PC. Instrument information for up to 16 systems can be registered to a single PC, allowing the system to be switched between LC or GC systems connected to the network.
LabSolutions' instrument operating status monitor allows the operator to check the operating status of connected systems and the scheduled analysis end times on each instrument. Even if multiple LC and GC systems are operating at the same time, the operating status can be known at a glance, which is useful for scheduling data acquisition to effectively minimize instrument downtime.

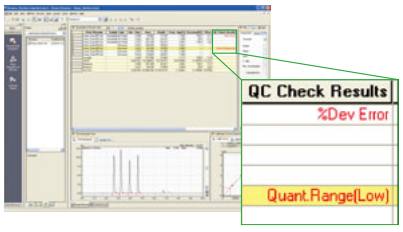


Automation Functions for Sample Analysis



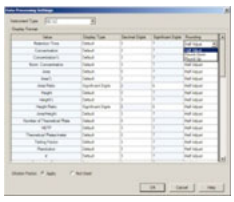
To start sample analysis, it is necessary to perform column equilibration and a noise level check, and to generate a schedule. LabSolutions enables automatic operation of these procedures, greatly improving workflow efficiency.

Comprehensive Quantitative Results Window



A quantitative results window enables easy review of data results and each chromatogram. LabSolutions supports the QC check by accuracy % and the range check to see whether a quantitative value falls within the range of the calibration curve; in addition, it supports calculation of impurity peak amounts, S/N ratio, and peak valley ratio. These various functions greatly reduce the time required for data analysis.

Customize the Operation Platform to Fit Your Workflow



LabSolutions allows users to customize the screen icons and layouts; therefore, the graphical user interface can be adapted according to individual preferences and workflow. Even the rounding method and number of displayed digits for the calculation results, such as area, height, concentration and column performance parameters, can be defined in the system for consistency and individual laboratory requirements.

Powerful Regulatory Compliance and Data Management for a Paperless Laboratory

System administration features, including system policy, user administration, log browser, and audit trail, are provided to assist users in FDA 21 CFR Part 11 compliance, which is supported and configurable on a stand-alone workstation as well as in a network environment. In addition, automatic registration of PDF files, which can be generated by LabSolutions as a standard function, into the database is available to support paperless operations in an analytical laboratory.

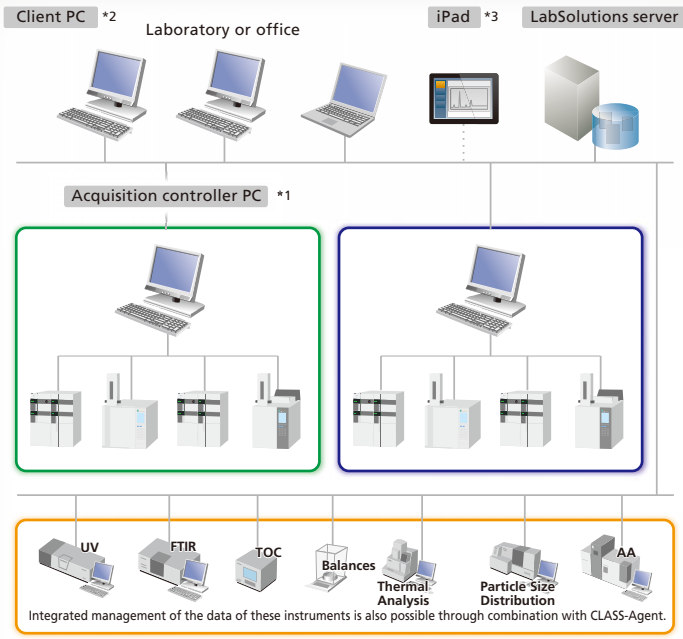
LabSolutions CS

Freely Accessible to the Analysis Network

Since all analytical data are managed in the database of a server computer, LabSolutions CS can read data from any personal computer on a network. In addition, analysis directions and instrument monitoring and control can be performed from a personal computer (client PC) not connected to the instruments.
Moreover, client PC functions are performed on a server and client PCs corresponding to a Windows terminal service do not need to install LabSolutions software.
Furthermore, LabSolutions CS corresponds to Citrix XenApp and can perform more advanced server management.

Recommended for the following customers

- ► Facilities with a large number of instruments and users
- ► Facilities interested in enhancing managerial efficiency
- ► Facilities interested in enhancing procedural efficiency
- ► Facilities where existing PCs can be used as client PCs



*1: The acquisition controller PC controls the analytical instruments. Analysis directions and re-analysis of data can be performed using a client PC.

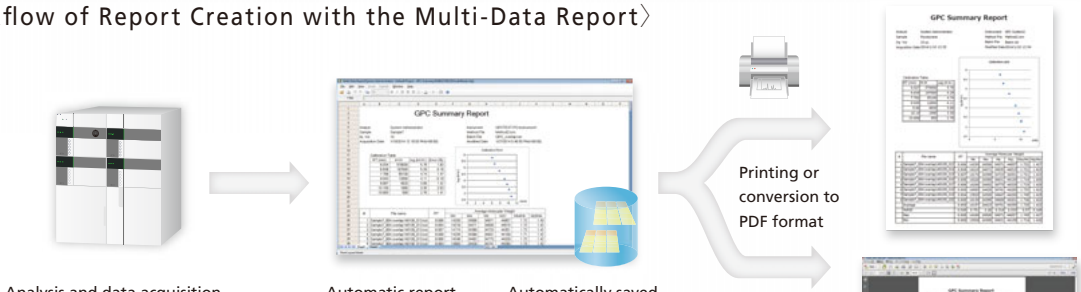
*2: It is not necessary to install LabSolutions software on the client PC for terminal service.

*3: When using an iPad, the installation of Citrix's XenApp is required. iPad is a registered trademark of Apple Inc.

Reduce the Work Involved in Creating a Final Report

Do you move your analytical results to a spreadsheet program (e.g., Excel) to create a final report?
LabSolutions includes a multi-data report feature, which reduces the work involved in report creation. Analytical results are automatically entered into a spreadsheet equivalent to the one used in Excel, eliminating the need to move the data.

〈Workflow of Report Creation with the Multi-Data Report〉



Analysis and data acquisition

Automatic report creation → Automatically saved to the database

Transfer of results is unnecessary

- Elimination of transfer errors
- Easy management of reports via the database
- Appropriate file protection provided by an audit trail feature

Note: Excel is a registered trademark of Microsoft Corporation.

Solvent Delivery Units / Column Oven

LC-10Ai / 6AD

LC-10Ai Solvent Delivery Unit for Bio-inert HPLC System

This bio-inert solvent delivery unit incorporates a serial dual plunger and offers low-pulsation performance from an optimized cylinder volume. It can be used together with the SIL-10Ai and SPD-20A (with bio-inert cell) to construct a high-performance bio-inert LC system. The LC-10Ai uses PEEK resin in liquid contact parts and is ideal for the analysis of physiologically active substances and metal ions. Resistance to acids, bases, and high-concentration aqueous NaCl solutions is even higher than with stainless steel.

LC-6AD Solvent Delivery Unit for Analytical to Semi-Preparative Scale

This multi-purpose pump delivers highly accurate solvent flow in a range from the low flow rate region to semi-preparative flow rates (up to 20 mL/min). When used with the 6AD recycle kit, it achieves a very high level of recycling efficiency for semi-preparative columns. Depending on conditions, more than one million theoretical plates can be obtained.

Specifications

	LC-10Ai (228-45089-xx)	LC-6AD (228-45068-xx)
Solvent-delivery method	Serial dual plunger	Parallel dual plunger
Plunger capacity	Primary side: 47 µL; Secondary side: 23 µL	47 µL
Maximum discharge pressure	27.4 MPa	49.0 MPa
Flow rate setting range	0.001 to 9.999 mL/min	0.01 to 20.00 mL/min
Flow rate accuracy	Within ±2% or ±2 µL/min., whichever is larger (0.1 to 5.0 mL/min.)	Within ±1% or ±10 µL/min., whichever is larger (0.01 to 5.0 mL/min.)
Flow rate precision	0.3% max. (RSD: 0.1% max.)	
Constant-pressure delivery	Possible	
Plunger rinse mechanism	Syringe or rinsing pump (228-39625-91) used	Syringe or FCV-7AL (228-45077-91) used
Operating temperature range	4 to 35°C	10 to 40°C
Dimensions, weight	W260 × D420 × H140 mm, 10 kg	W260 × D500 × H160 mm, 20 kg
Power requirements	AC 110 V, 230 V, 100 VA, 50/60 Hz	AC 110 V, 230 V, 200 VA, 50/60 Hz

* A PC-31L interface (228-31103-91) must be installed in the LC-6AD to enable connection of the solvent delivery unit to the CBM-20A/Alite or SCL-10A*VP* system controller.
* System-check software cannot be used with the LC-6AD.
* Use the preparative mixer (228-20600-91) if the flow rate is greater than or equal to 10 mL/min.

CTO-10AS*VP*

The CTO-10AS*VP* is a space-saving, compact and affordable oven with a block heating mechanism.
The CTO-10AS*VP* controls temperature from –15°C below room temperature to 60°C, and accommodates two manual injectors.

Specifications

CTO-10AS*VP* (228-45059-XX)			
Type	Block heating	Applicable columns	25 cm (2 columns max.)
Cooling method	Electronic cooling	Function	Change of temperature setting
Temperature setting range	4 to 80°C	Safety features	Leak sensor, temperature fuse, temperature upper limit
Temperature control precision	±0.1°C	Dimensions, Weight	W130 × D420 × H415 mm, 12 kg
Temperature control range	–15 to 60°C, room temperature	Power requirements	AC 110 V, 230 V, 120 VA, 50/60 Hz

Autosamplers / Fraction Collector

SIL-10AF / 10AP / 10Ai

SIL-10AF / 10AP Versatile Autosamplers

The SIL-10AF and SIL-10AP injectors use the fixed-loop injection method. They can also perform sample pretreatment, including dilution and mixing, at a high speed. The SIL-10AP is a preparative autosampler that can inject up to 5 mL while offering the same level of performance and functionality as the SIL-10AF.

SIL-10Ai Bio-inert Autosampler

This bio-inert autosampler uses PEEK resin in parts that contact liquids. It can be used for the analysis of physiologically active substances and metal ions.

Specifications

	SIL-10AF (228-45056-xx)	SIL-10AP (228-45057-xx)	SIL-10Ai (228-45075-xx)
Injection method	Loop injection, variable injection volume		
Injection-volume setting range	1 to 50 µL (standard) 1 to 400 µL (option) 1 to 2,000 µL (option) 1 to 5,000 µL (option)	1 to 5,000 µL (standard) 1 to 400 µL (option) 1 to 2,000 µL (option)	1 to 50 µL (standard) 1 to 250 µL (option)
Number of samples processed	100 with 1.5 mL vials (60 with optional cooler) 80 with 4 mL vials (50 with optional cooler) 25 with 13 mL vials (not applicable to SIL-10Ai) 192 with two 96-well microtiter plates		
Injection-volume accuracy	Not specified		
Injection-volume precision	RSD: 0.5% max. (10 µL injection, standard mode)	RSD: 1% max. (10 µL injection)	RSD: 0.5% max. (10 µL injection, standard mode)
Sample carryover	Not specified		
Number of repeated injections	30 max. per sample		
Needle rinsing	Set freely before and after sample injection		
Sample cooler	Optional Sample Cooler S (228-45063-xx) or L (228-45064-xx) Block-heating /cooling method 4 to 70°C		
Operating pH range	pH1 to pH10		
Operating temperature range	4 to 35°C		
Dimensions, weight	Main unit: W260 × D420 × H280 mm, 19 kg Syringe unit: W100 × D150 × H280 mm, 4 kg		
Power requirements	AC 110 V, 230 V, 100 VA, 50/60 Hz		

* SIL-10AF / 10AP / 10Ai can not control from CBM-20Alite.

FRC-10A

A Fraction Collector for a Wide Variety of Fractionation Modes

The FRC-10A can be used over a wide range of flow rates, covering small and large-scale preparative work. It flexibly adapts to various applications, such as simple, manual collection performed while viewing chromatograms, and advanced, continuous and automated preparative separation and collection performed in combination with an autosampler and detector.

Convenient Fraction Simulation

Fraction simulation can be performed using LabSolutions, so the optimization of fractionation conditions is very simple.

Minimal Influence of Variations in Elution Time

Even if the elution time changes due to the influence of fluctuations in room temperature or the composition of the mobile phase, it is still possible to accurately perform fractionation by catching the target component with special parameters. This function is indispensable for continuous automatic preparative separation.

Specifications

FRC-10A (228-45070-xx)			
Drive system	Arm-movement X–Y system	Cooling function	Possible with Sample Cooler L (228-45064-xx)
Maximum number of fractions	16 to 144 (depending on the type of rack used)	Ambient temperature range	4 to 35°C
Collection method	Solenoid valve (fraction-collector head with valve) or direct through nozzle (fraction-collector head)	Dimensions, weight	W260 × D420 × H280 mm, 15 kg
		Power requirements	AC 110 V, 230 V, 100 VA, 50/60 Hz
Maximum flow rate	150 mL/min		
Fraction modes	Basic mode (using initial parameters), and Time-Program mode (14 different functions available)		

Conductivity Detector

CDD-10AVP

Handles a Wide Variety of Analysis Options

The CDD-10AVP conductivity detector achieves an even higher level of sensitivity and makes it possible to perform a wide variety of analysis scenarios with a single unit. An option card enables the simultaneous 2-channel measurement of anions and cations, and a suppressor option allows expansion to a suppressor system for ultra-high sensitivity work. Organic acids can be analyzed using Shimadzu's unique post-column pH-buffered electroconductivity method.

Ions	Concentration (µg/L)	RSD (%)
F	50	0.46
Cl	200	0.23
NO_2	15	5.41
Br	100	0.71
NO_3	80	0.54
PO_4	500	0.63
SO_3	200	2.30

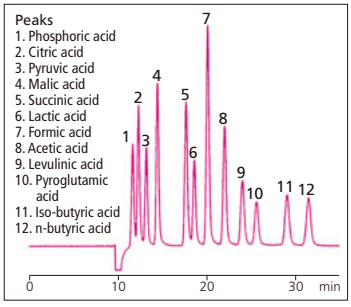
Reproducibility in Anion Analysis
(Lower concentration limits of quantitative analysis range for 2001 edition of Water Supply Testing Methods, Japan)

Perform Analysis with Highest Sensitivity

The sensitivity of detectors that monitor weak electrical signals from analytes is affected by the inherent electrical noise of the detector itself. With the CDD-10AVP, electronic parts with low electrical noise are used, and the layout of the electronic components has been optimized in order to reduce noise levels, thereby attaining an extremely high level of sensitivity. Combining the CDD-10AVP with a suppressor unit makes it possible to perform ultra-high sensitivity ion analysis on the order of 0.25 µg/L (detection limit: S/N = 3) for Cl^-.

Applicable to Both Suppressor and Non-Suppressor Systems (available in limited regions)

When used with a CTO-20AC, expansion to a full suppressor system can be realized by adding the suppressor option. Suppressor functions can be disabled when necessary, making it possible to switch between anion analysis using a suppressor system and cation analysis using a non-suppressed system. In addition to a single flow-line system, expansion to a dual flow-line system is also possible, allowing the creation of a variety of system configurations. For example, simultaneous analysis of anions and cations using a combination of suppressed and non-suppressed detection is possible.



High-Sensitivity Analysis of Organic Acids

Shimadzu's post-column pH-buffered electroconductivity method (Patent No. 2017498) enables selective, high-sensitivity analysis of organic acids. Even samples that traditionally require time-consuming pretreatment to handle unwanted constituents can be analyzed after simple pretreatment procedures such as dilution and filtration. The level of reliability attained in quantitative analysis is much higher than that attained conventionally with a low-wavelength UV method or a simple conductivity method. Superior linearity enables batch analysis in cases where constituent concentrations differ greatly and, consequently, helps reduce analysis time.

Specifications

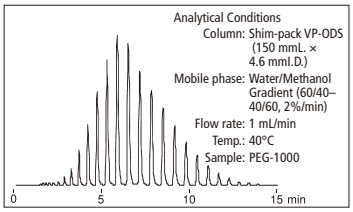
	CDD-10AVP (228-45054-xx)
Temperature coefficient	25 nS·cm^{-1}/C (background: 285 µS·cm^{-1}; cell temperature: 43°C)
Cell volume	0.25 µL
Cell constant	25 µS·cm^{-1}
Material used in parts making contact with liquid	PEEK, SUS316
Maximum operating pressure	2.9 MPa (30 kgf/cm^2)
Response	0.05 to 10 sec., 10 steps
Zero adjustment	Autozero, baseline shift
Operating temperature range	4 to 35°C
Dimensions, weight	W260 × D420 × H140 mm, 6.0 kg
Power requirements	AC110 VA, 230 V, 250 VA, 50/60 Hz

Evaporative Light-Scattering Detector

ELSD-LT II

Highly Versatile Detection Method

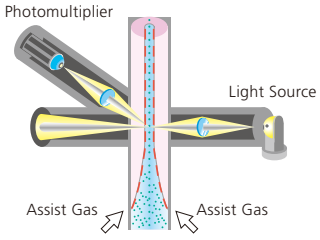
Not all compounds have a chromophore or other such structural property that allows the use of an absorbance detector. Refractive Index Detection (RID) is one option but it suffers from the inability to run gradient analysis. Evaporative Light Scattering Detection (ELSD) is a perfect alternative to RID as it is more rugged, quicker to stabilize, and gradient compatible. ELSD is ideal for applications like testing the purity of compounds, measuring the molecular weight distribution of synthetic polymers, and analyzing natural substances.



Chromatogram of Non-Chromophoric Compound

Detects Most Compounds

With the exception of some highly volatile compounds, the ELSD-LT II is able to detect almost any compound. Unlike traditional absorbance detectors (UV-Vis, PDA, etc.), sensitivity is not dependent on the physical or structural properties of the compound, but rather the absolute quantity of the solute passing through the detector cell. Therefore, it is especially useful for detecting unknown or breakdown compounds and/or validating purity of a target compound. By this mechanism of detection the ELSD-LT II is truly a universal detector.



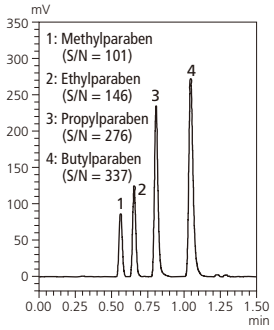
Assist Gas Functions

High Sensitivity by Low Temperature Evaporation

The ELSD-LT II detector uses a unique nebulizer and drift tube design to achieve stable and low-temperature evaporation of mobile phases, making it possible to analyze semi-volatile and/or thermally unstable compounds.
High-sensitivity detection is achieved by focusing the sample at the detection point with assist gas flow. The ELSD-LT II offers high sensitivity with this low-temperature evaporation technology and superb detection technology. A smaller volume nebulizer and drift tube further improve sensitivity.

Automated Functions

Auto-Powerdown functions for the LED light source and nebulizer gas reduce operating costs. The self-cleaning design makes maintenance of the drift tube easier.



Example of analyzing 4 semi-volatile alkyl parabens, considered difficult to analyze with conventional ELSD detectors.

Specifications

	ELSD-LT II (228-45115-xx)
Nebulizing Method	Siphon Splitting
Light source	LED
Detection	Photomultiplier Tube
Temperature setting range	Ambient to 80°C
Nebulizer gas	Nitrogen (N_2) or Air *1
Gas flow rate, Gas pressure	Max. 3.0 L/min, Max. 450 kPa
Mobile phase flow rate	0.2 to 2.5 mL/min
Analog output	0 to 1 V
Operating temperature range	5 to 40°C
Operating humidity range	Max. 80% (5 to 31°C, room temperature) Max. 50% (31 to 40°C, room temperature)
Size, Weight	W250 × D550 × H450 mm, 20 kg
Power supply	AC 115 V, 230 V, 150 VA, 50/60 Hz

*1: Requires gas supply source, such as a gas line, nitrogen generator, or air compressor.

Note
- An optional pressure regulator with filter is required to remove microscopic materials in gas.
- When using a nitrogen generator or an air compressor, please be careful that moisture, oil, dust, etc. should not be contained in nitrogen or air.
- Please use it in the room where exhaust equipment is available.

FCV Series Flow-Line Selection Valves

FCV-20AH2 (228-45015-XX)
FCV-20AH6 (228-45017-XX)

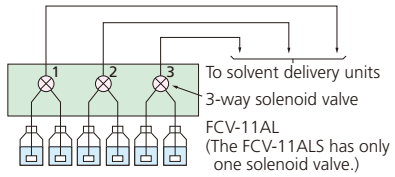
High-Pressure Flow-Line Selection Valves

The FCV-20AH2/20AH6 is a stand-alone, high-pressure, flow-line selection valve. The valve position is controlled by event signal input. Direct control is also possible from the unit itself.

FCV-11AL (228-45048-58)
FCV-11ALS (228-45049-58)

Reservoir Selection Valves

These solenoid valve units can automatically switch between two solvents (e.g., mobile phase and column rinse solvent) plumbed to one solvent delivery unit. The FCV-11AL can handle the automatic selection of solvents for up to three solvent delivery units whereas the FCV-11ALS is used for one unit.

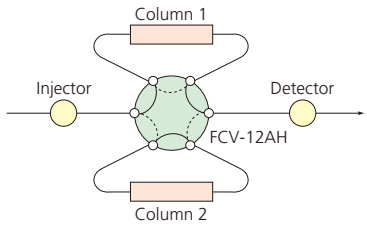


FCV-12AH/12AHi (228-45013-57/58)
FCV-32AH (228-45166-91)

High-Pressure Flow-Line Selection Valves

These flow-line selection valves incorporate 6-port, 2-position, high-pressure valves.
They can be used for automatic column selection and automatic pretreatment.

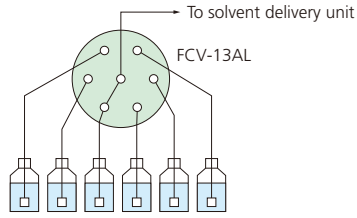
* The liquid contact parts of the FCV-12AHi have bio-inert specifications.



FCV-13AL (228-45016-91)

Reservoir Selection Valve

This unit performs automatic solvent selection and incorporates a 7-port, 6-position valve.
It can perform the switching of up to six solvents for a stepwise gradient.

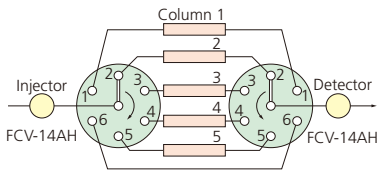


FCV-14AH/14AHi (228-45014-57/58)
FCV-34AH (228-45185-41)

Column Switching Valves

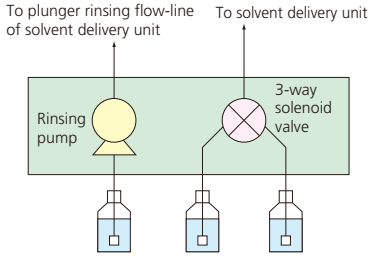
This unit performs automatic column selection and incorporates a 7-port, 6-position, high-pressure valve. It can be used for automatic multi-column switching. (Two units used.)

* The liquid contact parts of the FCV-14AHi have bio-inert specifications.



FCV-15AL (228-28418-91) — Reservoir Selection Valve with Rinsing Pump

It incorporates a pump that can continuously automatically rinse the rear side of the solvent delivery unit's plunger seals of solvent delivery unit.
The device can automatically switch between two solvents. It is convenient to automatically rinse column and flow-line.



FCV-7AL (228-45077-91) — Reservoir Selection Valve

This device can switch between two solvents using a solenoid valve. It incorporates a pump that can automatically rinse the rear side of the solvent delivery unit's plunger seals.
It can be controlled from the LC-6AD or from a system controller or workstation connected via the LC-6AD.

* This image is with 4 port option kit

FCV-230AL (228-45163-41) — Reservoir Selection Valve

This device can switch between two solvents using a solenoid valve (option four solvents).
It can be controlled from the LC-20AP or a system controller CBM-20A/20Alite or workstation. It can be extended switching between four solvents by adding 4 port option kit (228-45165-41).

	FCV-12AH FCV-12AHi	FCV-32AH	FCV-20AH$_2$	FCV-14AH FCV-14AHi	FCV-34AH	FCV-20AH$_6$	FCV-13AL	FCV-11AL FCV-14ALS	FCV-15AL	FCV-230AL
Valve type	6-port, 2-position valve			7-port, 6-position valve				3-way solenoid valves		
Solvent pH usage range	1 to10	1 to 14	1 to 10	1 to 10	1 to 14	1 to 10	1 to 14			
Maximum pressure	34.3 MPa (12AH) 34.3 MPa (12AHi)	130 MPa	34.3 MPa	34.3 MPa (14AH) 34.3 MPa (14AHi)	100 MPa	34.3 MPa	—			
Dimensions	W110 × D110 × H250		W110 × D140 × H250	W110 × D110 × H250		W110 × D140 × H250	W110 × D110 × H250			
Weight	4.0 kg							2.0 kg	4.0 kg	2.7 kg

* 1 An Option Box VP or a Sub-controller VP is required for control of the FCV-12AH/13AL/14AH. This does not apply to the FCV-12AH/14AH when it is connected to the CTO-20A/20AC. Two FCV-12AH units and a total of two FCV-13AL or FCV-14AH units can be controlled from the SCL-10A$_{VP}$.
* 2 When using FCV-11AL/11ALS/15AL units for solvent selection, only one of these units can be controlled from the SCL-10A$_{VP}$ or a solvent delivery unit. The SCL-10A$_{VP}$ and Option Box VP or Sub-controller VP is required to use two of these units simultaneously.

Optional Accessories

Options for Solvent Delivery Units

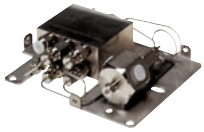
* The automatic rinse kit for the LC-20AB is shown in the photograph.

Automatic Rinsing Kit

- 20AD Automatic Rinsing Kit (228-45567-91)
- 20AT Automatic Rinsing Kit (228-45568-91)
- 20AB Automatic Rinsing Kit (228-18803-92)

These optional kits are used to continuously, automatically rinse the backs of the plunger seals and plunger units. They wash away the salt that is deposited on the surfaces of the seals and plungers when buffer solution is used as the mobile phase, thereby helping to prolong the service life of these parts. There are kits for use with the LC-20AD, the LC-20AT, and the LC-20AB.

Mixer



* The Mixer 0.5-2.6 mL HP is shown in the photograph.

- Mixer 0.5-2.6 mL HP (228-45093-93)
- Mixer 100 µL HP (228-35830-93)
- 20A Bio-inert Mixer (228-45093-92)
- Preparative Mixer (228-20600-91)
- 6AD Preparative Mixer (228-20738-92)

These gradient mixers offer superior mixing performance. Mixing volumes of 0.5 mL, 1.7 mL, and 2.6 mL can be selected for the Mixer 0.5-2.6 mL HP. The mixing volume for the Mixer 100 µL HP is 100 µL. The 20A bio-inert mixer incorporates PEEK resin and ceramic for use with bio-inert systems, and two mixing volumes can be selected. There are also mixers for preparative applications.

- MR 20 µL Mixer for UHPLC
- MR 40 µL Mixer for UHPLC
- MR 100 µL Mixer for UHPLC
- MR 180 µL Mixer for UHPLC

Reducing the gradient delay volume is reguired in ultra high speed (UHPLC) analysis. The mixer for UHPLC performed to minimize the gradient delay volume and optimize the mixing performance. When using the LC/MS system, use the MR 20 µL. When using no formic acid, acetic acid, or trifluoroacetic acid (TFA), use the MR 40 µL. When using formic acid and acetic acid, use the MR 100 µL. When using TFA, use the MR 180 µL. There are lineup of suitable mixers for purpose.

DGU-10B (228-45067-93) — Helium Degassing Unit

This degasser purges dissolved air from the mobile phase and prevents phenomena such as bubble formation, baseline noise, and drift. The DGU-10B can degas up to four mobile phase solutions with helium gas. It is turned ON/OFF from the solvent delivery unit or system controller.

Options for Chemical Reaction Units

CRB-6A (228-45065-XX) — Chemical Reaction Chamber

This air circulation-type reaction chamber is used for post-column derivatization.
Temperature-control range: Between 15°C above room temperature and 150°C
Temperature-control precision: ±0.1°C (100 V operation only)

Options for Sample Injection Units

* The Rheodyne 7725i/9725i incorporates a position-sensing switch.

Sample Injectors

- Rheodyne 7725 (228-32210-91) For general analysis
- Rheodyne 7725i (228-32210-93) For general analysis
- Rheodyne 8125 (228-23200-91) For semi-micro systems
- Rheodyne 9725 (228-32650-91) For bio-inert LC systems
- Rheodyne 9725i (228-32650-93) For bio-inert LC systems

Optional Loops

Volume	Material	Part Number	Volume	Material	Part Number
100 µL	SUS	228-32211-16	500 µL	SUS	228-32211-18
	PEEK	228-32651-16		PEEK	228-32651-18
200 µL	SUS	228-32211-17	1 mL	SUS	228-32211-19
	PEEK	228-32651-17		PEEK	228-32651-19

Valve Options

* Option Box VP is shown in the photograph.

Option Box VP (228-45060-91)
Sub-controller VP (228-35308-91)

Option Box VP can house up to two FCV-11AL(S)/12AH/13AL/14AH units. One FCV-11AL or FCV-11ALS unit, up to two FCV-12AH units, up to two FCV-13AL/14AH units, and one DGU-10B unit can be controlled from the CBM-20A or SCL-10AVP via Option Box VP.
Sub-controller VP has the same control functions as Option Box VP but has no housing capability.

Solvent Recycle Valve Kit (228-45080-91)

Using a solvent recycle valve kit during isocratic analysis allows column eluent to return to the reservoir bottle when no peaks are detected according to the set threshold level. This helps reduce consumption of the mobile phase, especially at higher flow rates.

Manual Recycle Valve (228-20401-92)

This manual switching valve is used to perform recycling operations with preparative systems.

Manual Column Switching Valve (228-13000-95)

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

Other Options

Reservoir Tray (228-45041-91)

The sturdy plastic tray will hold up to seven 1-liter reservoir bottles.

Outlet Unit (228-35327-XX)

This unit provides eight outlets (4 unswitchable, 4 switchable by CBM-20A).

Column Holder

Column Holder, SLIM

Column Holder (228-45079-91)
Column Holder, SLIM (228-45203-41)

This holder supports the mounting of two columns (SLIM: Second column is optional.*) with inner diameters in the range of 20 to 50 mm, one analytical column, maximum four manual selection valves of various types (SLIM: Maximum five).

Dimensions: Column Holder W250 × D400 × H465 mm
Column Holder, SLIM W110 × D500 × H625 mm

* Optional column clamp ASSY (228-17701-94) is required separately to mount two columns.

From HPLC to UHPLC
—Extensive Lineup of Shimadzu LCs—

Shimadzu's extensive LC lineup fulfills a wide range of analytical needs, from conventional to ultra-high speed analysis. With scalable column size and packing material particle size, Shimadzu can provide an LC system most appropriate for your applications.

	Conventional		Ultra-high speed/High-separation	
Packing material particle size (μm)	10 – 3	3 – 2		< 2
Column size (mm)	~ 250	~ 75	~ 150	
Typical column	Shim-pack VP	Shim-pack XR	Shim-pack XR II	Shim-pack XR III
Prominence / Prominence-i				
Nexera XR / Nexera-i				
Nexera X2				

Shimadzu LC lineup according to column categories

Routine Analysis
Easy Operation

Nexera-i

The UHPLC system perfect for multi-analyte processing such as drug dissolution testing. Autosampler accommodates a total of 216 standard vials and features a direct access mechanism that allows the user to place the sample even during analysis.

Prominence-i

The HPLC system perfect for checking synthetic compounds, quantitative testing with standard operative procedures, etc. This system is suitable for a wide range of industries, such as pharmaceuticals, chemicals, foods and the environment. It can be operated as a single-use system or a shared system. Its small footprint facilitates the management and relocation of systems.

Nexera X2

The flagship UHPLC system supporting columns with sub-2 µm micro-particle packing materials, realizing both ultra-high speed and ultra-high separation. Excellent reproducibility of low injection volume and ultra-low carryover ensures reliable data, even with ultra-sensitive LC/MS/MS methods.

Nexera XR

The UHPLC system supporting most commercial UHPLC and HPLC columns. Superior gradient performance and minimized delay volume enable ultra-high speed analyses with excellent reproducibility. The Method Scouting System can be constituted to support more efficient method development.

All-round LC Expandability

Prominence

The standard HPLC system with excellent expandability. It can be configured to meet a variety of analytical conditions. This system offers reduced maintenance costs while still enabling high-speed analysis by using short columns with 2 µm particles.

Specifications

Solvent Delivery Units LC-20AD / 20AT / 20AB

▸▸▸ P. 6

	LC-20AD (228-45000-XX)	LC-20AT (228-45001-XX)	LC-20AB (228-45002-XX)
Solvent delivery method	Parallel-type double plunger	Serial-type double plunger	Parallel-type double plunger (2 sets)
Plunger capacity	10 µL	Primary side: 47 µL, Secondary side: 23 µL	10 µL
Maximum discharge pressure	40 MPa		
Flow rate setting range	0.0001 to 10.0000 mL/min	0.001 to 10.000 mL/min	0.0001 to 10.0000 mL/min
Flow rate accuracy	No more than ±1% or ±2 µL/min, whichever is greater (0.01 to 2 mL/min)	No more than ±2% or ±2 µL/min, whichever is greater (0.01 to 5 mL/min)	No more than ±1% or ±2 µL/min, whichever is greater (0.01 to 2 mL/min)
Flow rate precision	No more than 0.06% RSD or 0.02 min SD, whichever is greater		
Typical pulsation	0.03 MPa (for water at 1.0 mL/min, and 7 MPa)	0.08 MPa (for water at 1.0 mL/min, and 7 MPa)	0.03 MPa (for water at 1.0 mL/min, and 7 MPa)
Gradient type	High-pressure mixing/low-pressure mixing		High-pressure mixing
Mixing-concentration precision	0.1% RSD max.		
Constant-pressure solvent delivery	Supported		Not supported
Plunger rinsing mechanism	Manual rinsing or automatic rinsing using optional product		
Safety measures	Liquid-leakage sensor, high-pressure/low-pressure limits		
Operating temperature range	4 to 35°C		
Dimensions, weight	W260 × D420 × H140 mm, 10 kg	W260 × D420 × H140 mm, 11 kg	W260 × D420 × H140 mm, 13 kg
Power requirements	AC 110 V, 230 V, 150 VA, 50/60 Hz		AC 110 V, 230 V, 180 VA, 50/60 Hz

Preparative Solvent Delivery Unit LC-20AP

▸▸▸ P. 7

	LC-20AP (228-45150-4X)
Solvent delivery method	Parallel-type double plunger
Plunger capacity	250 µL
Maximum discharge pressure	42 MPa
Flow rate setting range	0.01 to 100.00 mL/min (to 42 MPa) 100.01 to 150.00 mL/min (to 30 MPa) 0.01 to 50.00 mL/min (low-gradient unit)
Flow rate accuracy	No more than ± 1% (water, 1 mL/min, 10 MPa)
Flow rate precision	No more than 0.1 %RSD or 0.02 minSD, whichever is greater
Gradient type	High-pressure mixing/low-pressure mixing
Plunger rinsing mechanism	Manual rinsing or automatic rinsing using an optional rinsing pump
Safety measures	Liquid-leakage sensor, high-pressure/low-pressure limits
Operating temperature range	4 to 35°C
Dimensions, weight	W260 × D500 × H210 mm, 19 kg
Power requirements	AC 110 V, 230 V, 400 VA, 50/60 Hz

Degassing Units DGU-20A3R / 20A5R

▸▸▸ P. 7

	DGU-20A3R (228-45018-XX)	DGU-20A5R (228-45019-XX)
Number of degassed solvents	3	5
Degassed flow-line capacity	400 µL	
Operating temperature range	4 to 35°C	
Dimensions, weight	W260 × D421 × H72 mm, 3.9 kg	W260 × D421 × H72 mm, 4 kg
Power requirements	Supplied from LC-20AD / 20ADXR / 20AT / 20AB	

Autosamplers SIL-20A / 20AC / 20AHT / 20ACHT

▸▸▸ P. 8

	SIL-20A (228-45006-XX)	SIL-20AHT (228-45119-XX)	SIL-20AC (228-45007-XX)	SIL-20ACHT (228-45120-XX)
Injection method	Total-volume sample injection, variable injection volume			
Maximum operating pressure	20 MPa	35 MPa	20 MPa	35 MPa
Injection-volume setting range	0.1 to 100 µL (standard), 0.1 to 2,000 µL (option)			
Number of processed samples	175 (1 mL vials), 105 (1.5 mL vials), 50 (4 mL vials) 192 (two 96-well MTP/DWP), 768 (two 384-well MTP/DWP) Also, ten 1.5 mL vials in addition to each of the above.		175 (1 mL vials), 70 (1.5 mL vials), 50 (4 mL vials) 192 (two 96-well MTP/DWP), 768 (two 384-well MTP/DWP) Also, ten 1.5 mL vials in addition to each of the above.	
Injection-volume accuracy	1% max (specified conditions)			
Injection-volume precision	RSD: 0.3% max. (specified conditions, typically 0.2% RSD max)			
Sample Carryover	0.005% max. (specified conditions, typically 0.0025% max)			
Number of repeated injections	30 max. per sample			
Needle rinsing	Set freely before and after sample injection.			
Sample cooler	None		Block cooling/heating, used together with defumidifying function, 4 to 40°C	
Operating pH range	pH1 to pH14			
Operating temperature range	4 to 35°C			
Dimensions, weight	W260 × D500 × H415 mm, 27 kg		W260 × D500 × H415 mm, 30 kg	
Power requirements	AC 110 V, 230 V, 100 VA, 50/60 Hz		AC 110 V, 230 V, 300 VA, 50/60 Hz	

* Prominence UFLC system uses SIL-20AHT UFLC version (228-45132-xx) or SIL-20ACHT UFLC version (228-45133-xx), which has outlet piping optimized for UFLC in standard SIL-20A or SIL-20AC.

Rack Changer II

▸▸▸ P. 8

	Rack Changer II (228-45164-XX)
Compatible plates	96-well MTP, 96-well DWP, 384-well MTP, 384-well DWP, 1.5 mL vial plate (54 vials)
Number of processed plates	12
Sample cooler	Block cooling/heating, used together with dehumidifying function, 4 to 40°C
Operating temperature range	4 to 35°C
Dimensions, weight	W425 × D500 × H415 mm, 32 kg
Power requirements	AC 110 V, 230 V, 350 VA, 50/60 Hz

System Controllers CBM-20A / 20Alite

▸▸▸ P. 10

	CBM-20A (228-45012-XX)	CBM-20Alite (228-45011-38)
Connectable units	Solvent delivery units: 4 max.; Autosamplers: 1; Column ovens: 1; Detectors: 2 max.; Fraction collectors: 1; Sub-controllers: 2 max.	Solvent delivery units: 4 max.; Autosamplers (SIL-10AF/10AP/10Ai): 1; Column ovens: 1; Detectors: 2 max.
Number of connectable units	8 (expansion possible up to 12)	5 (including the unit incorporating the system controller)
Data buffering	Approx. 24 hours for one analysis (at 500-ms sampling rate; available only with LCsolution)	
Event I/O	4 inputs, 4 outputs	2 inputs, 2 outputs
Analog boards	Up to 2 boards can be mounted.	Mounting not supported.
Operating temperature range	4 to 35°C	
Dimensions, weight	W260 × D420 × H140 mm, 5.5 kg	W120 × D100 × H20 mm, 0.5 kg
Power requirements	AC 110 V, 230 V, 100 VA, 50/60 Hz	Supplied from unit

Specifications

Column Ovens CTO-30A

▸▸▸ P. 12

	CTO-30A (228-45160-XX)
Type	Block heating system
Temperature setting range	4 to 150°C in 1°C steps
Temperature control precision	± 0.05°C (room temperature 25°C)
Temperature control range	5°C above room temperature to 150°C
Column size and capacity	150 mmL. × 4.6 mmI.D. column × 2
Devices that can be accommodated	Gradient Mixer, High-Pressure Flow Switching Valves (2), Post Column Cooler etc.
Functions	Linear temperature programs supported
Safety measures	Solvent sensor, Liquid-leakage sensor, temperature fuse, temperature upper limit
Operating temperature range	4 to 35°C
Dimensions, weight	W260 × D500 × H210 mm, 10 kg
Power requirements	AC 110 V, 230 V, 300 VA, 50/60 Hz

Column Ovens CTO-20A / 20AC

▸▸▸ P. 12

	CTO-20A (228-45009-XX)	CTO-20AC (228-45010-XX)
Temperature control method	Forced-air circulation	
Cooling method	None	Electronic cooling
Temperature setting range	4 to 85°C	
Temperature control precision	0.1°C max. (typically 0.04°C max.)	
Temperature control range	10°C above room temperature to 85°C	10°C below room temperature to 85°C
Storage capacity	W220 × D95 × H365 mm	
Storable devices	2 manual injectors, gradient mixer, 2 high-pressure flow-line selection valves, etc.	
Time program	Linear temperature programs supported	
Safety measures	Solvent sensor, temperature fuse, temperature upper limit	
Operating temperature range	4 to 35°C	
Dimensions, weight	W260 × D420 × H415 mm, 20 kg	W260 × D420 × H415 mm, 23 kg
Power requirements	AC 110 V, 230 V, 600 VA, 50/60 Hz	

Photo Diode Array Detector SPD-M30A

▸▸▸ P. 14

	SPD-M30A (228-45196-XX)
Light source	Deuterium (D_2) lamp
Number of diode elements	1024
Wavelength range	190 to 700 nm
Slit width	1 nm, 8 nm
Wavelength accuracy	± 1 nm
Noise	0.4×10^{-5} AU (under specified conditions)
Drift	0.5×10^{-3} AU/h (under specified conditions)
Linearity	2.0 AU (ASTM standard)
Cell	Standard cell: Optical path length: 10 mm, Capacity: 1 µL, Pressure: 8 MPa Optional high-sensitivity cell: Optical path length: 85 mm, Capacity: 9 µL, Pressure: 8 MPa
Functions	Contour output, spectrum library, MAX plotting
Safety measures	Liquid-leakage sensor
Operating temperature range	4 to 35°C
Dimensions, weight	W260 × D500 × H140 mm, 12 kg
Power requirements	AC 110 V, 230 V, 150 VA, 50/60 Hz

UV-VIS Detectors SPD-20A / 20AV
Photodiode Array Detector SPD-M20A

▸▸▸ P. 14

	SPD-20A (228-45003-XX)	SPD-20AV (228-45004-XX)	SPD-M20A (228-45005-XX)
Light source	Deuterium (D_2) lamp	Deuterium (D_2) lamp, tungsten (W) lamp	
Number of diode elements	None		512
Wavelength range	190 to 700 nm	190 to 900 nm	190 to 800 nm
Bandwidth, slit width	8 nm		1.2 nm (high-resolution mode), 8 nm (high-sensitivity mode)
Wavelength accuracy	± 1 nm max.		
Wavelength precision	± 0.1 nm max.		
Noise	0.5×10^{-5} AU (under specified conditions)		0.6×10^{-5} AU (under specified conditions)
Drift	1×10^{-4} AU/h (under specified conditions)		5×10^{-4} AU/h (under specified conditions)
Linearity	2.5 AU (ASTM standard)		2.0 AU (ASTM standard)
Functions	Dual-wavelength detection in the range 190 to 370 nm and upwards of 371 nm, ratio-chromatogram output, wavelength scanning		Contour output, spectrum library, MAX plotting
Cell	Optical wavelength: 10 mm, Capacity: 12 µL, Pressure: 12 MPa		Optical wavelength: 10 mm, Capacity: 10 µL, Pressure: 12 MPa
Cell temperature control range	5°C above room temperature to 50°C		
Web control	—		Parameter setting, log management, management of consumable parts, etc.
Buffer memory	Refer to the information on the CBM-20A/20Alite		Approx. 20 minutes of data in the entire wavelength region (only when using LabSolutions)
Operating temperature range	4 to 35°C		
Dimensions, weight	W260 × D420 × H140 mm, 13 kg		W260 × D420 × H140 mm, 12 kg
Power requirements	AC 110 V, 230 V, 160 VA, 50/60 Hz		AC 110 V, 230 V, 150 VA, 50/60 Hz

* Prominence UFLC and Prominence UFLCXR system use SPD-20A UFLC version (228-45130-xx) which has a semi-micro temperature-controlled flow cell installed for optimization of fast analysis. (Standard type temperature-controlled flow cell is optional for SPD-20A UFLC version.)

Fluorescence Detectors RF-20A / 20Axs

▸▸▸ P. 16

	RF-20A (228-45147-XX)	RF-20Axs (228-45148-XX)
Light source	Xenon lamp	Xenon lamp, low-pressure mercury lamp (to check wavelength accuracy)
Wavelength range	0, 200 to 650 nm	0, 200 to 750 nm
Spectral bandwidth	20 nm	
Wavelength accuracy	± 2 nm	
Wavelength reproducibility	± 0.2 nm	
S/N	Water Raman peak S/N 1200 min.	Water Raman peak S/N 2000 min.
Cell (capacity, pressure resistance, material)	12 µL; 2 MPa (approx. 20 kgf/cm^2); SUS316L, PTFE (fluororesin), quartz	
Cell Temperature input range	—	4 to 40°C, 1°C step
Cell	—	(Room temperature – 10°C) to 40°C (2 mL/minute max. flow rate, 85°C max. oven temperature)
Functions	Any two wavelengths between 200 and 650 nm	Any two wavelengths between 200 and 750 nm
Safety measures	0.5 s per wavelength	
Operational temperature range	4 to 35°C	
Dimension, weight	W260 × D420 × H210 mm, 16 kg	W260 × D420 × H210 mm, 18 kg
Power requirements	AC 110 V, 230 V, 400 VA, 50/60 Hz	

Refractive Index Detector RID-20A

▸▸▸ P. 18

	RID-20A (228-45104-XX)
Refractive index range	1 to 1.75 RIU
Noise level	2.5×10^{-9} RIU max.
Drift	1×10^{-7} RIU/h max.
Range	A mode: 0.01×10^{-6} to 500×10^{-6} RIU, P and L modes: 1×10^{-6} to $5{,}000 \times 10^{-6}$ RIU
Response	0.05 to 10 sec, 10 steps
Polarity switching	Supported
Zero adjustment	Auto zero, optical zero, fine zero
Maximum operating flow rate	20 mL/min (150 mL/min with option)
Temperature control of cell unit	30 to 60°C
Cell volume	9 µL
Cell withstand pressure	2 MPa (cell unit)
Operating temperature range	4 to 35°C
Dimensions, weight	W260 × D420 × H140 mm, 12 kg
Power requirements	AC 110 V, 230 V, 150 VA, 50/60 Hz

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