

LC System

# Prominence-i

*i*-Series Plus



# -Series Plus

The new industry-wide standard LC Systems

 innovative ..... Integrated and Optimized but Expandable

 intuitive ..... Insightful Graphical User Interface

 intelligent ..... Ingenious Onboard Functions Simplify Operation



## Support for Multiple Detectors

The Prominence-i is an LC system that offers expandability to allow the user to select from different detectors depending on the sample components. Basic systems come with the choice of a UV detector or photodiode array (PDA) detector. To this, users can add the RF-20A or RF-20Axs fluorescence detector and the new RID-20A differential refractive index detector for simultaneous analysis of multiple components.

## High-Throughput Performance

Faster processing of larger numbers of analytes is increasingly demanded in the market. The i-Series Plus features increased high-throughput performance. A total of 216 standard vials can be accommodated in 4 individual plates. Ultra fast injection speed with 7 seconds injection time improves cost effectiveness by shortening overall analysis time. Batch analysis can be performed much faster. Cooler function is another added feature that allows analysis of samples below ambient temperature.

## Incomparable Carryover

The i-Series Plus has improved low carryover performance of 0.0025%. Result reproducibility and accuracy are further enhanced.

## Open Access Sample Placement

A direct access mechanism on sample racks, that allows the user to place the sample on racks that are not involved in sample injection even during analysis. Furthermore, racks can be shared by multiple analysts, without interrupting the analysis of samples placed by others. Overall, this function enhances the work efficiency.



## Compact Integrated LC

The i-Series Plus incorporates all of the functions needed for integrated LC analysis. In addition, a width of only 410 mm allows three systems to fit in a space that can only accommodate two systems from other manufacturers. Also, additional detectors will not change the instrument's footprint.





## Easy Operation

The i-Series Plus features a single on/off button to power up/down all components simultaneously. Interactive Graphical User Interface (GUI) offers visual aid to the user from system start-up, system check, method development, running analysis to system shut down. Time required for running an analysis is thus reduced significantly.

## Large-Capacity Column Management

The column oven of the i-Series Plus which can set temperature control between ambient  $-10^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ , can fit three 300 mm long columns or six 100 mm long columns. It also allows the installation of an optional 6-position 7-port flow line selection valve. Analysis can be performed by switching between multiple columns, without having to install different columns for different analytical conditions.

## Quaternary Delivery Pump with Switching

To obtain reliable data, the solvent must be delivered with high reproducibility. The Prominence-i quaternary delivery pump features an automatic pulse correction function and a  $10\ \mu\text{L}$  micro plunger that ensures reliable and accurate gradient delivery even at low flow rates. Installation of additional reservoir switching valve further extends the mobile selection to 7 eluents. The high-performance degassing unit, with an internal volume one-tenth of the conventional product, results in a dramatically shorter wait times for baseline stabilization and mobile phase purging.

## UHPLC Ready

Prominence-i is upgradable to Nexera-i with 66 MPa to perform UHPLC analysis method.

# i ntuitive

## i nsightful Graphical User Interface

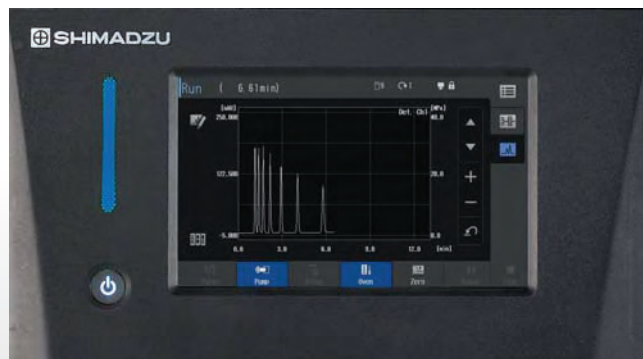
The control and maintenance of multiple analytical systems can be time consuming, so Prominence-i provides an intuitive and simple operating interface that reduces the burden for both operators and administrators.

The controller monitors and displays the operating status of each pump, autosampler, column oven, and detectors. In addition to, the maintenance navigation feature assists the process of replacing consumables, which are also monitored for use throughout the entire system.



## i ntuitive Control of the Entire System with Simple Operations

The system includes a system controller that can display chromatograms, in addition to the status of respective units, such as pump flowrate and pressure, column oven temperature, and detection wavelength. Furthermore, purging mobile phases (auto-purging) when starting up the system, checking how often consumables have been used (system check), and so on, can be performed directly via the touch panel.



## Interactive Communication Mode

Security policies of LabSolutions enable all the operations to comply with GxP regulations. The new feature, Interactive Communication Mode (ICM) enables the operator to edit and start the analysis and batch files from the i-Series Plus. These methods

and batch files are uploaded to LabSolutions synchronously. Routine operations such as purging, column conditioning and etc. can be executed from the i-Series Plus.

### LabSolutions

The direct control can be administrated in accordance with the laboratory policy.



- Method edit
- Start auto purge
- Create batch file
- Start analysis

- Full control
- Operation key lock



### Instrument

Two way communication between LabSolutions and i-Series touch panel enables data acquisition and analysis simultaneously.

## Intuitive Auto-Validation with Self Diagnostic

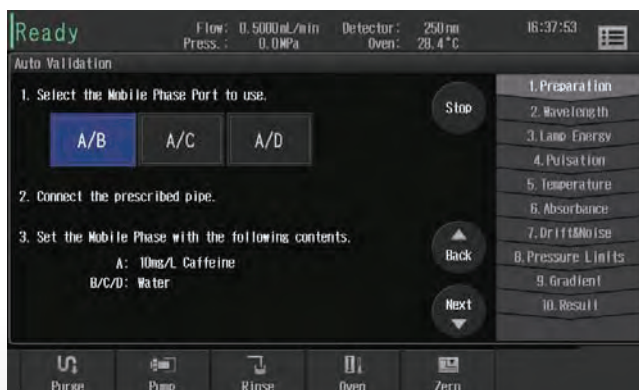
i-Series Plus auto-validation function helps users to set a procedure via the operating screen on the main unit to examine solvent delivery stability, wavelength accuracy, absorbance accuracy, gradient accuracy, the presence of any drift or noise, and other parameters. In addition, a system check function is provided that allows the user to automatically conduct the routine inspection before using the instrument.

A system check report indicates the system's self-diagnostic results, total solvent volume delivered by the delivery pump, and a record of how often consumables have been used, such as the number of

autosampler injections, the number of hours the lamp has been illuminated, and so on. This makes it easy to accurately determine the instrument's operating status.

### Starting Auto Validation

Procedures, mobile phases, and other information necessary for validation are displayed on the screen, which allows the user to perform inspection by simply following the instructions.



## ntuitive Remote Functionality with Web Monitoring

i-Series Plus web monitor can check the operating status from the smart device without using any special software. The basic parameters including, pump status, oven temperature and usage frequency of the consumable parts, can be easily confirmed from the web monitor. Furthermore, remote chromatogram monitoring eliminates the need to return to the laboratory or office for chromatogram inspection.

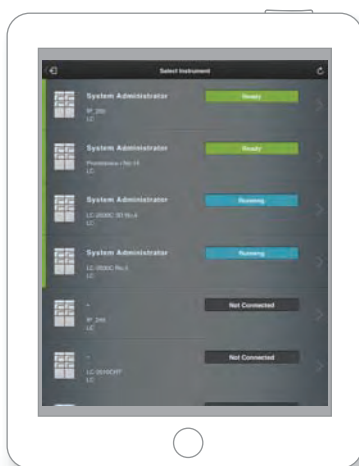


## ntuitive and Smart Control by LabSolutions Direct

LabSolutions Direct is a remote access tool used to control or monitor Shimadzu LC systems, including the i-Series Plus from a smart phone or a tablet computer. Therefore, methods can be

downloaded or a single or batch analyses can be executed even if the computer and LC system are situated in different locations.

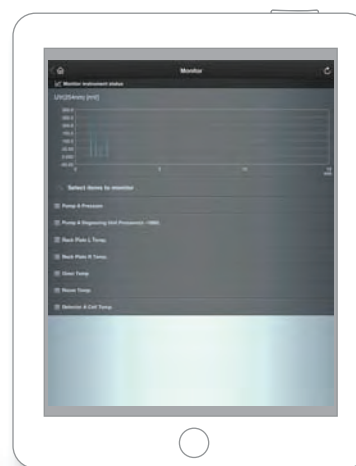
Note: LabSolutions Direct supports controlling or monitoring HPLC systems via LabSolutions LC/GC software.



The operating status of Prominence-i and other LC systems connected to the analytical instrument network can be confirmed.



Any analytical system on the analytical instrument network can be accessed to instruct it to start batch analyses. Analyses can be queued behind batch analyses being performed by other analysts.

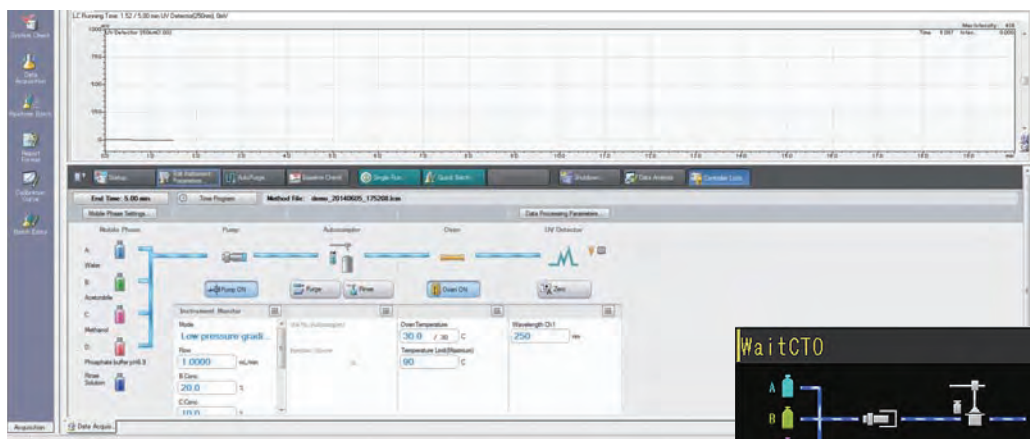


The chromatogram currently being acquired and status information about each unit can also be confirmed via a smart device.

## Uniformity between LabSolutions and System Graphical User Interface (GUI)

The new version of LabSolutions with GUI features the same icons as the LCD display of the i-Series. It has uniformity for usability. Status of the system can be evaluated visually by the icons in the flow diagram. Parameters can be set in the

window associated with the icon of each unit. Unnecessary windows can be closed at the users discretion. Users can view different window templates as per their convenience.



Analytical window of LabSolutions



Touch panel for i-Series Plus

## Quick Batch Function Simplifies Batch File Creation

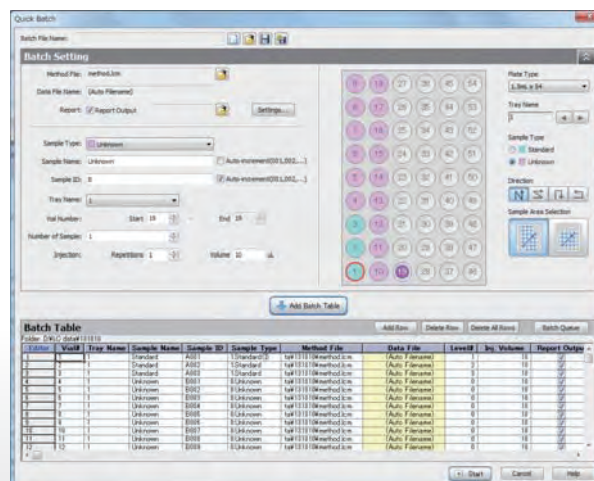
Sample vial numbers and batch sequence can be entered automatically through batch analyses edit window. This function allows the user to create the batch file easily and reduces the risk of incorrect operation.

## Reduction of Data Volume

The Multi-Wavelength Detector mode (on systems with a PDA detector) allows users to use PDA detector as a multi-wavelength scanning device. To reduce the data volume, chromatograms can be obtained at specific wavelengths, up to four channel selections.

## Lock Function Prevents Unintended Parameter Editing or Operations

The i-Series Plus lock function can be activated from the workstation. To help ensure data reliability, locking operations via the touch panel prevents accidental parameters' editing and unintended operation.



Quick batch window



## **i**ngenious Onboard Functions Simplify Operation

System Suitability Test (SST) on device performance ensures that reliable data is obtained. It is a time consuming yet important work especially for a high throughput laboratory. i-Series Plus can perform SST automatically before the start of analysis. This will significantly improve daily work efficiency.



## **i**ngenious Shutdown Function Reduces Power Consumption by over 90%

The shutdown function, which includes stopping the pump, oven temperature and detector lamp are featured in the i-Series Plus. The new shutdown function can turn off the power supply automatically, which reduces power consumption by over 95 percent and is thus eco-friendly. Moreover, the auto

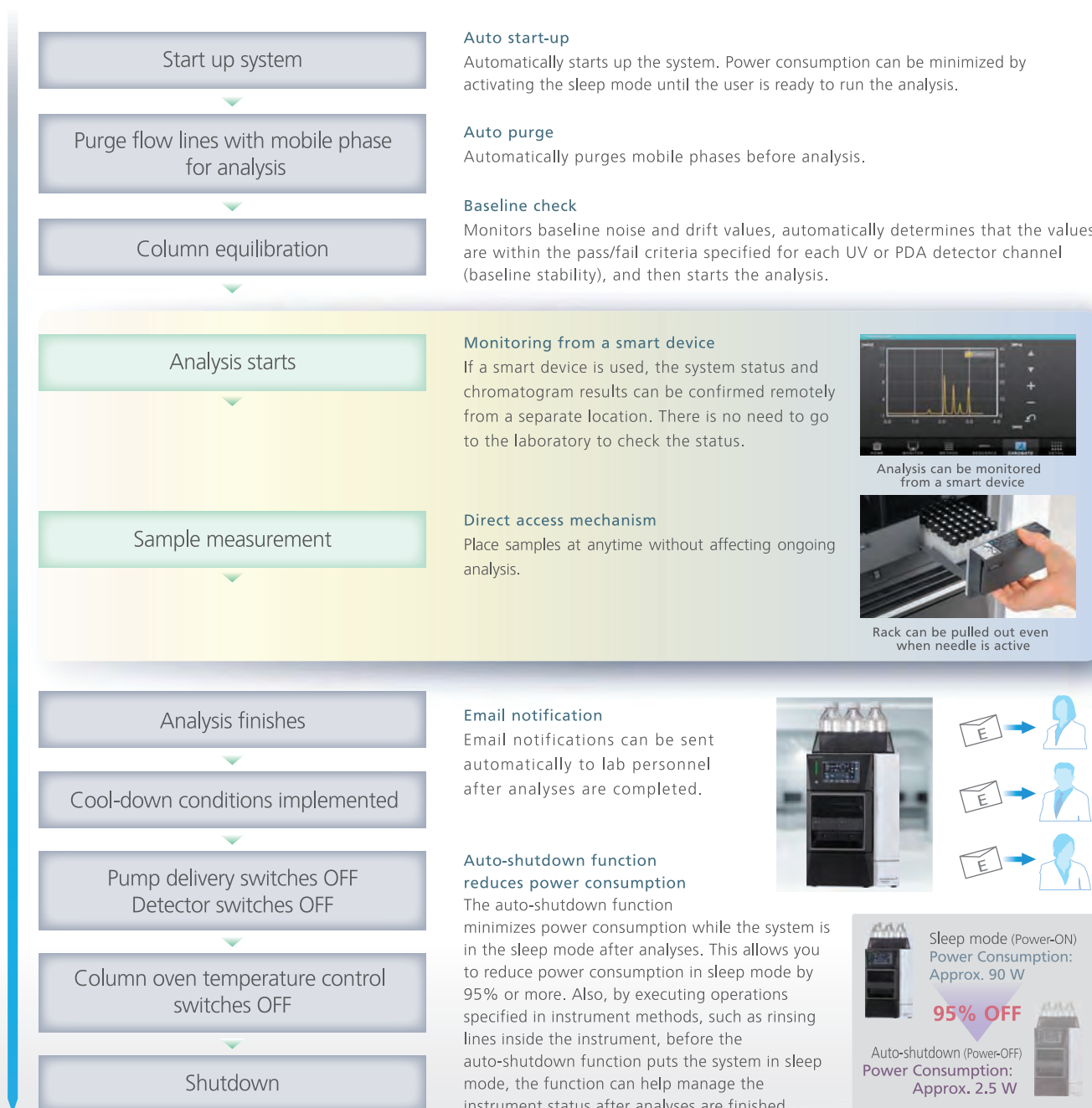
start-up function can turn on power supply at a designated time. Overall, the auto shut down function turns off the power supply after analysis automatically, while the auto start-up function can get the system up and running automatically without the presence of lab personnel.



## ngenious and ECO Friendly

The entire work flow of analysis can be fully automated, from system start-up, mobile phase purging, column equilibration and starting of analysis to shutting down the system. Automatic

pass/fail function determines the validity of the System Conformation Tests. Based on analysis results sample re-injection can be automated for routine analysis operation.



# Using Existing Analytical Methods in the Latest Instruments



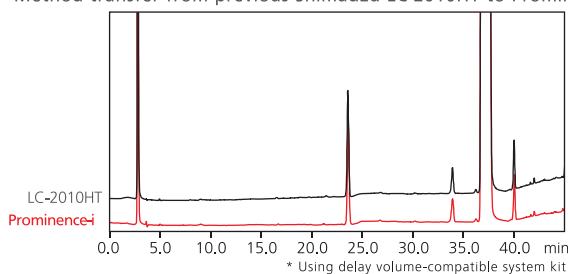
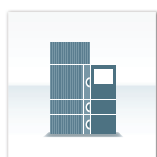
At first glance, an updated model of the same instrument is a sound choice if you wish to continue using existing analytical methods. But technology is always advancing and system performance aspects, such as instrument stability and ease of use, change in ways not apparent in the data. By upgrading to i-Series Plus, you retain compatibility with existing systems, but also acquire substantial improvements in the reliability and stability of your analytical results. i-Series Plus supports the transfer of analytical methods as it relates to both system capacity and software control, and also provides the optimum analytical environment for increasing the speed of analytical methods and other areas of method development.

## Supporting Analytical Method Migration Operations at the Hardware Level

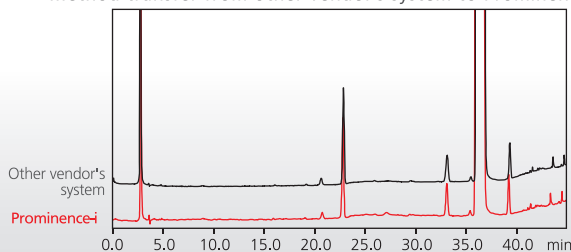
i-Series Plus system capacity is highly compatible with other systems, and analytical methods can be transferred with ease from competitor systems. An optional kit can also be used to make i-Series Plus compatible with Shimadzu's previous LC-2010 series, reducing the work involved in migrating existing analytical methods, and supporting the smooth startup of operations following instrument installation. Based on a given

set of analytical results, the chromatograms below show compatibility between a standard i-Series Plus configuration and a competitor's system, and between the a standard i-Series Plus configuration and a previous Shimadzu instrument (LC-2010) when using the optional kit. The chromatograms show that i-Series Plus has been designed with a high level of compatibility built into its hardware.

Method transfer from previous Shimadzu LC-2010HT to Prominence-i



Method transfer from other vendor's system to Prominence-i

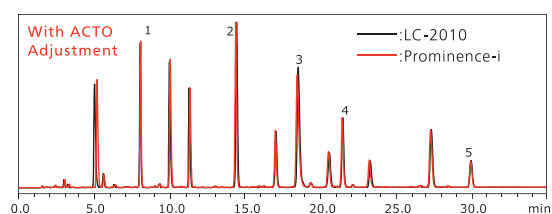
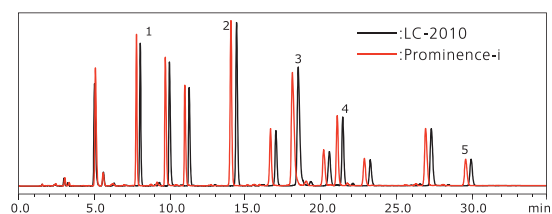


## Compatibility Through Software Control (ACTO)

Say you want to migrate an existing method unaltered but also develop methods using the latest equipment available in the development laboratory. In this situation, the ACTO (Analytical Condition Transfer and Optimization) function can be used. ACTO is the general name given to method transfer/migration tools supplied by Shimadzu. It can be used to adjust gradient start times and allows analysis to be performed without

worrying about the effects of piping volume.

ACTO allows you to adjust gradient timings via simple software settings without having to edit the gradient program itself. As shown below, similar analytical results can be obtained using a method created for a previous system with a larger system capacity and for Prominence-i. This gradient start time adjustment function can be used with all i-Series Plus models.



Using ACTO to Confirm Compatibility of Prominence-i and Previous Shimadzu System (LC-2010HT)

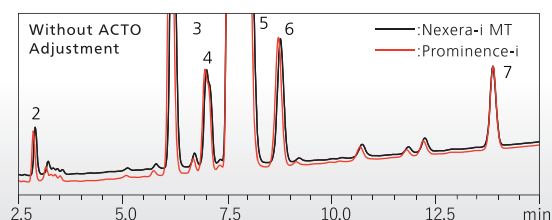
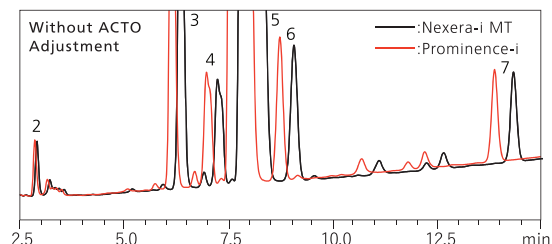
Retention Time Difference (%)

	Without ACTO Adjustment	With ACTO Adjustment
1	-3.13%	0.31%
2	-2.63%	-0.39%
3	-2.08%	-0.38%
4	-1.71%	-0.17%
5	-1.19%	-0.10%

## Utilizing ACTO for US Pharmacopeia-Compliant Method Migration

Maintaining method compatibility during gradient analysis can be difficult due to differences in gradient delay volumes between models. USP <621> allows the use of a gradient start time adjustment function (ACTO) to adjust the initial hold time without the need for revalidation (when adjustments are required, the column packing may be changed

[maintaining the same chemistry], the duration of an initial isocratic hold may be changed [when prescribed], and/or dwell volume adjustments can be made). Even when instrument models have different gradient delay volumes, analysis can be performed in accordance with the US Pharmacopeia without replacing piping, etc



HPLC Conditions

Column : Phenyl silyl silica gel column  
(50 mm L, × 4.6 mm I.D., 1.8 μm)  
Mobile phase A : Water/TFA=2000/3  
Mobile phase B : Acetonitrile/TFA=2000/3  
Flowrate : 1.2 mL/min  
Gradient : B Conc. 40% (0 min) → 40% (3 min) → 51% (16 min)  
Column temp : 30°C  
Injection volume : 10 μL  
Sample : Montelukast sodium

Comparison of Retention Time Difference (%) With and Without ACTO Adjustment

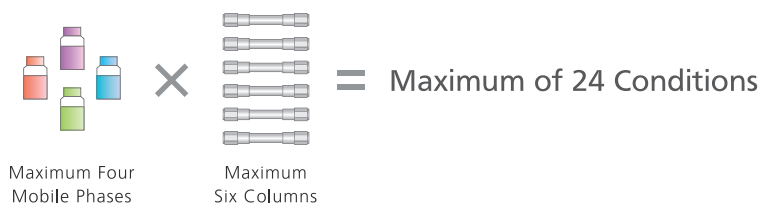
Component	Without ACTO Adjustment	With ACTO Adjustment
1, impurity A	1.3	1.1
2, impurity B	2.7	0.3
3, impurity C, D	3.1	0.2
4, Montelukast Sodium	2.7	-0.1
5, impurity E	2.8	-0.1
6, impurity F	2.5	-0.3

## Utilizing Method Scouting for Method Development

i-Series Plus is now compatible with method scouting systems.\* Attaching a flow line switching valve allows up to six columns and four mobile phases to be switched automatically for analysis and to obtain optimum conditions for separation. Many

i-Series Plus systems are used in manufacturing departments and other areas due to their simplicity, and performing method development with the same system improves the efficiency of method migration operations.

\* Not including Nexera-i MT



### Mobile Phase and Column Database

Preregistering the mobile phases and columns to be used can make it easy to specify method settings. In addition, the database includes a sort function that makes it easy to find the desired mobile phase or column even if a large number have been registered.



### Evaluating Gradient Conditions

An extensive range of gradient patterns, such as isocratic, multilinear, or stepwise, can be specified. Concentration conditions for specific locations can be easily changed and up to 100 gradient patterns can be evaluated.



### Evaluating Mobile Phase and Column Conditions

The estimated analysis end time is displayed based on the specified method and conditions being evaluated. Therefore, condition settings can be specified based on operating plans, such as by adjusting the number of samples or number of injections (both with a maximum of 10).



### Automatic Batch Settings

Batch files are created automatically based on the condition settings being evaluated.

The created batch file can be edited before analysis starts, or analysis the analysis can be automatically started without editing the file. Processes performed after analysis can also be automated by specifying column rinsing and shutdown settings.

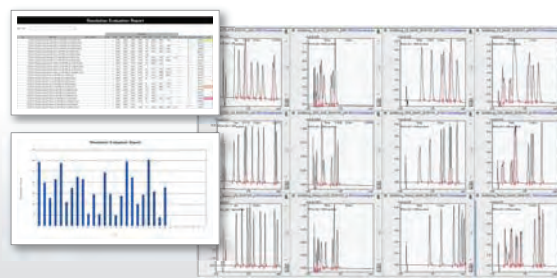
Batch	Time	Mobile Phase	Concentration	Viscosity	Retention Time	Method ID
1	1.0	Water	100%	1.0	1.0	1.0
2	1.5	Water	100%	1.0	1.5	1.0
3	2.0	Water	100%	1.0	2.0	1.0
4	2.5	Water	100%	1.0	2.5	1.0
5	3.0	Water	100%	1.0	3.0	1.0
6	3.5	Water	100%	1.0	3.5	1.0
7	4.0	Water	100%	1.0	4.0	1.0
8	4.5	Water	100%	1.0	4.5	1.0
9	5.0	Water	100%	1.0	5.0	1.0
10	5.5	Water	100%	1.0	5.5	1.0

### Quickly and Immediately Check Results When Analysis Is Finished

Data Browser can be used to display multiple chromatograms by simply dragging and dropping multiple sets of acquired data to the window. This enables quick comparison of the analytical results for more efficient decision-making.

Using the multi-data report function improves the visibility of data when considering a large number of results. It can be used to compare a large number of conditions based on the same criteria, such as resolution and number of peaks, and then to assign values accordingly to determine the optimal conditions.

Results for all the conditions considered can be automatically output as an Excel file, which provides powerful support for medium and long-term data management.



## Analytical Columns that Support Method Development

The scalability of columns used in method scouting is important for method development. Shim-pack GIS/GIST/GISS series columns are available in sizes from 5 mm, suitable for HPLC analysis, to 2 mm, suitable for UHPLC analysis, allowing

smooth transfer of analytical methods obtained by UHPLC method scouting for HPLC analysis. The series is also available with a wide range of modified groups, which are powerful tools in method development.

### Shim-pack GIS Series

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Genuine Ideal Symphony Ideal Generic HPLC Columns

Highly regarded throughout the world, Shim-pack GIS series HPLC columns are packed with high-purity silica gel. A highly uniform pore size ensures a good mobile phase flow path and excellent low pressure performance. Not only can this substantially reduce mobile phase solvent costs, but system load can be reduced. The silica gel surface is uniform and chemical modifications are stable, providing excellent reproducibility.



### Shim-pack GIST Series

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Genuine Ideal Symphony Tenacity Highly Stable, Highly Durable

Shim-pack GIST series columns are packed with high-purity porous spherical silica. Their increased inertness not only improves peak shapes, but also increases durability. The series columns also have a large working pH range (1 to 10), and are designed for ease-of-use during analysis of a wide variety of compounds. Reproducibility between production lots is also excellent, with the series columns recommended not only for quality control and research and development, but also for people just starting out in analysis. This series is available in a variety of pore sizes, which makes it easy to migrate methods between conventional and ultra-high-speed analysis.

### Shim-pack GISS Series

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Genuine Ideal Symphony Speed Robust Inertness, High-Speed Analysis

Shim-pack GISS series columns are designed with the robust inertness and wide working pH range of the GIST series, while also delivering rapid elution times and sharp peaks. Packing surface area, pore size, and chemical modification have been optimized for excellent peak shapes, making these columns ideal for high-sensitivity LC/MS/MS analysis. This series also includes the 1.9 mm and 3 mm HP series for UHPLC analyses.



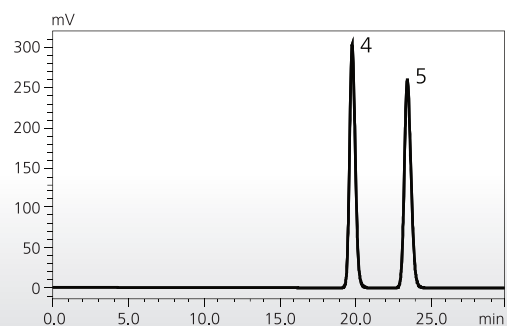
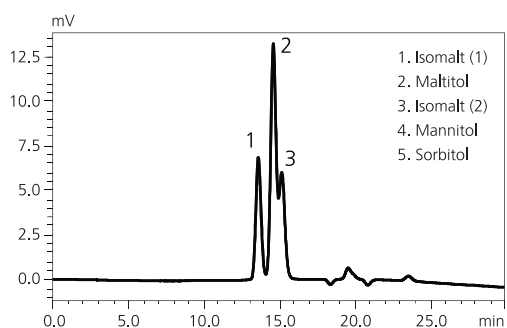
## Greater Efficiency, Greater Ease of Use



i-Series Plus incorporates the technology developed for the Prominence (LC-20A) series, and provides a high level of basic performance with improved ease-of-use. The column oven comes with a larger adjustable temperature range, allowing high-temperature analysis to be performed with ease, while all i-Series Plus models include the automated pretreatment function as standard for sample dilution and co-injection with internal standard substances. i-Series Plus will not only improve analysis throughput, but will also automate human work for improved operational efficiency.

## Reliable Data Acquisition Even During High-Temperature Analysis

The i-Series Plus column oven has a maximum temperature setting of 90°C. Using mannitol analysis as an example, the US Pharmacopeia method notes to control temperature at 85°C for analysis. i-Series Plus can be equipped with a 300 mm long column, and can easily accommodate high-temperature analysis with this column.



System Suitability Test Results

System Suitability Evaluation Items	Target Component	Reference Value	Analysis Results
Retention time	Mannitol	20	19.9
Relative retention time for mannitol	Isomalt(1)	0.6	0.69
	Maltitol	0.69	0.74
	Isomalt(2)	0.73	0.77
	Sorbitol	1.2	1.2
Resolution	Mannitol Sorbitol	2.0	4.8
Relative standard deviation of peak area	Mannitol	1.0%	0.25%



Even though i-Series Plus is equipped with an additional detector, the compact footprint of the system has been preserved.

## Using an Automatic Pretreatment Function to Improve Operational Efficiency

All i-Series Plus models now come with an automatic pretreatment function. By simply entering items on a template, the automatic pretreatment function can perform operations such as automatic sample dilution, reagent addition, and sample co-injection with an internal standard substance. Since

all pretreatment operations are performed by the system, stable results can even be obtained by users unfamiliar with the process, and samples can be analyzed over the weekend or at night without needing human supervision, which promises to achieve substantial improvements in operational efficiency.

## Dilution Function Automates the Process of Calibration Curve Creation to Unknown Sample Quantitation

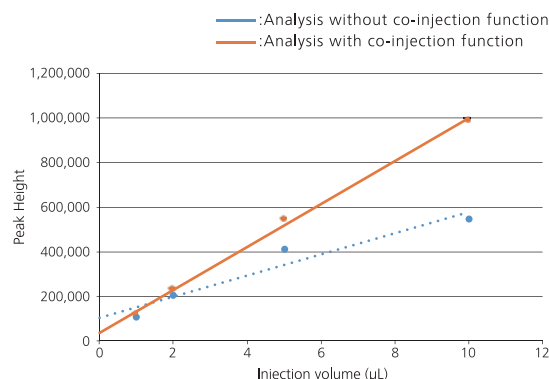
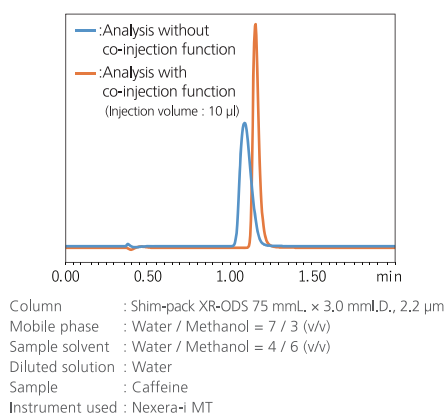
The dilution function can dilute a sample to a specific dilution ratio. As an example, the dilution function can be used to automatically create a calibration curve by simply placing a standard stock sample solution in the autosampler and specifying the desired dilution ratio. It can also be used to analyze unknown samples consecutively, and output reports containing the quantitation results.

## A Co-Injection Function with Various Applications

The co-injection function prevents peak shape degradation by co-injecting the sample and diluted solution together.

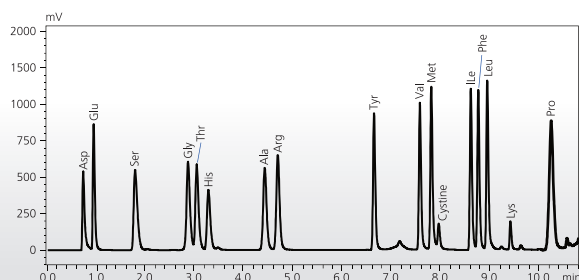
As an example, when the sample solvent is a high-concentration organic solvent, the injection volume can affect the sample solvent and lead to a degradation of peak shape. In these situations, co-injecting the sample and diluting solvent

together can prevent peak shape degradation. This problem is more pronounced the smaller the internal diameter of piping used in the UHPLC system, but the co-injection function allows analysis to be performed without replacing piping.



## Pre-Column Derivatization for Amino Acid Analysis

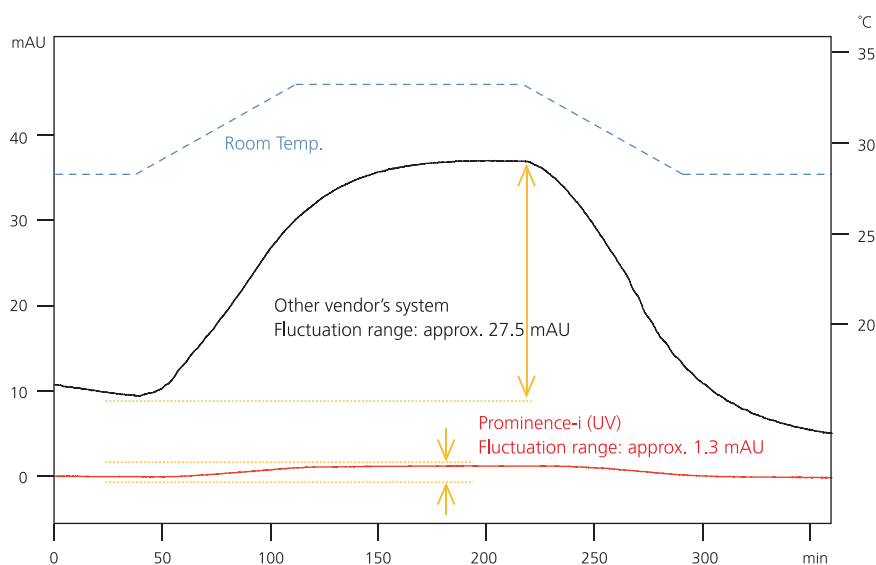
Using the co-injection function allows a sample to be reacted with reagent within the injection needle. The chromatogram below shows the results of using the co-injection function to perform a pre-labeling reaction with amino acid OPA reagent. The entire aspirated sample is delivered for analysis, reducing the sample and reagent volumes required by analysis to a minimum and also allowing for a highly sensitive analysis.



Analytical Conditions  
Column : Raptor ARC-18 2.7 µL(Restek)  
Mobile phase A : 20 mmol/L of phosphate buffer solution  
Mobile phase B : Acetonitrile  
Flow rate : 0.8 mL/min  
Column temp : 30°C  
Detection : Fluorescence  
Sample : 17 amino acid components (15.6 µmol/L)  
Sample injection volume : 1 µL  
Instrument used : Prominence-i

## Excellent Baseline Stability: Dual-Temp Control with TC-Optics and Flow Cells

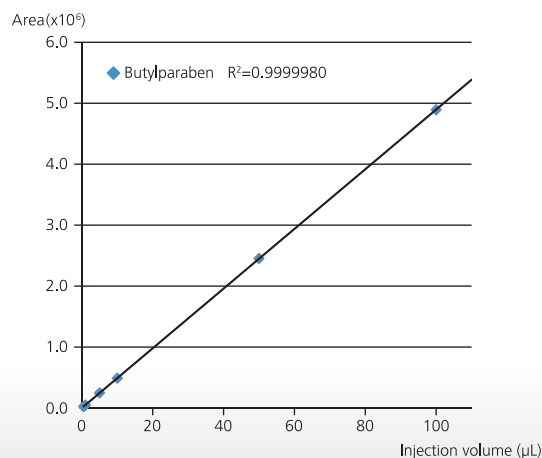
In addition to the temperature control function in flow cells, the i-Series Plus employs new temperature control technology for detector optical systems, known as TC-Optics (Temperature Controlled Optics). Measurement with a stable baseline, hardly affected by room temperature fluctuation, ensures high precision of validation and quantitation tests on trace components.



## Assists Analysis over Wide Concentration Range: Linearity and Reproducibility of Injection Volume

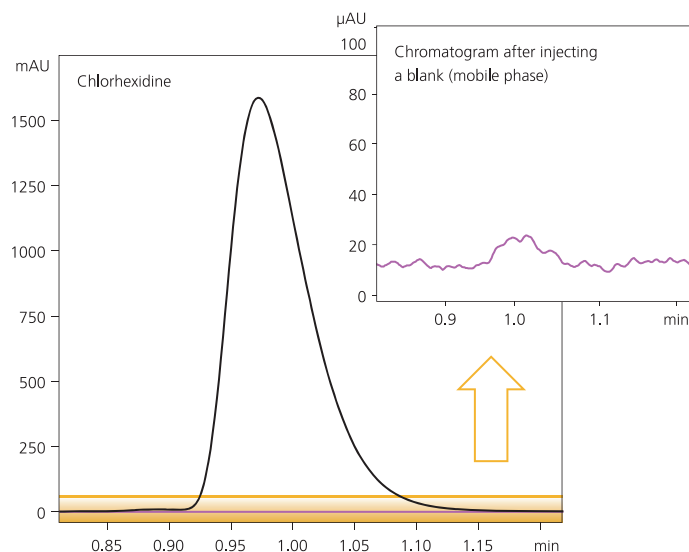
The i-Series Plus provides highly precise data in micro volume injections of 1  $\mu\text{L}$  or less. This system allows the direct injection of the concentrated samples without dilution to save the preprocessing operation. In addition, the superior injection volume linearity improves the reliability of data for a wide range of injection volumes.

Injection Volume ( $\mu\text{L}$ )	Area Reproducibility (%RSD)
0.5	0.121
1	0.076
5	0.020
10	0.006
50	0.006
100	0.006



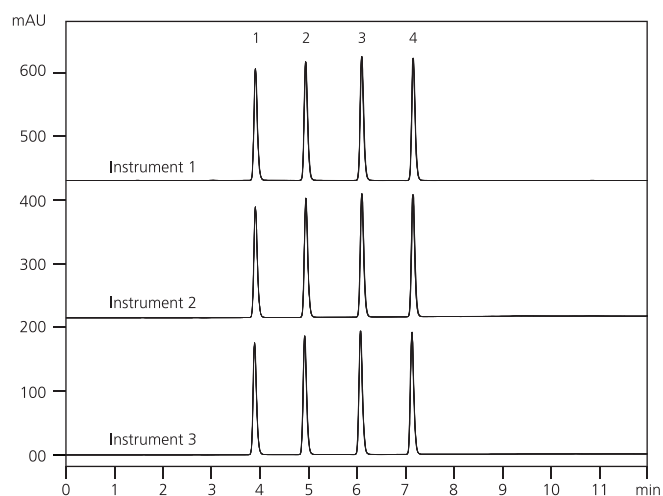
## Ultra-Low Carryover Performance Enables High-Sensitivity Analysis

Due to Shimadzu's proprietary flow channel design, carryover effects from residual samples are reduced to nearly zero. The carryover specification has been improved to 0.0025%, thereby providing highly precise quantitative performance when analyzing a complex sample.



## System-to-System Reproducibility Improves Data Compatibility

In addition to its reproducible performance on a single system, the i-Series Plus's excellent system-to-system reproducibility further improves data reliability. With its unsurpassed performance in areas such as solvent delivery precision, concentration accuracy, and injection volume accuracy, the i-Series Plus is now a new industry standard for global labs.



	Peak 1		Peak 2		Peak 3		Peak 4	
	R. time	Area	R. time	Area	R. time	Area	R. time	Area
Instrument 1	0.031	0.032	0.057	0.065	0.049	0.032	0.055	0.022
Instrument 2	0.044	0.027	0.068	0.018	0.064	0.052	0.053	0.037
Instrument 3	0.054	0.062	0.056	0.035	0.055	0.022	0.043	0.040

Retention time and area reproducibility (%RSD) of each instrument

# Future Proof Applicability

The i-Series Plus enables simultaneous analysis of complex samples by selecting from multiple detectors depending on physical properties of respective components. In addition, a flow line selection valve (option) allows you to set the 3 columns of 300 mm L. or 6 columns

of 100 mm L. A single i-Series Plus system can be used as multiple analytical systems by automatically switching between different mobile phases and column.

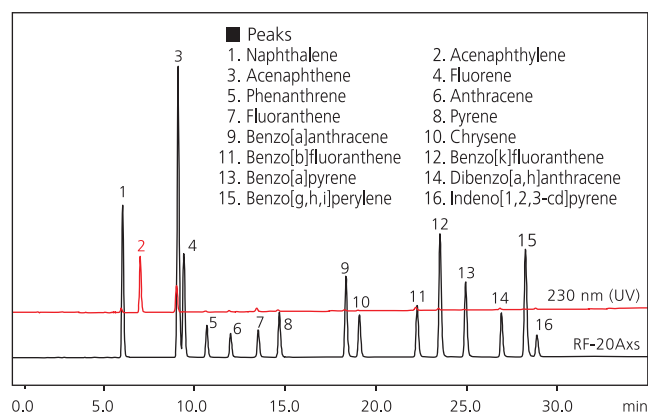
## Combination of UV/VIS and Fluorescence Detectors for Simultaneous Analysis of Polycyclic Aromatic Hydrocarbons

Additionally connecting an RF-20Axs fluorescence detector to a system equipped with a UV detector enables simultaneous analysis of complex samples. Compounds can be analyzed at

optimal wavelengths by specifying analytical conditions that automatically switch the excitation wavelength and fluorescence wavelength based on the retention time of each compound.

### Analytical Conditions

Column	: RESTEK Pinnacle II PAH (250 × 4.6 mmI.D., 4 µm)
Flow rate	: 1.5 mL/min (2-solvent gradient mode)
Column temperature	: 40°C
UV detector	: 230 nm
Fluorescence detector	: On-time excitation/wavelength switching
Sample	: Polycyclic aromatic hydrocarbons



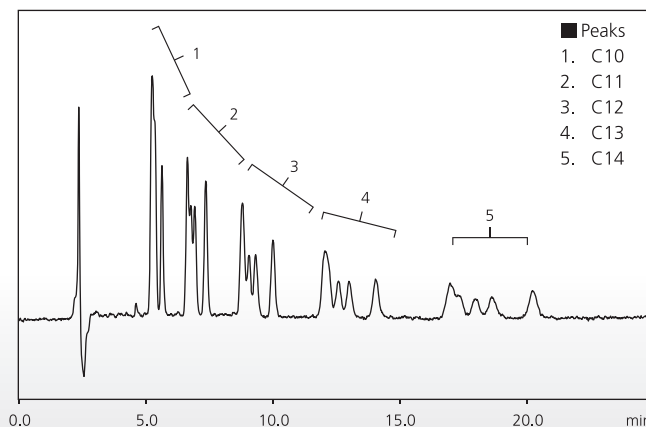
Simultaneous analysis of polycyclic aromatic hydrocarbons

## World's Highest Sensitivity Fluorescence Detector for Analysis of Anionic Surfactants

Combining the system with the RF-20Axs, the most sensitive fluorescence detector in the world, ensures reliable detection and identification of trace components.

### Analytical Conditions

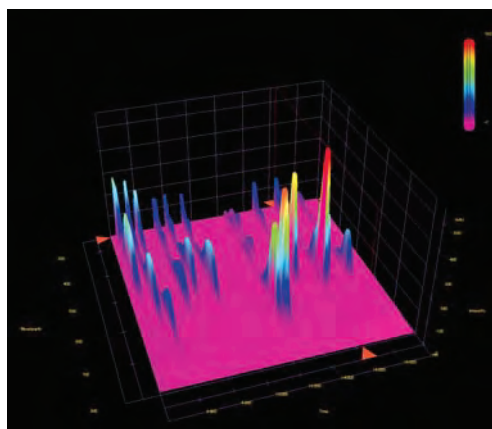
Column	: Shim-pack VP-ODS (250 × 4.6 mmI.D.)
Flow rate	: 1.0 mL/min
Column temperature	: 40°C
Fluorescence detector	: Excitation at 221 nm and fluorescence at 284 nm
Sample	: Drinking water spiked with 0.04 mg/L each component
Injection volume	: 20 µL



High-sensitivity analysis of anionic surfactants (LAS) in drinking water

## PDA detector for Target Components Confirmation Using Absorption Spectrometry

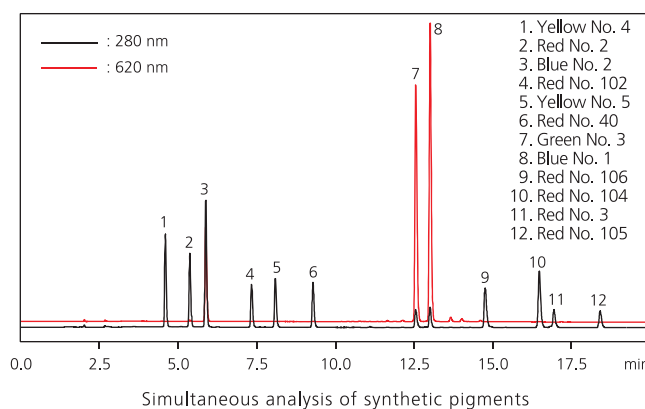
Systems with a PDA detector are ideal for quantitative testing, such as for non-pharmaceuticals, and confirmation testing using absorption spectrometry. In addition to chromatograms from quantitative testing, the three-dimensional data obtained from the PDA detector, in terms of time, absorbance, and wavelength axes, also



### Analytical Conditions

Column	: Shim-pack VP-ODS (150 × 4.6 mmI.D.)
Flow rate	: 1.0 mL/min (2-solvent gradient mode)
Column temperature	: 40°C
Detector	: PDA
Sample	: Standard synthetic pigment sample

enables obtaining absorption spectra for each component from a single analysis and it also allows you to compare purity indices to a standard spectrum. By adding a tungsten lamp (option), synthetic pigments and other substances measured in the long-wavelength region can be detected with high sensitivity.



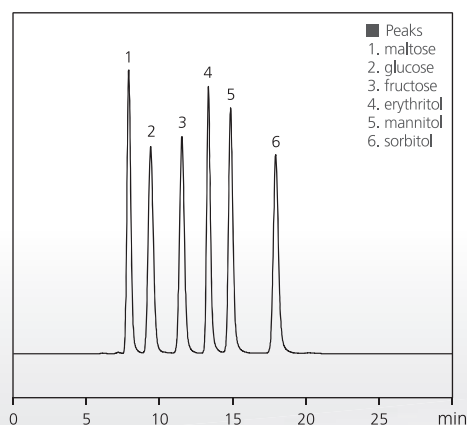
Component Name	S/N at 280 nm	S/N at 620 nm
7. Green No. 3	1113	4997
8. Blue No. 1	1257	6245

## Differential Refractive Index Detector for Analysis of Sugars and Sugar Alcohols

The i-Series Plus column oven can fit three 300 mm long columns and can also be temperature-controlled to 90 °C. Therefore, it supports ligand exchange columns used to analyze sugars and sugar alcohols or long columns required for applications such as GPC analysis.

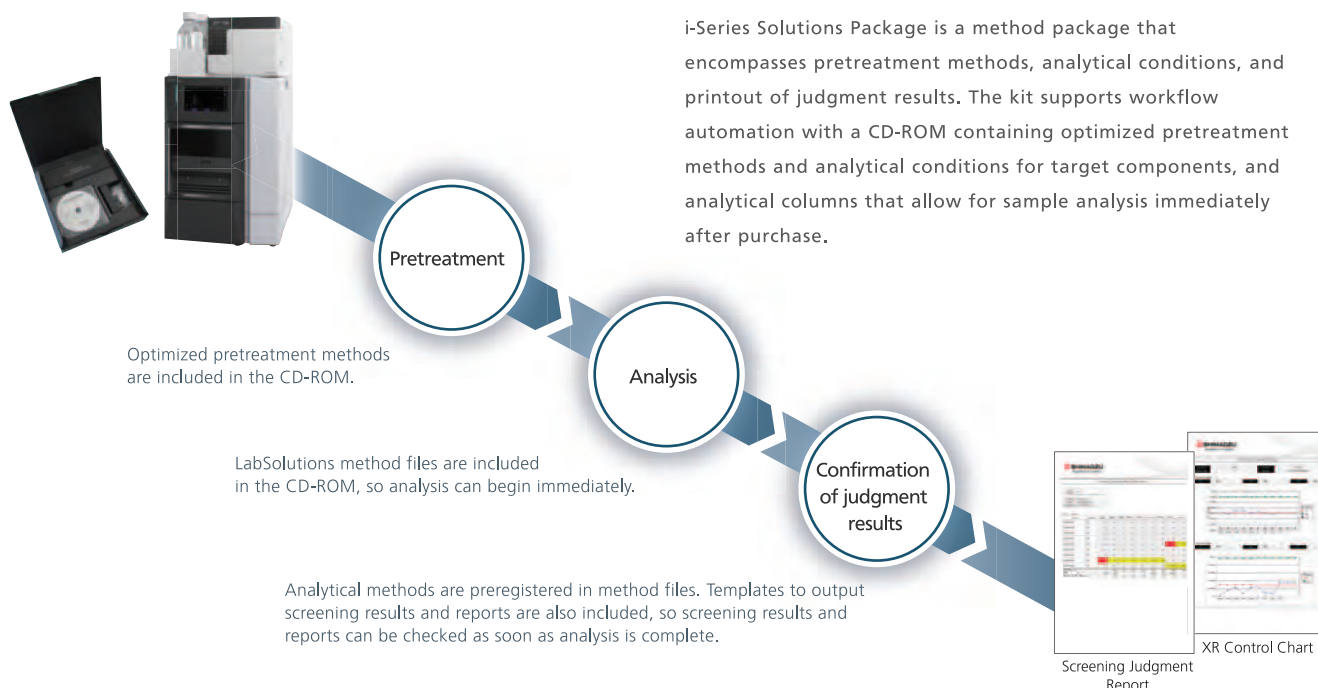
### Analytical Conditions

Column	: Shim-pack SPR-Ca (250 × 7.8 mmI.D., 8 μm)
Mobile phase	: Water
Flow rate	: 0.6 mL/min
Column temperature	: 80°C
Sample	: Standard mixture solution



# Applications Utilizing i-Series Plus

## i-Series Solutions Package

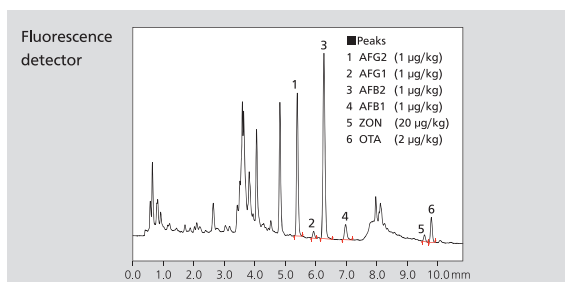


## Mycotoxin Screening System

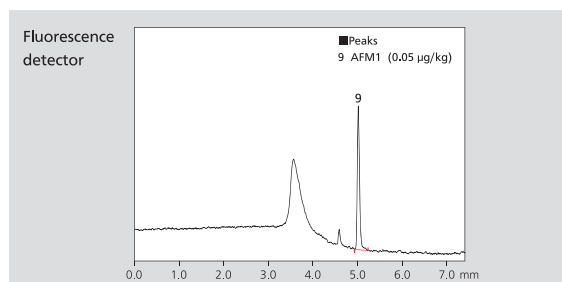
The mycotoxin screening system is a package that can detect mycotoxins with high sensitivity at concentrations specified by EU standards. The package includes pretreatment methods optimized for grains (soft wheat flour and rice flour), milk, and

apples. A troubleshooting section includes considerations for each process step, from extraction to analysis, which helps ensure that reliable data can be acquired even when analyzing samples for the first time.

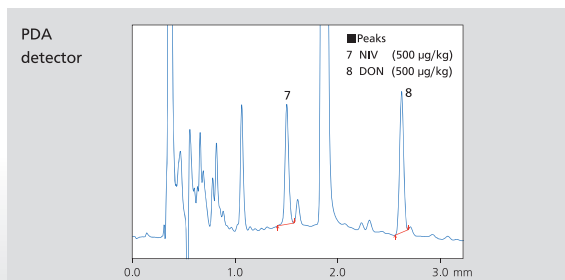
### Grain (Soft Wheat Flour)



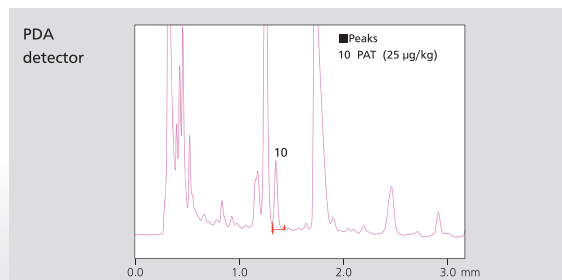
### Milk



### Grain (Soft Wheat Flour)



### Apples



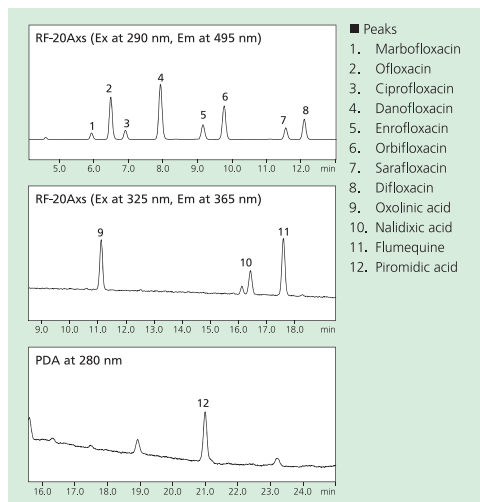
All added mycotoxin concentrations are converted for foods.  
\* For more details, refer to the product catalog or to Application News L512.

## Antimicrobial Screening System

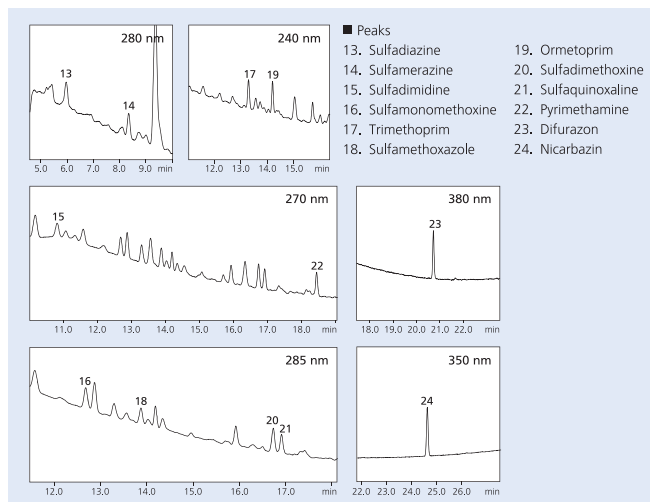
Synthetic antimicrobials are types of veterinary drugs and food additives, and residue levels of these antimicrobials are specified to avoid adverse effects on health. With a pretreatment method that minimizes the influence of

contaminant components in meat (muscles of beef, pork, and chicken), the synthetic antimicrobial screening system enables screening of 24 synthetic antimicrobials in meat that are identified as regulated substances in Japan and Europe.

### Quinolone Agents



### Sulfa Drugs



(A standard solution was added to chicken meat by an amount equivalent to the standard concentration.)

\* For more details, refer to the product catalog or to Application News L509, L510.

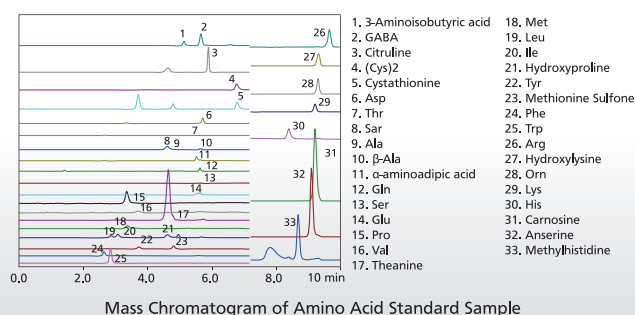
## i-Series Plus as a Front-End for LCMS

Mass spectrometers are used in a variety of sectors, from pharmaceuticals to food. i-Series Plus (LC-2030C LT) features a compact size and the ability to process multiple samples, and combining these strengths with the superior qualitative analytical performance of Shimadzu's single quadrupole LCMS-2020 produces a system that supports powerful quantitative and qualitative analyses.

Amino acids are often a target of analysis in the food sector, but are difficult to detect with UV detectors due to their normally poor light-absorbing properties. Mass spectrometers can easily analyze amino acids, so a LCMS system with excellent ease-of-use can be built by combining a detector-less i-Series Plus model with the LCMS-2020.



Example Combination of a Detector-less Model (LC-2030C LT) and Single Quadrupole Mass Spectrometer (LCMS-2020)





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