C190-E092F

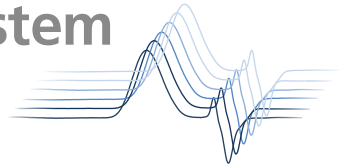
SHIMADZU
Excellence in Science

Gel Permeation Chromatography System

# Nexera GPC System

# Nexera™ GPC System

Gel Permeation Chromatography System



## Analytical Intelligence

ANALYTICAL INTELLIGENCE

- Automated support functions utilizing digital technology, such as M2M, IoT, and Artificial Intelligence (AI), that enable higher productivity and maximum reliability.
- Allows a system to monitor and diagnose itself, handle any issues during data acquisition without user input, and automatically behave as if it were operated by an expert.
- Supports the acquisition of high quality, reproducible data regardless of an operator's skill level for both routine and demanding applications.

# Integrating Analytical Intelligence with Exceptional Instrument Performance

The Nexera GPC System provides highly reliable and highly extensible performance in a wide variety of applications. Hardware provides rapid instrument stabilization and excellent reproducibility of analytical results, while software includes analytical workflow automation and overlap injection functions and features a user-friendly analysis screen view, all leading to higher productivity.

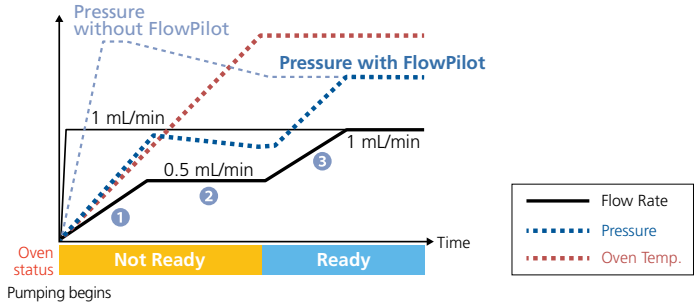
In addition, Analytical Intelligence functionality based on state-of-the-art digital technology provides highly reliable analytical results by preventing potential problems and ensuring the instrument is always in a stable state, regardless of the skill, knowledge, or experience level of the analyst.

# Ensures Highly Reliable Analysis Regardless of an Operator's Skill Level

## Protects Expensive GPC Columns: FlowPilot

ANALYTICAL INTELLIGENCE

HPLC columns can be damaged by sudden pump starts and stops or extreme gradient changes. The Nexera automatically uses FlowPilot (Smart Flow Control) to increase the flow rate gradually to the set point. There is no need to create startup protocols for each analysis.



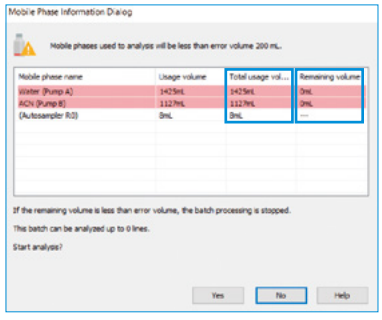

## Mobile Phase Levels Measured in Real Time

ANALYTICAL INTELLIGENCE

Reservoir tray weight sensors (optional) can be used to monitor the volume of mobile phase or autosampler rinse solution in up to twelve* containers. The containers can also be checked remotely from a smart device.

You will no longer need to worry about running out of mobile phase mid-analysis, because the device will notify you before starting the run if the volume remaining is too low.

* Up to 12 solutions can be monitored using 1-liter containers or up to 4 solutions using larger containers (2-liter or up to 5-liter containers).




Checks whether the quantity to be consumed by the analysis is available.

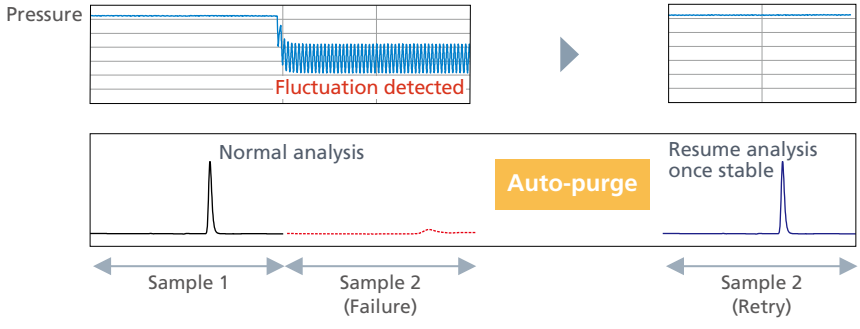
The mobile phase level can even be monitored from outside the laboratory.

## Auto-Diagnostics and Recovery

ANALYTICAL INTELLIGENCE

In rare cases, air bubbles can form in the mobile phase and cause problems if inhaled into the pump. The Nexera has the ability to monitor baseline changes and pressure fluctuations to check for abnormalities.

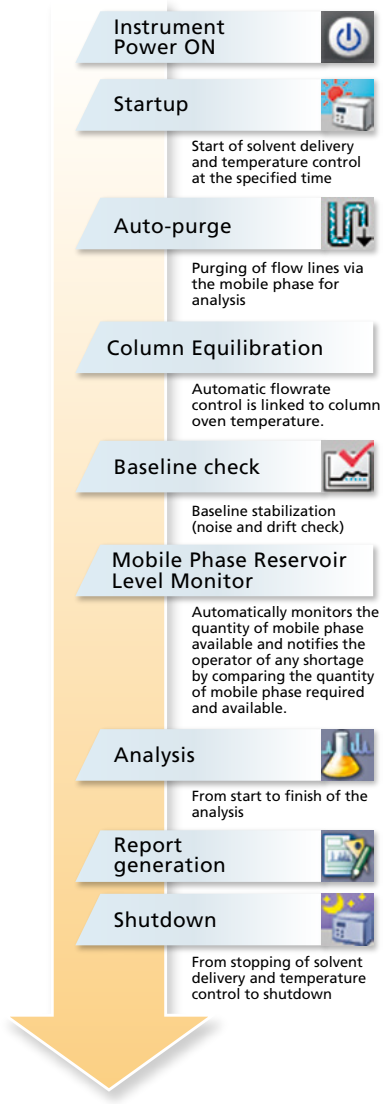
When it detects an unusual fluctuation, it can automatically pause the analysis, purge the flow path, and restart analysis once it has confirmed recovery to normal pressure.



## Automated Workflow

ANALYTICAL INTELLIGENCE

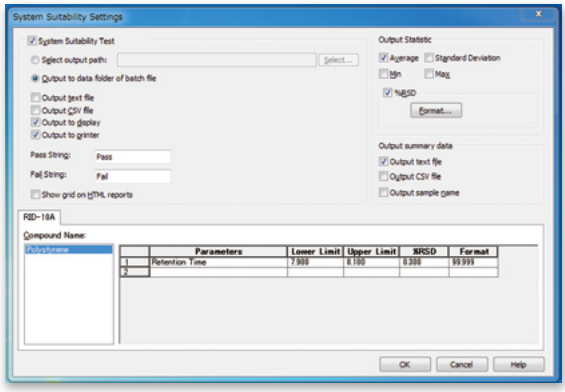
Functionality for assisting the entire series of analytical process steps, from instrument startup to shutdown, significantly increases work efficiency. FlowPilot mobile phase flowrate control functionality is linked to column oven temperature, so that columns are protected during automatic column equilibration. By automatically checking for baseline drift, instrument stability is maintained without the operator having to remain next to the instrument.




## Automated and Easy System Suitability Testing (SST)

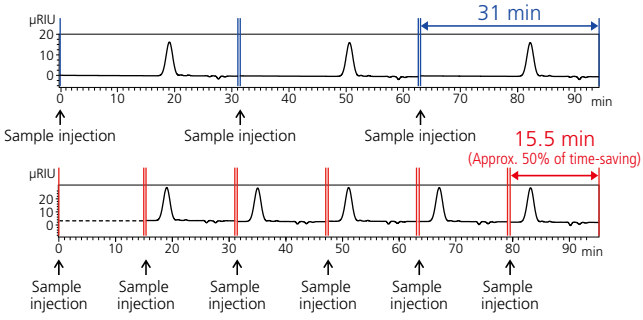
The LabSolutions™ software is designed with a function to use a control sample or standard sample to check system compatibility prior to measurement of an unknown sample.

This function can be included in batch analysis to allow the actual sample to be measured only when a positive test result is obtained. The software can also output test results in text or CSV format.

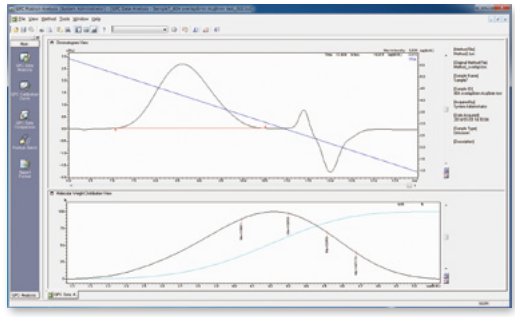



## Shorter Analysis Times — Overlap Injection Function

Using the overlapped injection function, included standard in Nexera autosamplers (SIL-40 series), significantly shortens the time required to analyze multiple samples, which increases throughput.




Example of Using Overlapped Injection to Improve Analysis Cycle Time by About 50%



As with normal analysis, molecular weight can be calculated from the analysis window.

# Assembling Elements Demanded in GPC Analysis

## Excellent Reproducibility in Molecular Weight Distribution Analysis

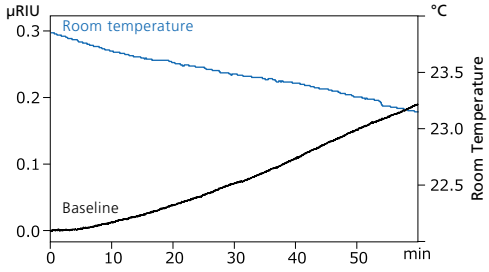
For the analysis of molecular weight distribution, since the molecular weight of compounds eluted between the exclusion limit and permeation limit are considered an exponential function of elution time (calibration curve), even a small variation in elution time causes a substantial change in the result.

The Nexera GPC System utilizes high-speed micro-plunger actuation and automatic pulse compensation to provide pulse-free solvent delivery and excellent elution time reproducibility.

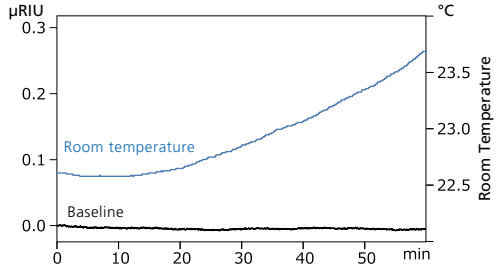
## Excellent Stability Maintained Even During Subtle Changes in Room Temperature

Nexera series detectors feature outstanding temperature-control functionality that provides superior baseline stability.

Since differential refractive index detectors are particularly sensitive to room temperature fluctuations, the RID-20A detector features dual temperature-controlled optics to ensure superior baseline stability by minimizing the effects of slight temperature changes.




RID-20A Without Cell-Temperature Control



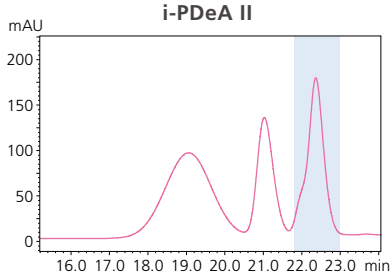

RID-20A Cell Temperature Controlled at 40°C

## Identifying Unseparated Additives as Single Peaks

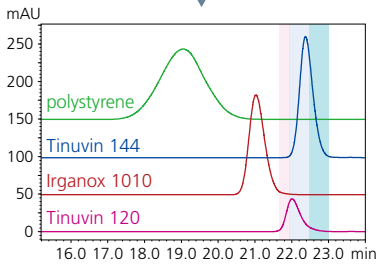
ANALYTICAL INTELLIGENCE

If LabSolutions software is used with a PDA detector, then peak convolution functionality (i-PDeA II) based on MCR-ALS (multivariate curve resolution alternating least square) analysis can be used to qualitatively and quantitatively identify peaks that are not completely separated by the column.

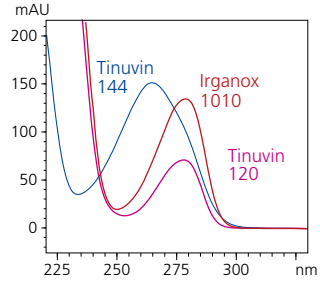
Peak convolution can also be used to confirm the purity of target peaks.




The smaller peak is normally impossible to extract




i-PDeA II chromatogram identifies the two separate peaks




Spectrum Analysis with i-PDeA II

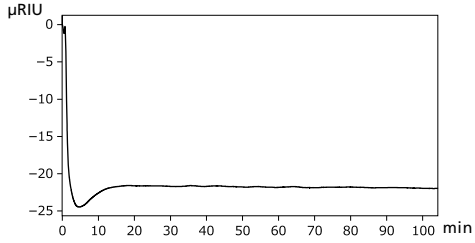
# The RID-20A Differential Refractive Index Detector Allows Productivity Improvements in GPC Analysis

Inheriting the stability and extensibility that are the strengths of the Prominence series, the new RID-20A differential refractive index detector is designed with a new reference-cell auto-purge feature and validation support function that dramatically improve GPC analysis productivity.

## Reduced Stabilization Time and Improved Baseline Stability: After 30 Minutes Power ON

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.

The stable baseline ensures reliable molecular weight distribution analysis.




Elapsed Time After Power ON

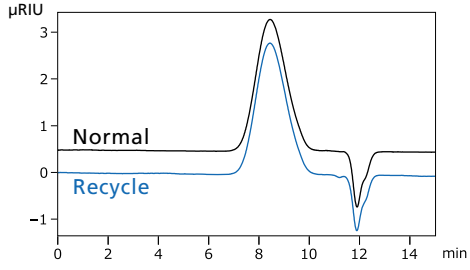
## 30%* Savings in Solvent Usage and Reduced Environmental Burden

The amount of mobile phase consumed can be saved by returning column eluate to the mobile phase bottle during intervals when no component peaks are eluted. This reduces the cost of analysis per sample and mitigates the environmental impact.

The recycle valve kit can be attached to the RID-20A and the SPD-40/40V.

When performing a 15-minute analysis 50 times (flow rate: 1 mL/min)

Without recycle valve kit ... 750 mL
With recycle valve kit ... 500 mL
→ Mobile phase usage reduced by approx. 30%* (* under specified conditions)

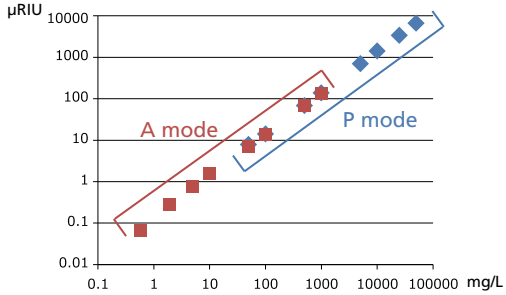



The use of the recycling valve cannot affect the baseline and the peak shape.

## Shimadzu's Proprietary Technology Supports Highly Sensitive Analytical 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) |

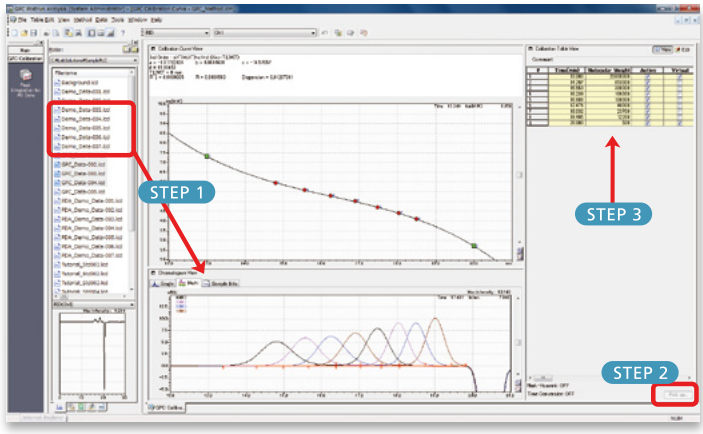



Conc. of Sucrose

# 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.

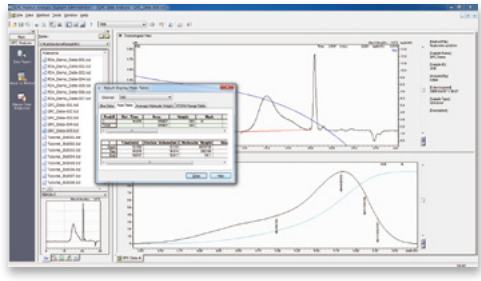
STEP 2 Load the retention times.

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

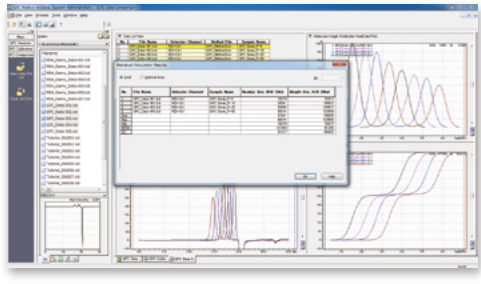


Because the molecular weight distribution curve is updated whenever peak integration is performed, results for mean molecular weight, intrinsic viscosity, polydispersity, and other parameters can be confirmed immediately.

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

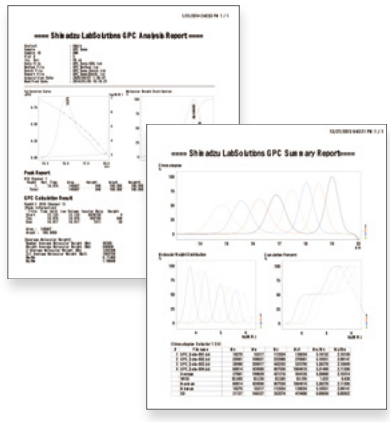
- The elution curves and derivative and integrated molecular weight distribution curves for up to 10 samples can be overlaid on a graph.
- Statistical results can be displayed for mean molecular weight, intrinsic viscosity, and polydispersity.



## Diverse Range of Report Formats

LabSolutions is equipped with report templates for a variety of analysis results. The software can accommodate a diverse range of reports thanks to a wealth of report items and a highly flexible layout.

In addition, a PDF output function is included as standard, so analysis results reports can be managed by automatic import to a database, helping your laboratory to go paperless and promoting an eco-friendly analysis process.

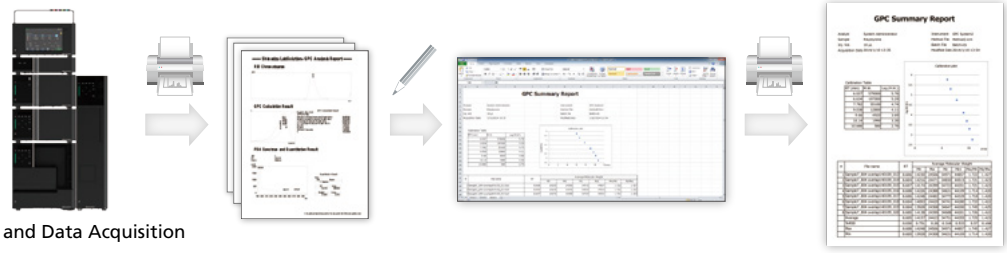


## Reduce the Work Involved in Creating a Final Report

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.

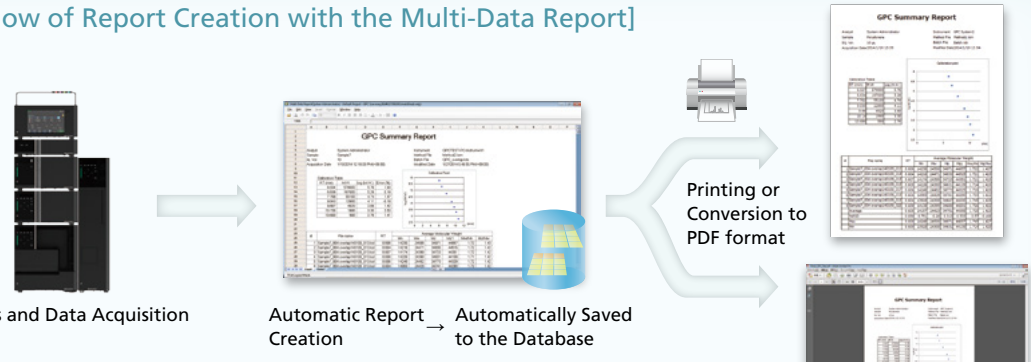
### [Conventional Workflow for Report Creation]




Transfer of results reports to a spreadsheet program

- Time and effort associated with transfer tasks, entry errors, and double checking
- Problems of paper/file management
- Time and effort associated with regular verification work

### [Workflow of Report Creation with the Multi-Data Report]



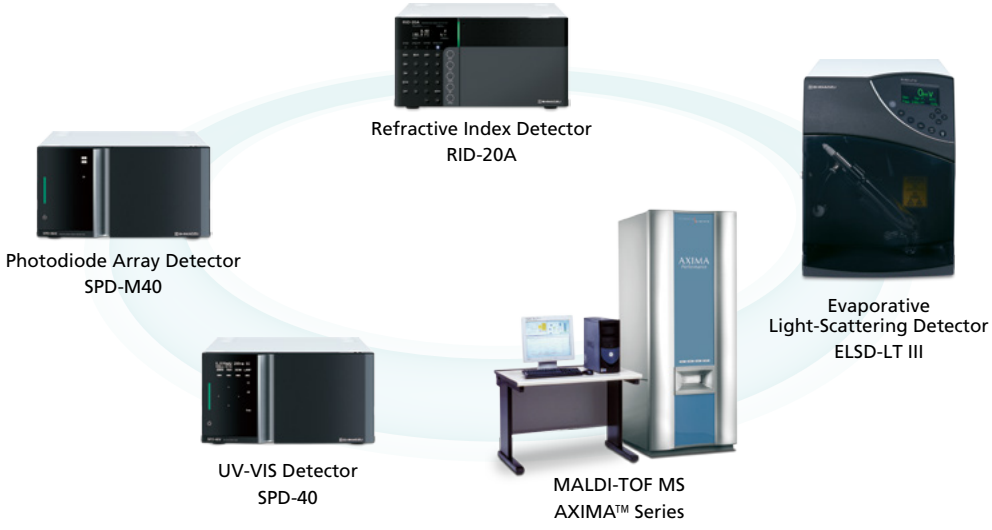

Transfer of results is unnecessary

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

# Superior Extensibility of the Nexera Series

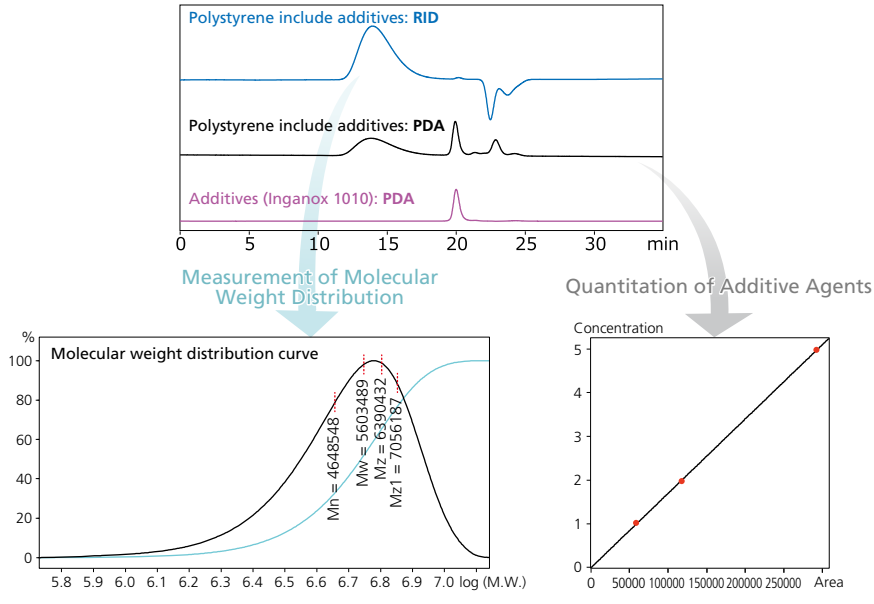
## Choose a Detector Designed to Your Objectives

A lineup of detectors is available, comprising the RID-20A differential refractive index detector, photodiode array detectors, UV-VIS detectors, and evaporative light-scattering detectors. Select the detector according to application, from organic solvent-based GPC applications for analysis of industrial polymers to water-based GPC applications for analysis of biopolymers. Also, using AccuSpot™ allows you to construct an automated analysis system capable of easy online processing—everything from GPC separation to MALDI-TOF MS measurement.




## Perform Diverse Analyses Within a Single Measurement

Using a differential refractive index detector together with a photodiode array detector enables high-sensitivity detection of peaks that are indistinct when analyzed with the differential refractive index detector alone. This makes it possible not only to measure molecular weight distribution, but also to identify and quantitate additive agents and impurities contained in polymers, all in a single analysis.



# Shim-pack™ GPC Series Columns for GPC Measurement

CoreFocus

Shim-pack GPC series columns include polystyrene polymers with different degrees of cross-linking, optimized based on target molecules, from polymers to oligomers.

## Shim-pack GPC-800 Series High-Performance GPC Columns

### For use with tetrahydrofuran (800 Series)

| P/N | Product Name | Exclusion Limit Molecular Weight (polystyrene) | Size (length × inner diameter, mm) |
|---|---|---|---|
| 228-20803-91 | Shim-pack GPC-801 | $1.5 \times 10^3$ | 300 × 8.0 |
| 228-20804-91 | Shim-pack GPC-802 | $5 \times 10^3$ | 300 × 8.0 |
| 228-20805-91 | Shim-pack GPC-8025 | $2 \times 10^4$ | 300 × 8.0 |
| 228-20806-91 | Shim-pack GPC-803 | $7 \times 10^4$ | 300 × 8.0 |
| 228-20807-91 | Shim-pack GPC-804 | $4 \times 10^5$ | 300 × 8.0 |
| 228-20808-91 | Shim-pack GPC-805 | $4 \times 10^6$ | 300 × 8.0 |
| 228-20810-91 | Shim-pack GPC-80M (Mixed gel) | $2 \times 10^7$ | 300 × 8.0 |
| 228-20812-91 | Shim-pack GPC-800P | Guard column | — |

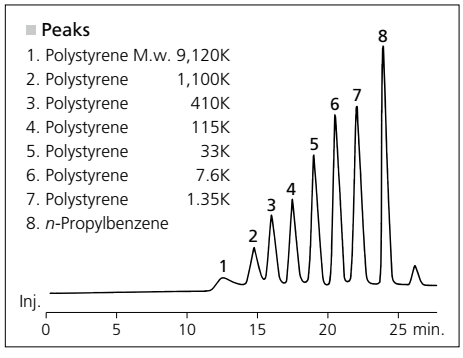
* Please refer to the below URL and QR code when you use other organic solvent such as chloroform. This guide page explains a compatible column which is usable for your analysis and how to exchange the shipping solvent (contained in a new column) for the Shim-pack GPC series to a different solvent required for analysis.

https://www.shimadzu.com/an/products/liquid-chromatography/hplc-consumables/shim-pack-gpc-series/features.html#anchor_1

## Shim-pack GPC-80M Mixed Gel Column

Shim-pack GPC-80M is a mixed gel column capable of analyzing samples over a wide range of molecular weight distributions.

**Analysis of Polystyrene Standard**




**Conditions**

Column : Shim-pack GPC-80M (2 columns in series) (P/N: 228-20810-91)
Mobile phase : Tetrahydrofuran
Flow rate : 1.0 mL/min
Column temp. : Ambient
Detection : UV 254 nm

## Shim-pack GPC-2000 Series Preparative Columns

Shim-pack GPC-2000 Series are dedicated to preparative LC of tetrahydrofuran and chloroform. They ensure separation efficiency comparable to analytical columns as well as large preparative capacity.

## Nexera GPC System Standard Configuration

| P/N | Description | Model | Qty |
|---|---|---|---|
| 228-65502-58 | System Controller | CBM-40*1 | 1 |
| 228-65002-58 | Solvent Delivery Unit | LC-40D | 1 |
| 228-65018-58 | Degassing Unit | DGU-403 | 1 |
| 228-65101-58 | Autosampler | SIL-40C | 1 |
| 228-71762-46 | Vial plate 1.5 mL | | 2 |
| 228-67723-42 | Solenoid valve for drain (PTFE) | | 1 |
| 228-65202-58 | Column Oven | CTO-40C | 1 |
| 228-65306-58 | Refractive Index Detector | RID-20A | 1 |
| 228-65508-58 | Reservoir Tray | | 1 |
| 228-53184-54 | SUS Piping (I.D. 0.3 mm × 600 mm) | | 2 |
| 228-70247-42 | 40 Series Wiring Kit, B | | 1 |
| — | Power cable | | 1 |
| — | Power outlet unit | | 1 |
| 228-57647-43 | Hand Tool Kit | | 1 |
| 228-38583-42 | Glass Reservoir Bottle, w/ Cap, 5 pcs | | 1 |
| 228-77057-41 | Bottle cap for GPC | | 2 |
| 228-65525-58 | Mobile Phase Monitor (Controller) | | 1 |
| 228-65526-58 | Mobile Phase Monitor (bottle holder) | | 1 |
| 074-83019-01 | Mobile Phase Monitor AC Adapter | | 1 |
| — | Analysis column | Shim-pack GPC Series*2 | — |
| 223-62700-92 | LC Workstation | LabSolutions*3 | 1 |
| 223-19189-92 | GPC Software | LabSolutions GPC Software*4 | 1 |

*1 : The CBM-40Alite (228-65501-58) and SCL-40 (228-65500-58) can also be chosen.
*2 : Choose according to the range of molecular weights to be measured.
*3 : A printer and cable are required separately.
*4 : LabSolutions DB GPC software (223-13812-92) and LabSolutions CS GPC software (223-18995-92) can also be chosen.

* The addition of the dedicated HFIP kit may be required depending on the mobile phase composition. Please contact the Shimadzu sales staff for further information.

## Nexera GPC System Standard Specifications

| Item | Specifications |
|---|---|
| System configuration | Modular |
| Measurement method | Single Flow |
| Mobile phase delivery method | Parallel Double Plunger |
| Mobile phase flow rate setting range | 0.0001 to 10.0000 mL/min |
| Mobile phase flow rate accuracy | No more than 1% or 2 µL/min, whichever is greater (0.01 to 2 mL/min) |
| Mobile phase flow rate precision | No more than 0.06% RSD or 0.02 min SD, whichever is greater |
| Mobile phase degassing method | Vacuum membrane |
| Degassing line flow rate | 400 µL |
| Sample injection method | Variable loop weighing |
| Sample injection volume setting range | 0.1 to 100 µL (standard) |
| Number of samples processed | 162 (1.5 mL vials) |
| Column temperature control method | Forced Air Circulation |

| Item | Specifications |
|---|---|
| Column temperature control range | (Room temperature + 10°C) to 85°C |
| Detector noise | $2.5 \times 10^{-9}$ RIU max. |
| Detector drift | $1 \times 10^{-7}$ RIU/h max. |
| Detector cell volume | 9 µL |
| Detector cell temperature control range | 30 to 60°C |
| Calibration curve approximation formulae | Linear, 3rd-order, 3rd-order + hyperbolic curve, 5th-order, 5th-order + hyperbolic curve, 7th-order, 7th-order + hyperbolic curve, or broken line |
| Calibration curve correction functions | Internal standard correction, Q-factor, RID sensitivity correction |
| Peak Integration | Automatic processing according to parameter settings. (Manipulation possible) |
| Molecular weight calculations | Mn, Mw, Mz, Mz1, Mv, Mw/Mn, Mv/Mn, Mz/Mw, and intrinsic viscosity |
| Data output | ASCII format |



SHIMADZU

Shimadzu Corporation

**www.shimadzu.com/an/**



© Shimadzu Corporation, 2024 / First Edition: June 2014, 3655-03401-PDFNS, C190-E092F