C146-E442A

SHIMADZU
Excellence in Science

Liquid Chromatograph Mass Spectrometer

LCMS-2050

UFMS
ULTRA FAST MASS SPECTROMETRY

SIMPLY EFFORTL

Seamless integration with LC by design

Superior detection for added confidence

Streamlined operation for cost efficiency

LCMS-2050

Liquid Chromatograph Mass Spectrometer

The LCMS-2050 provides both high speed and high sensitivity analysis even in a small design. We have achieved the utmost in both miniaturization and high performance with Shimadzu's technology cultivated over many years of MS development. A single platform, a single solution for LC detection, the LCMS-2050 has the power to deliver better results with incredible simplicity and unparalleled robustness. It may be small but the design and capability of the new single quadrupole LC/MS will change the productivity of any analytical laboratory.

LESS

Seamless integration with LC by design

To simplify its use as the ultimate LC detector, the LCMS-2050 features uncompromising instrument design, instrument control, and data analysis.

Nexera™ series

Seamless Connectivity with Shimadzu LC Systems

The small footprint of the LCMS-2050 creates the flexibility to adapt to different needs. As with other LC detectors, It can be integrated into any Shimadzu LC architecture whether it is a high throughput analytical system, a preparative LC with fraction collection, or even a legacy model.

i-Series

Nexera Prep

Quick Startup

The vacuum system is ready in as little as 6 minutes, enabling rapid mass data acquisition after a power interruption. The system can be accessed as if it were an LC that you simply turn ON and use.

Easy Parameter Settings for Seamless Operation

Mass spectrometers are often considered difficult to use, but the advanced engineering of the LCMS-2050 makes it as simple to use as other LC detectors. Only the simplest of acquisition parameters are required to obtain reliable and sensitive detection.

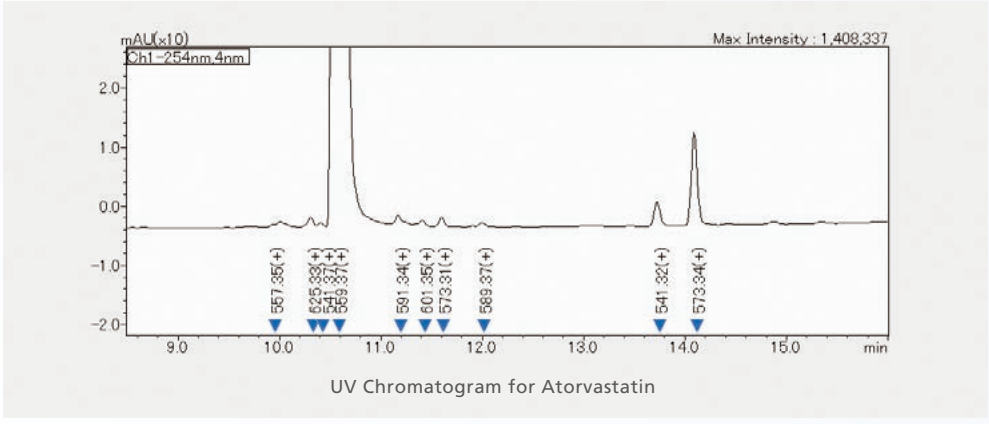
Adding MS to Complement and Confirm Optical Detection

UV-PDA and MS are orthogonal technologies each having their own strengths. MS detectors are generally more sensitive than optical detectors, and moreover enable selective detection of compounds by their masses. For this reason, MS detectors can detect co-eluting compounds as well as many analytes which do not respond to UV detection. The LCMS-2050 is a valuable addition to any LC system to help increase reporting confidence.

Mass-it™ (Mass signature impartment technology)

ANALYTICAL INTELLIGENCE

Mass-it is a new invention for displaying mass information that helps scientists to grasp complex data at a single glance. It detects and overlays signature mass information onto the LC-UV or the LC-PDA chromatogram. This makes it possible to spot where there are multiple components co-eluting in a single UV peak and where there are 'hidden' components without UV absorbance. All in a single click, at a single glance.



UV Chromatogram for Atorvastatin

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.

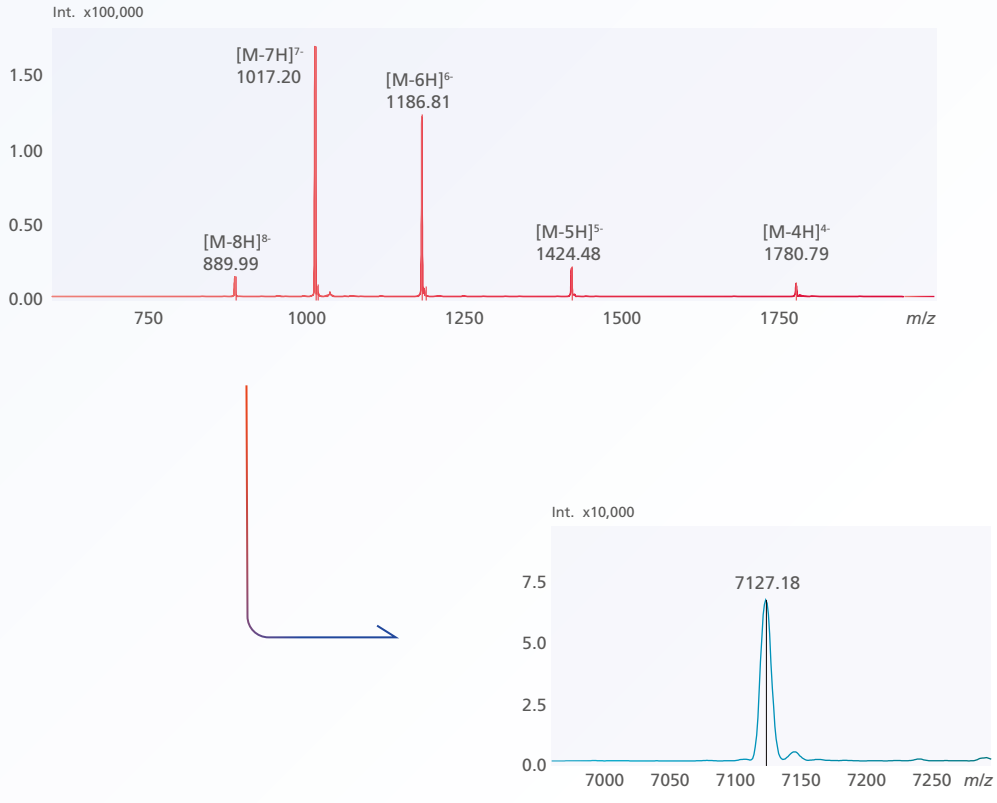
Superior detection for added confidence

High-speed performance is a hallmark of Shimadzu LCMS detectors, and the LCMS-2050 is no exception. Industry leading scan speeds and polarity switching speed have now been incorporated into a miniaturized single quadrupole LCMS instrument in addition to excellent ionization capability and a wide mass range.

Wide Mass Range

The wide mass range of the LCMS-2050 is a powerful tool for molecular weight determination of large molecules such as oligonucleotides, peptides, proteins, polymers, and more. As an example, analysis of an antisense oligonucleotide, nusinersen, on the LCMS-2050 results in the detection of a series of deprotonated ion peaks of charge states -4 to -8 from *m/z* 890 to 1781. Using the deconvolution function of LabSolutions™ LCMS (pages 12-13), the molecular weight of nusinersen is estimated to be 7127.18 at an accuracy of 0.05 Da error to the theoretical value(7127.23). The wide mass range is beneficial for this type of analysis as including more peaks for deconvolution generally results in a more reliable computation of the molecular weight.

Nusinersen Mass Spectrum and Deconvolution Results



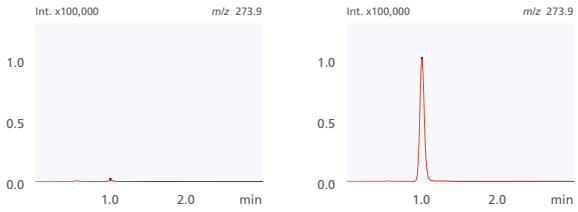
Heated Dual Ion Source

The LCMS-2050 is equipped with the newly developed Heated Dual Ion Source (Heated DUIS™) as the standard configuration. This hybrid source combined the benefits of electrospray ionization (ESI) and atmospheric pressure chemical ionization (APCI), two orthogonal techniques widely used in mass spectrometry. The result is excellent sensitivity achieved for compounds for a diverse range of chemical properties, including low-polarity compounds.

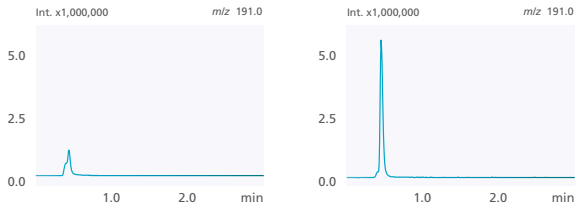
Good Sensitivity for Low-Polarity Compounds

Convensional MS detectors will require switching ion sources from ESI to APCI to detect low-polarity compounds such as quintozene and trimellitic anhydride. With the heated DUIS on the LCMS-2050, both can be detected at high sensitivity.

Quintozene



Trimellitic anhydride

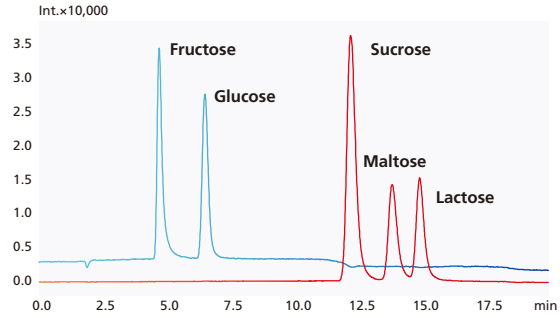


Conventional ESI/LCMS-2020

Heated DUIS/LCMS-2050

Analyzing More Compounds Than Before

HPLC is widely used for the analysis of sugars. However, sugars do not absorb light in the UV-VIS range, so they cannot be detected with common LC-UV detectors. Using mass spectrometry, sugars can be analyzed with high sensitivity. The figure below shows the mass chromatograms obtained from an analysis of five sugar components using the LCMS-2050. The LCMS-2050 can perform high sensitivity qualitative and quantitative analyses of monosaccharides and disaccharides.



Mass chromatograms for fructose and glucose (monosaccharides in negative ion MS detection) and sucrose, maltose and lactose (disaccharides in positive ion MS detection)

Shimadzu's High Speed Technology

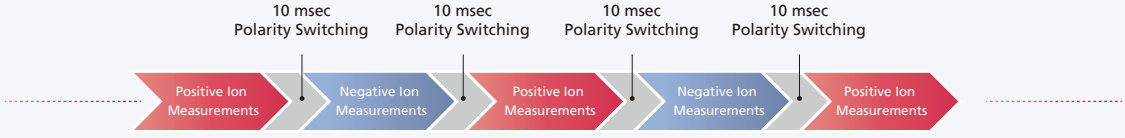
UFscanning™

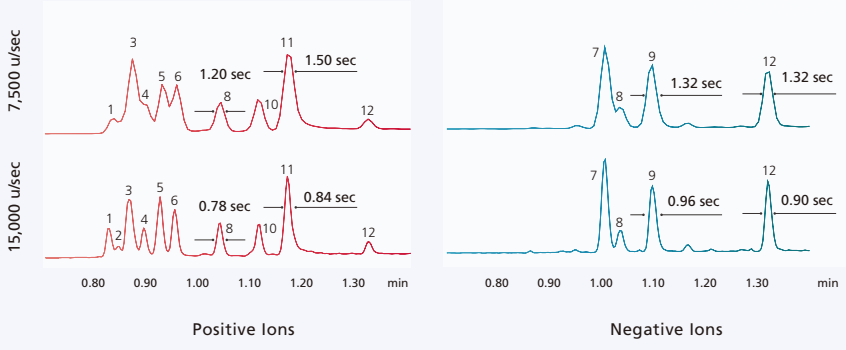
High-speed Scanning Rate of 15,000 u/sec

UFswitching™

High-Speed Polarity Switching in 10 msec between Positive and Negative Ionization

The LCMS-2050, which is equipped with Shimadzu's high speed technology, misses none of the sharp peaks in Ultra High Perfomance LC (UHPLC). Thanks to the sufficient number of data points, the instrument even reliably captures peaks that are overshadowed (Peak 2 in the figure below) or insufficiently separated (Peaks 3, 4, etc., in the figure below) at lower scan speeds.



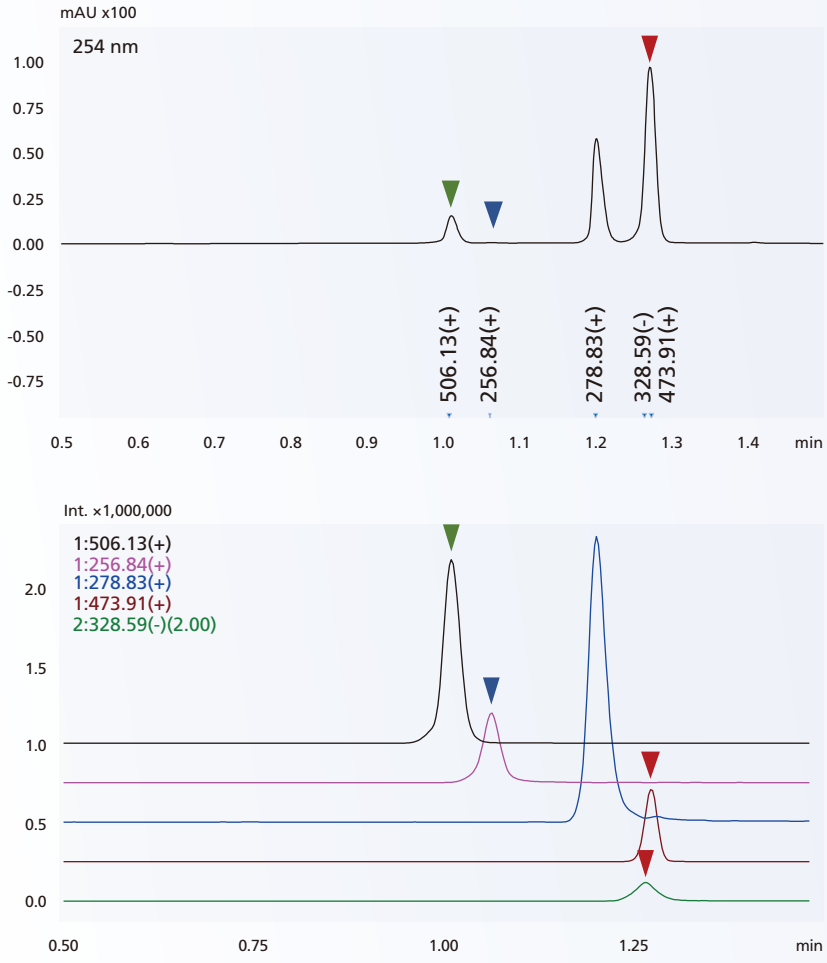


1:Papaverine (+)
2:Propranolol (+)
3:Diphenhydramine (+)
4:Dipyridamole (+)
5:Amitriptyline (+)
6:Reserpine (+)
7:Chloramphenicol (-)
8:Sulfadimethoxine (+) (-)
9:Furosemide(-)
10:Carbamazepine (+)
11:Isopropylantipyrine (+)
12:Nitrendipine (+) (-)

Total Ion Chromatogram for 12 Pharmaceutical Components

Improved Detection for Fast Chromatography

Compounds can be detected with good sensitivity by the LCMS-2050 even when minimal UV adsorption prevents them from being analyzed by LC-UV. In addition, the LCMS-2050 can detect both positive and negative ions quickly with a scan speed of 15,0000 u/sec, and 10 msec positive/negative polarity switching. The LCMS-2050 is therefore the ideal detector for UHPLC chromatography and high-throughput laboratories.



UV Chromatogram (Top) and Mass Chromatogram (Bottom)
for Five Pharmaceutical Components

The superiority of MS detection over UV detection is demonstrated in the chromatograms of five pharmaceutical compounds above. MS detection was performed at a scan speed of 15,000 u/sec with 10 msec positive/negative ion switching. Four positive ion components and one negative ion component were accurately detected by the LCMS-2050. In the UV chromatogram, no peak is observed at retention time 1.07 min (indicated by blue ▼). But in the mass chromatogram a strong signal is observed, demonstrating superior MS detection for compounds with low UV absorption. The peak at retention time 1.28 min (indicated by red ▼) appears to be a single component in the UV chromatogram, but the mass chromatogram confirms that two compounds are coeluting. The component detected at retention time 1.01 min (indicated by green ▼) is at the lowest possible concentration for UV detection, but the high sensitivity of the LCMS-2050 makes for easy and reliable quantitation.

Streamlined operation for cost efficiency

In addition to saving on laboratory space, the LCMS-2050 contributes to significant energy savings and improved operational efficiency. In particular, the instrument is replete with technology and functions to ensure that even users unfamiliar with mass spectrometers can easily and efficiently proceed with data acquisition. The LCMS-2050 enhances laboratory productivity by saving energy and saving space, and then delivers maximum results with minimum effort.

Space Savings

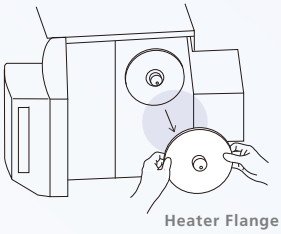
The LCMS-2050 is similar in size and stackable with LC units so it can be added without the need for additional space.

Simple and Rugged Accessibility

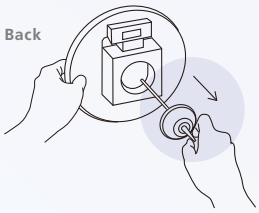
The LCMS-2050 has been designed for simplified operation, accessible to all user levels. Only basic acquisition parameters are required, and tuning can be performed automatically using the system check function (Page 12) which does not require manual intervention such as flow line switching. The system check function can be run at a user-defined date and time, so analysis can start under the best conditions with tuning being completed outside of analysis working hours, such as overnight or on weekends.

Easy Maintenance

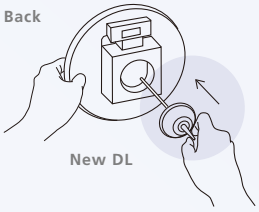
Like all other MS products by Shimadzu, the ionization interface of the LCMS-2050 has a simple, accessible design that minimizes the efforts needed to maintain the instrument in a good state. The desolvation line (DL) that transfers the sample into the vacuum chamber can be replaced without using tools and without breaking the vacuum. Quick and easy maintenance means less downtime, labor, and cost.



Remove the heater flange.



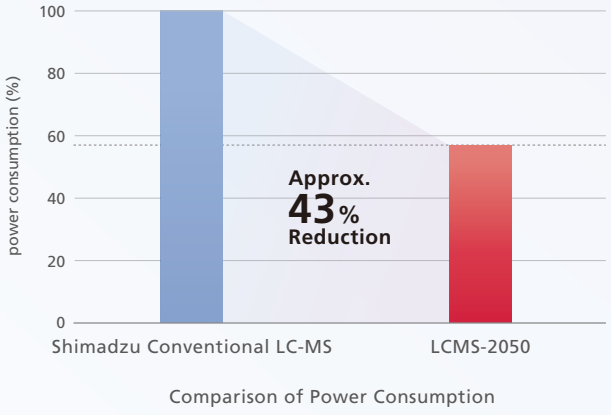
Remove the DL assembly from the back of the heater flange.



Attach a new DL assembly to the heater flange.

Environmental Responsibility

Thanks to its small size, its single-phase 100 to 240 V specifications, and its Ecology Mode function (page 12), the LCMS-2050 achieves energy savings of 43% in comparison with the LCMS-2020. It is also recognized as an Eco Product Plus under Shimadzu's proprietary environmentally friendly product recognition system. The system not only limits running costs during analysis, but contributes to realizing a carbon-free society by limiting CO_2 emissions.



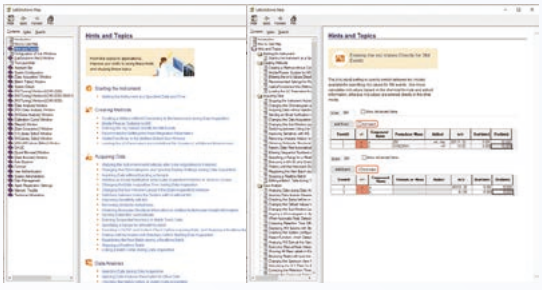
Comparison of Power Consumption

Shimadzu recognizes this as an Eco Product Plus. This means that power consumption is reduced 43% in comparison to the previous Shimadzu model.

Assumptions: the ecology mode detects idle times and automatically shuts down the system (vacuum not stopped) for 8 h/day on average, including 2 h/day during working hours; for 2 days/week, the instrument is fully shut down including the vacuum.

Enhanced FAQ

The LabSolutions LCMS workstation is equipped with an advanced Help function and an extensive FAQ section to support an in-depth understanding of LCMS analysis. It enables you to increase knowledge whenever necessary, ideal for both beginners and experts.



LabSolutions LCMS

Total Support from Data Acquisition to Data Analysis with an Integrated Operating Environment

The LabSolutions LCMS workstation for the LCMS-2050 delivers streamlined instrument control and sophisticated data analysis using Analytical Intelligence. It also foresees and addressees the increase in demand for energy savings. In addition, the LCMS-2050 is compatible with Open Solution, which can further improve the efficiency of laboratory work.

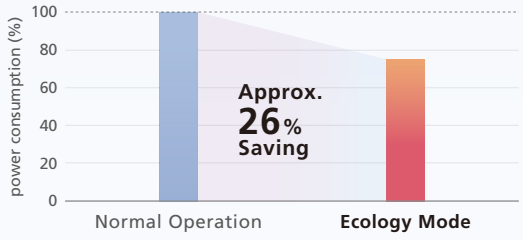
Improving Laboratory Workflows

Ecology Mode Function

This function checks the usage of the system, and if it has not been used for a set time, it shuts down automatically. The following three shutdown modes can be selected.

- Complete shutdown of LC and MS (with vacuum pump OFF)
- Shutdown of LC and MS (vacuum pump ON)
- Shutdown of LC

Assumptions: the ecology mode detects idle times and automatically shuts down the system (vacuum not stopped) for 18 h/day on average, including 2 h/day during working hours; for 2 days/week, the instrument is fully shut down including the vacuum.



Comparison of Power Consumption

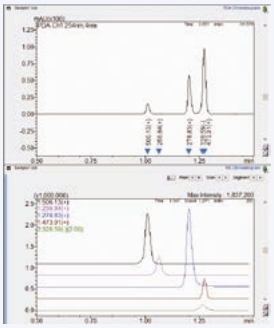
ANALYTICAL INTELLIGENCE

Performance Concierge

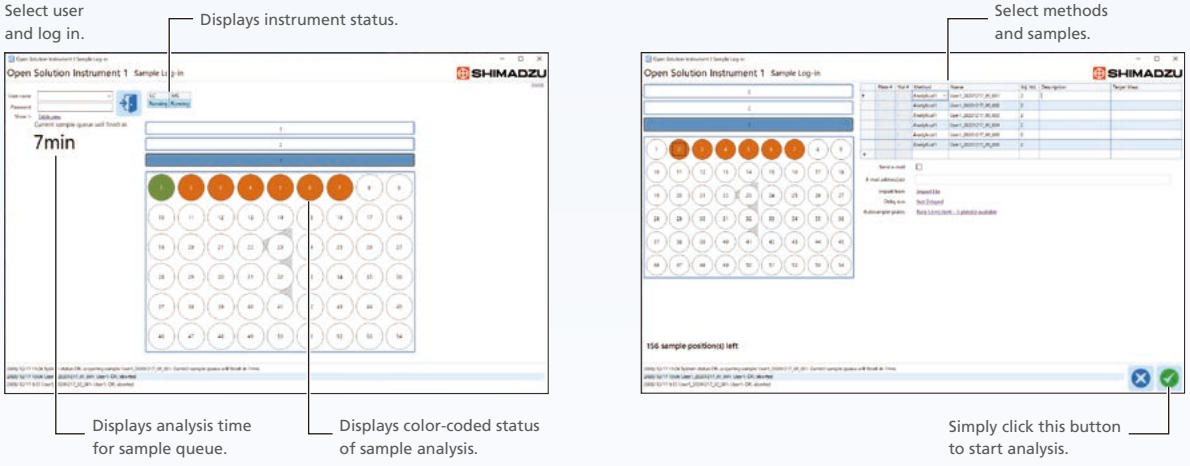
This system check function introduce a standard sample automatically, checks the mass accuracy, resolution, and spectral intensity, and checks the instrument status. Calibration is automatically performed according to the configured pass/fail criteria. This can be implemented at a user-defined date and time, so the instrument can be calibrated without interrupting sample analysis. Optimal instrument performance can be maintained without user intervention, achieving reliable data acquisition and stable system operation.

LC and MS Controlled with the Same Software

LabSolutions LCMS can control the LC and MS instruments simultaneously. The mass data and data obtained by the various LC detectors can be analyzed on the same platform. Including MS in your workflow makes the data easier to interpret, with no compromise in operational capability. The LC and mass chromatograms as well as UV and mass spectra can be displayed in a single window, which makes it easy to compare the data.



Open Solution—Optional Open Access Software



Simple and Intuitive Sample Logging and Data Review

- Open-access functionality for sharing instruments among multiple users.
- After logging in to the [Sample Log-in] window, simply select methods and samples to start analysis.
- Performs automated method switching for multiple users, including column and mobile phase switching, and automatic rinsing of flow lines.
- LC, PDA and MS instrument status.

Data Browser—Display and Analyze Data

- Quickly display data by simply clicking on samples in the rack diagram.
- The data browser can be launched on any networked computer by simply installing software on that computer.
- Peak integration (adding or deleting peaks) for LC chromatograms can be performed easily.
- Displays mass and UV spectra for user-specified times.
- Calculates and displays peak purity based on similarity score of mass spectrum.

Future-Proof your Laboratory Against the Next Decade of Transition and Transformation

Currently, our society is amid a revolutionary transition and transformation. Advancement of computing hardware, networking technologies and programming algorithms have all contributed to driving the modernization of legacy systems. Among those that are slower in the process of change could be our own mindset. Look around us, and recognize that our laboratories will largely transform over the next decade; human efforts replaced by automation, sophistication becoming the norm, productivity made measurable and assessed against CO_2 emission as well as cost. All these imaginations are the driving force to realize the change.

Shimadzu has over fifty years of history of providing mass spectrometers, spectroscopic analyzers, high-precision balances, and chromatography systems. Underlying this business style is the corporate philosophy to contribute to society through science and technologies. As a first priority, Shimadzu has always been eager to implement the latest technologies to create a new value, such as analytical intelligence.

Containing state-of-the-art detection technologies, data processing algorithms, and the connectivity with other instrument and network systems, the LCMS-2050 is the instrument that can stay on top for the next decade, the decade of transition and transformation.

Whatever you envision will be realized, and the LCMS-2050 will be part of the change.

Shimadzu Corporation
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