

Fully Automated Sample Preparation Module for LC-MS

# CLAM-2040



# 24/7 LC/MS capability in your lab... Now!<sup>(1)</sup>

Pave the way for the future of clinical research.

The simplification of LC-MS systems has made LC/MS an advantageous technique for clinical research thanks to its specificity, its accuracy, and its capability to analyze several targets simultaneously. CLAM™-2040 is an online automated sample preparation module that brings LC/MS smoothly into your laboratory.

(1) Not including preventive maintenance



## EFFORTLESS PERFORMANCE

- User-oriented, intuitive design which fits seamlessly into daily operation.
- System operation requires no technical know-how.
- Start of analysis is straightforward and fast due to ease of use.
- Sample extraction and analysis are fully automated; simply insert the sample tube.



## STANDARDIZED WORKFLOW

- Quality control functionalities and specification alerts allow users to maintain peak instrument performance.
- Fully automated sample preparation prevents operator errors.
- Absence of manual intervention guarantees reproducible sample results.
- Safety of workplace is improved due to lowered risk of infection.



## OPERATIONAL PRODUCTIVITY

- Improved overall efficiency – higher throughput at a lower cost.
- Process automation enables users to perform LCMS analysis at any time.
- Users can continuously add and re-prioritize samples to accommodate any urgent analysis requirements.
- LC/MS technology enables multiplex analysis.
- Ability to connect to Laboratory Information System (LIS).



## FLEXIBILITY

- Users have freedom to use pre-existing, dedicated assays, or to create their own.
- LCMS configuration is customizable and permits for future upgrades.
- High resolution LC-MS is also available (Q-TOF), facilitating large screenings.
- Various sample container options available to meet any diverse needs.



## INNOVATION

- Create a laboratory ready for tomorrow's transitions to LC/MS with no human intervention between the conveyor and the result.
- Be a pioneer and lead the way with a future-proof clinical research laboratory.





# Easy to use and to maintain.

## Reduced workload for operators.

Simply uncap sample collection tubes (or specialized sample cups) and place them into the system. Select the appropriate method from the touch screen, and then the CLAM-2040 performs the next steps automatically: dispensing the sample onto the specialized filter vial, adding reagents, shaking, heating, filtering, and transferring the extracted sample to the LC-MS system autosampler. The LCD touchscreen allows for rapid control through the dedicated user-oriented software. Containers for liquid waste and filter waste reduce the infection risk and ensure operator safety. Easy access to all system automated parts, consumables, and waste also allows for easy maintenance over time.

### SPECIALIZED EXTRACTION FILTERS

Specialized filter vials for biological samples. Single use for no cross-contamination. Continuous filter loading capability.

### REAGENT PROBE

A dedicated probe for reagent dispensation prevents contamination. Several rinsing solvents are available.

### SAMPLES AND REAGENTS

A dedicated area for samples and reagents. Temperature control for longer stability. A wide range of glass vials, tubes and cups to fit a variety of routine needs. Checks sample ID via barcodes. Continuous sample loading capability. Priority sample option also available.

### SAMPLE PROBE

A dedicated probe for dispensing samples. Several rinsing solvents are available to ensure absence of cross-contamination.



### Typical protocol of automated sample extraction



“The CLAM system is very robust and easy to use.” “We can do the programming of the system on our own.” “The system is analyzing the samples automatically, so it's kind of fire-and-forget. It's doing all the work for you.”

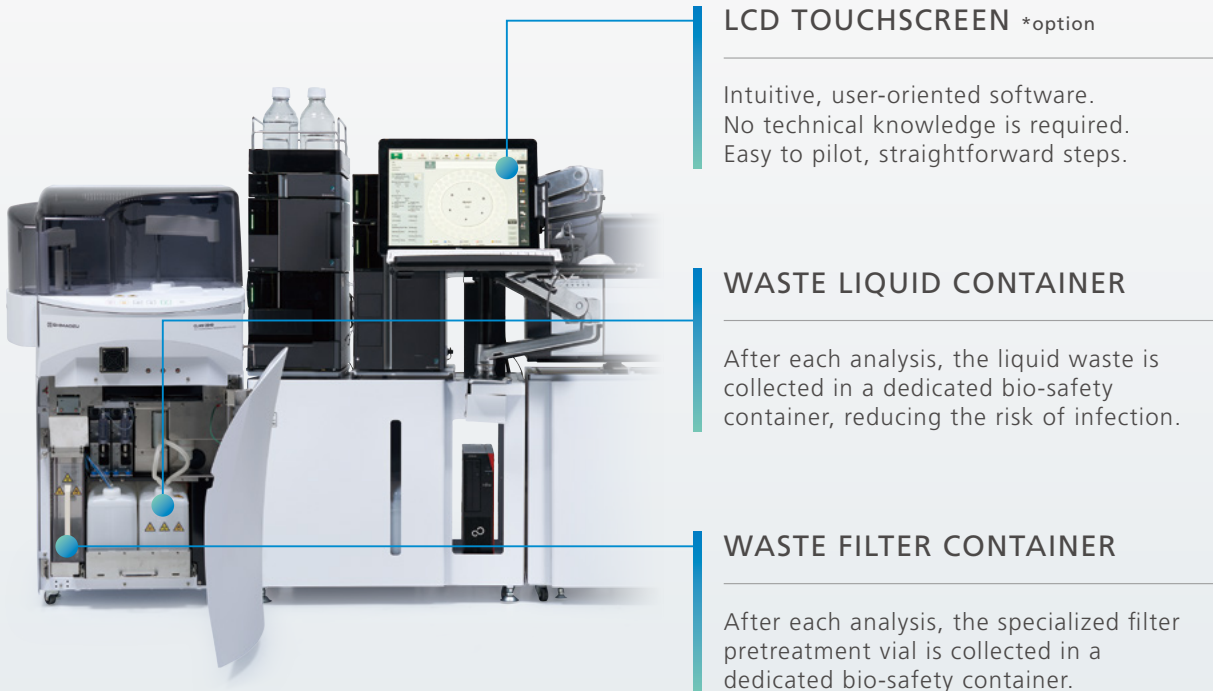


— **Dr. rer. nat. Lars Kröner**, Labor Wisplinghoff, Cologne, Germany.



“The CLAM system is an ideal tool which allows personnel with nonspecific chromatographic and mass spec experience to measure samples. On the other hand, the automation also allows the specialist to implement new parameters freely, when there is no commercially available method on the market.”

— **Dr. rer. nat. Frank Streit**, University Hospital, Göttingen, Germany.



SAMPLE PREPARATION OVERLAP: **ONE RESULT EVERY 2.6 MIN** IN AN OPTIMIZED WORKFLOW.



# Operational productivity.

Automates all process steps from pretreatment to result.

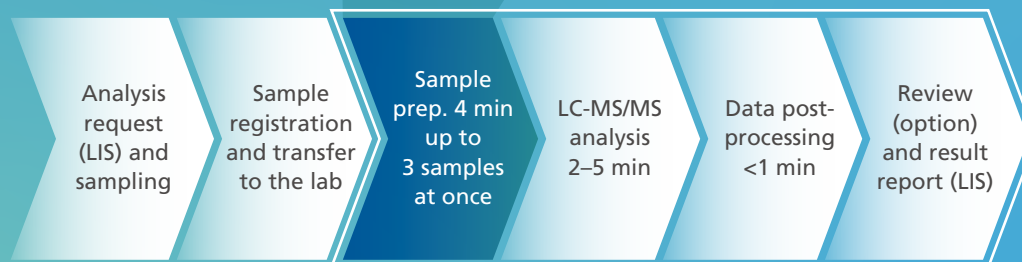
The CLAM-2040 and LC-MS instrument accompanies your analytical workflow and improves your overall throughput by drastically reducing the sample preparation time. Additionally, the CLAM-2040 has the capability to prepare up to 3 samples simultaneously to further optimize your routine. While manual or semi-automated sample extraction will deliver one result every 12 to 60 min, the CLAM-2040 and LC-MS, in optimized conditions, will deliver up to one result every 2.6 min.

Typical LC/MS analysis workflow in the clinical research laboratory.



One result every 12 to 60 min.

CLAM-2040 + LC/MS improved analysis workflow.



These steps are managed by the CLAM-2040 and LC-MS instrument.

**Up to one result every 2.6 min.**

# No compromise.

High efficiency and high comfort.

## IMPROVED EFFICIENCY

Higher throughput at a lower cost by reducing manual operations. Save time on intensive user trainings with an open and easy access system.

## 24 HOUR / 7 DAY CAPABILITY

Run samples at night and on weekends. Add samples and consumables continuously with the option to submit priority analysis requests for urgent samples.

## MULTIPLEX ANALYSIS

Associated with the CLAM-2040, Shimadzu's LC/MS technology enables you to analyze several compounds simultaneously, saving time and reducing overall costs.

## HIGHER USER COMFORT

Decrease in manual operation helps prevent end user errors. Controlled safety creates peace of mind, and the intuitive software makes it effortless to run samples.



# The Shimadzu advantage.

CLAM-2040, the unique **flexible** LC/MS automation.

Shimadzu has always attached great importance to providing the best solutions while maintaining the highest possible flexibility for the operator and providing products of great robustness. These key advantages are at the heart of our developments and in all our products. Here too, the CLAM-2040 surpasses these values to give reliable results and increased confidence.



## USE ANY APPLICATION OF YOUR CHOICE

- Compatible with a wide range of Shimadzu methods.
- Supports Alsachim reagents.
- Compatible with third-party reagents.
- Easily transfer your laboratory developed tests (LDT).



## FREEDOM TO CHANGE

- Methods can be optimized and modified.
- New methods can be freely added without the need for Shimadzu intervention.
- Creating your in-house method (LDT) is possible at any time.



## FLEXIBILITY

- Freedom to choose your LC-MS configuration and to evolve it at will (see details hereafter).
- A wide range of purifications available, such as online solid phase extraction (SPE).
- Various sample and reagent containers available to meet the diversity of routine needs.
- The LC-MS system can be used independently.



## OPERATIONAL CONNECTIVITY

- Connect to your laboratory information system at any time.
- Connect your LC-MS system to online automation when necessary.



## ROBUSTNESS

- Standardized workflow reduces variability in sample results.
- Includes the latest quality control functionalities.
- Built to handle high throughput of biological samples.
- Consistent results over time reduces calibration frequency.

**One automated system, unlimited possibilities.**



# Full evolution potential.

Free to evolve your LC/MS technology at any time.

To meet your required sensitivity, you are free to choose your LC-MS/MS system by selecting one of our triple quadrupoles, from the LCMS-8040 (not shown below) to the LCMS-8060NX. You can change your MS system at any time. For your most exigent screenings, high resolution is also available with our time-of-flight systems (QTOF). These options ensure maximum flexibility.

## Time-of-flight

(toxicology screening, metabolomics...)



LCMS-9050

LCMS-9030



Resolution

## Triple quadrupoles

(Drug quantitation, toxicology...)



LCMS-8060NX

LCMS-8060

LCMS-8050

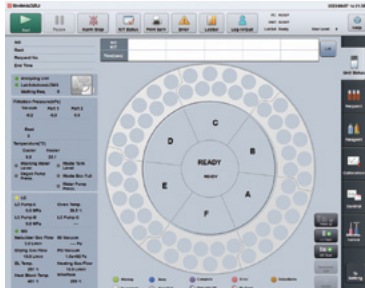
LCMS-8045



Sensitivity

# Easy, intuitive, smart.

Rapid control by simple user-oriented software.

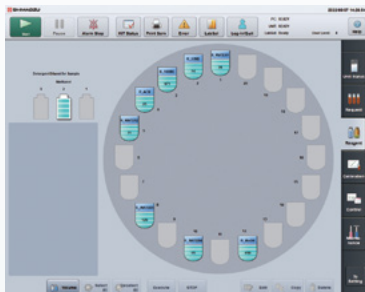


## INTUITIVE SOFTWARE

- Easy to pilot with no need for expertise or training.
- Easy to optimize and modify existing methods.
- Easy to configure your own methods.



\* optional steps



## EASY REAGENT MANAGEMENT

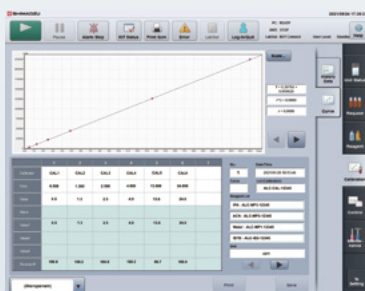
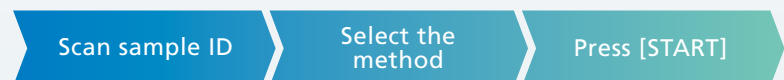
- Reagent vials of 3 different volumes for maximum adaptability and flexibility: 1.5 mL, 6 mL, or 12 mL.
- Free configuration of your reagents (commercial or in-house).
- Clear display of available reagents and remaining usage count.
- Automatic detection of missing reagent before starting analysis.

Open configuration with clear visualization.



## STRAIGHTFORWARD ANALYSIS

Simply scan your sample ID using the barcode reader, select the analysis method, and press start. The CLAM-2040 will perform the next steps automatically.



## EASY DATA REVIEW

- Easy visualization of calibration results (precision and accuracy).
- Easy visualization of quality control results (precision and acceptance range).
- Data alerts when results are out of specification.
- Easy review of quantitative results (concentrations).
- Possibility to check individual chromatograms when needed.
- Direct communication with LIS for data reporting.

Designed for routine use.

# Flexible, open.

A wide range of applications within reach.



## Open configuration of methods and reagents

- Compatible with Alsachim reagents and Shimadzu methods.
- Supports Shimadzu databases for toxicology (TQ or high resolution).
- Supports Shimadzu Metabolites Method Package Suite.
- Compatible with third-party reagents.
- Compatible with your laboratory developed tests (LDT).

---

## A WIDE RANGE OF EXISTING APPLICATIONS

Examples of applications demonstrating the automation by CLAM

- Analysis for Voriconazole Antifungal Drug in Plasma (App. No. C146-E464)
- Tacrolimus from dry blood spot (App. No. 01-00276-EN)
- Choline, TMA, and TMAO in plasma (App. No. 01-00238-EN)
- Primary Metabolites in plasma (App. No. 01-00217-EN)
- Organic acids in serum (DOI: 10.3390/diagnostics11122195)
- First-Line toxicological screening in plasma (DOI: 10.1093/jat/bkaa075)
- Antiarrhythmic drugs in plasma (App. No. LAAN-A-LM-E123)
- Remdesivir and metabolites in plasma (App. No. C217)
- Raltegravir, Dolutegravir, Elvitegravir, and Bictegravir in Plasma (DOI: 10.15369/sujms.32.91)
- Uracil and dihydrouracil in plasma (DOI: 10.1016/j.jchromb.2020.122038)
- Anticoagulants (NOAC) in plasma (App. No. PO-CON1851E)
- Toxicological quantification in whole blood, plasma and urine (DOI: 10.1016/j.cca.2019.03.076)
- Mycophenolic acid and metabolite in plasma (poster "Integration of mycophenolic acid and its metabolite analysis in plasma using LC-MS/MS with full-automated sample preparation")
- Drugs of abuse in plasma (DOI: 10.1007/s00216-018-1159-7), in urine (App. No. PO-CON1737E), and in oral fluids (App. No. PO-CON1753E)
- Hydrophilic metabolites in serum and plasma (App. No. PO-CON1720E)
- Novel system for analyzing hydrophilic blood metabolites in Plasma (DOI: 10.1016/j.jbiosc.2017.01.015)
- Psychoactive drugs in serum, whole blood and urine (App. No. PO-CON1714E)
- Metanephrine and normetanephrine in plasma (App. No. PO-CON1751E)
- Unbounded amino acids in urine (App. No. PO-CON1733E)
- Antibiotics in plasma (poster "Antibiotics in Plasma: A Novel, Seamlessly Automated LC-MS Solution to Increase Sensitivity, Specificity and Routine Throughput effectiveness")
- Antiepileptics, benzodiazepines, neuroleptics, and TCA in serum (App. No. PO-CON1786)
- Neuroleptics drugs in plasma (App. No. PO-CON1785E)
- Tricyclic antidepressant drugs in serum (App. No. PO-CON1777E)
- Benzodiazepines in serum (App. No. PO-CON1776E)
- Antiepileptics drugs in plasma and in serum (App. No. PO-CON1788E and PO-CON1775E)
- 25-OH Vitamin D2/D3 in Serum (App. No. PO-CON1692E)
- Steroids in serum (App. No. PO-CON1691E)

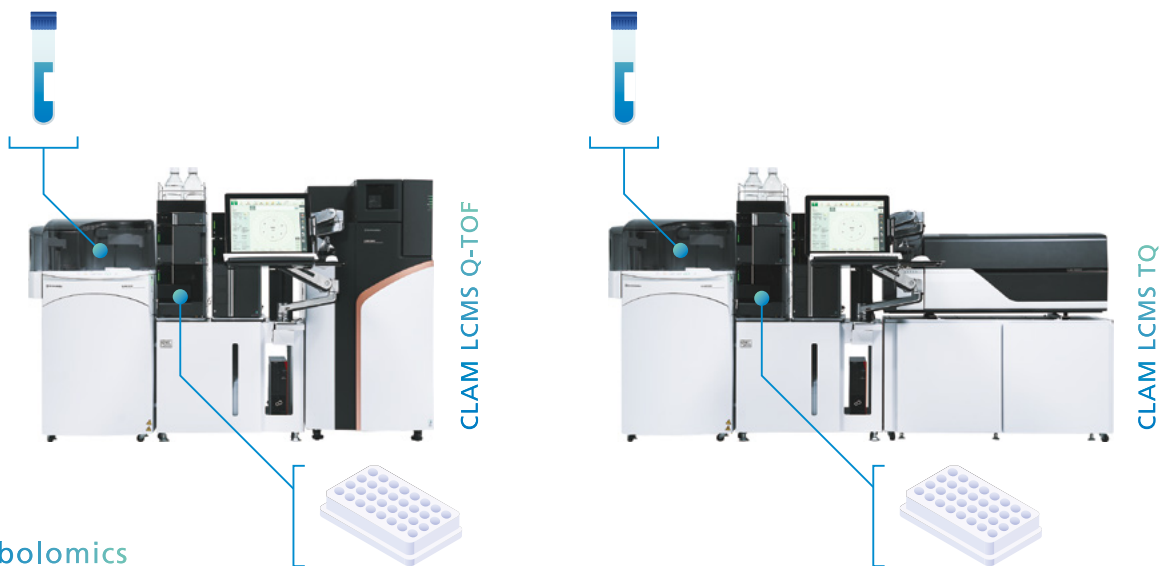
# One system, multiple uses.

Build the clinical research laboratory of the future.





From the sample tube, the CLAM can perform extraction and LC/MS analysis automatically.



Metabolomics

The LC-MS system can be used independently at any time.

Monoclonal antibodies  
(mAbs)

Endocrinology

# Best for our customers.

Shimadzu support team is conscious of your exigence.

The Shimadzu support team is aware of the demanding environment of clinical research and fully understands the challenges and importance of this work. We know that smooth and efficient communication with our engineers is critical to maintain continuous analysis workflow.

## PERSONALIZED SUPPORT CONTRACT

Together with your local Shimadzu representative, build your personalized support contract by selecting the best options to fit your needs. This could cover interventions for emergencies, preventive maintenance planned on a regular basis over the year, as well as any necessary spare parts. This will ensure the safe routine use of the system and your peace of mind. Our service engineers are based in regions as close as possible to your laboratory to ensure quick response. Please contact your local Shimadzu representative for detailed information.



# Full flexibility, unlimited capability.

Get the most out of your clinical research laboratory.

The CLAM-2040 is the online automated sample preparation module for LC-MS that integrates LC/MS smoothly into your laboratory:

- Effortless performance with no need for technical knowledge.
- Capability to connect to your laboratory information system.
- Flexibility to use our dedicated assays as well as any assay of your choice.
- Flexibility to choose your LC-MS configuration and to evolve it at any time.

## System summary

Applications	Shimadzu methods / Alsachim reagents / third-party reagents / your own LDT
Throughput	Up to 23 samples per hour (under specific conditions)
Sample capacity	60 samples (primary tubes or sample cups) – new sample loading at any time
Sample matrix	Whole blood, plasma, serum, urine, oral fluids, dried blood spots
Barcode support	Code 39, NW-7, Code 128, 2 OF 5
Connectivity	HL7 standards
Dimensions	W 670 mm, D 700 mm, H 1190 mm (Main Unit)



CLAM is a trademark of Shimadzu Corporation or its affiliated companies in Japan and/or other countries.



Shimadzu Corporation  
[www.shimadzu.com/an/](http://www.shimadzu.com/an/)

**For Research Use Only. Not for use in diagnostic procedures.**

This publication may contain references to products that are not available in your country. Please contact us to check the availability of these products in your country.

Company names, products/service names and logos used in this publication are trademarks and trade names of Shimadzu Corporation, its subsidiaries or its affiliates, whether or not they are used with trademark symbol "TM" or "®".

Third-party trademarks and trade names may be used in this publication to refer to either the entities or their products/services, whether or not they are used with trademark symbol "TM" or "®".

Shimadzu disclaims any proprietary interest in trademarks and trade names other than its own.

The contents of this publication are provided to you "as is" without warranty of any kind, and are subject to change without notice. Shimadzu does not assume any responsibility or liability for any damage, whether direct or indirect, relating to the use of this publication.