

Technical Report

Support of Remote Analysis Work with Integrated LC System i-Series

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Abstract:

A variety of workplaces are currently facing the challenge of further improving efficiency through more extensive adoption of new working styles, such as working from home or teleworking. Due to dramatic advances in digital and networking technologies in recent years, it is now possible to specify instrumental analysis settings, to perform analyses, and to perform data processing of acquired data, all remotely. In addition, Shimadzu i-Series integrated LC systems include "Analytical Intelligence" functionality that can remotely perform a wide variety of operations that were previously performed in person, such as startup or column equilibration. Such functionality will provide a powerful boost to the transition to remotely performed analytical processes.

Keywords: automatic startup, remote operation and monitoring, LabSolutions™ Direct, LabSolutions CS

1. A New Style of Analytical Operations

With the demand for higher operational efficiency and more flexibility in working style, there have been significant changes in what is considered ideal for LC analytical processes. Environments are increasingly required in which even operators not physically situated in the laboratory or inexperienced operators can obtain identical results by executing equivalent analytical operations and

data processing. While ensuring the same outstanding performance as previous systems, i-Series integrated LC systems (LC-2050/LC-2060) consistently provide highly reliable analytical results by addressing the increasing need for diversity in analytical work with respect to personnel, workplace, and working style.

i-Series can automatically and remotely perform all the steps involved in an analysis, including system startup, column equilibration, start of analysis, and system shutdown, which previously

Preconfigured tasks can be performed automatically
Configure your instrument for automatic startup, data acquisition, and shutdown.

Operations that can be performed remotely via computer or smart device
Operations or monitoring can be performed by a computer or a smart device via a network.

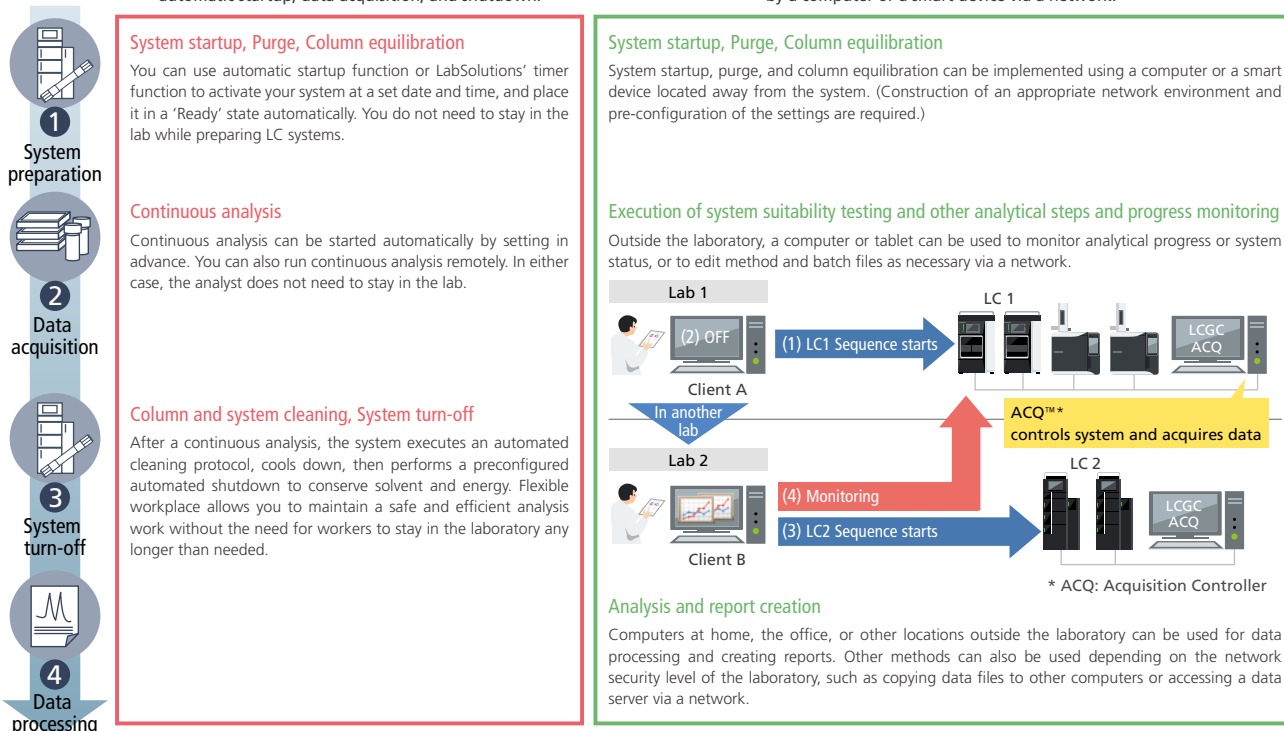


Fig. 1 New Analysis Workflow Provided by i-Series

required the physical presence of an operator. Remote operation and monitoring can be performed with either a computer or a smart device.

Using dedicated software, it is even possible to perform data processing and create reports from outside the laboratory, assuming the software and data files are accessible. The optimal platform can be selected based on the laboratory network security level required.

2. Solutions Supporting Remote Operability

There are two basic types of Shimadzu LabSolutions workstation software available, either standalone or networked. The solutions for the remote operability of analytical processes are shown below for a standalone system and a networked system, respectively.

Standalone LabSolutions LC/GC	Networked LabSolutions CS
<ul style="list-style-type: none"> System is controlled via connected computers. Data is saved on individual computers. 	<ul style="list-style-type: none"> Client terminals are used to control the system, view the data, and perform data processing. Data is managed centrally on a server.

2-1. Standalone System (LabSolutions Direct)

LabSolutions Direct is a remote access tool of LabSolutions LC/GC (Fig. 2) for remotely controlling or monitoring HPLC systems via a

web browser on a smart device or computer. With this software, method files or batch files are easily selected and specified for use in analysis. Analysis can be started after confirming column equilibration by monitoring the system status, detector baseline, or other factors. Chromatograms can be monitored during analysis, and analysis reports in PDF format can be viewed after analysis.

2-2. Networked System (LabSolutions CS)

With LabSolutions CS, which is designed for networked systems with a server and client terminals, system control and data processing can be performed simultaneously from any client terminal. Since it is centrally managed in a database on LabSolutions server, the data can be viewed from any client terminal.

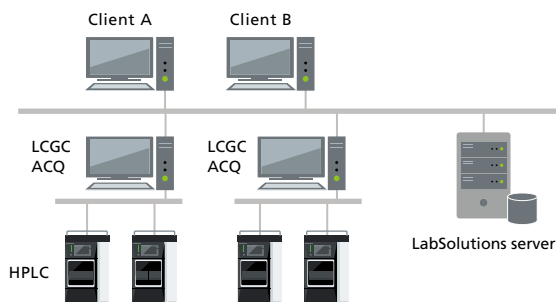
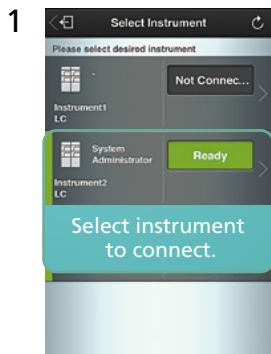
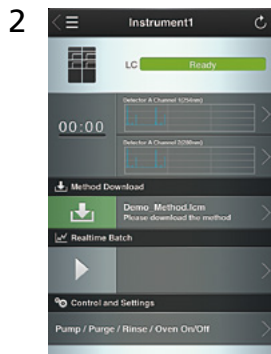


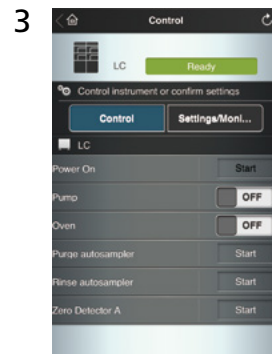
Fig. 3 LabSolutions CS System Configuration



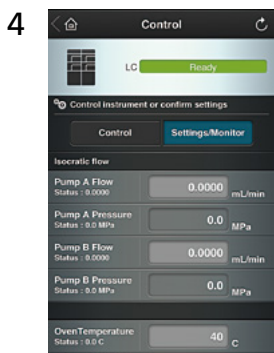
After login, select the instrument to be used.



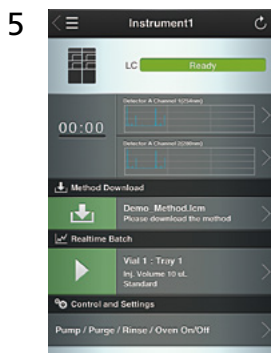
Download the selected method.



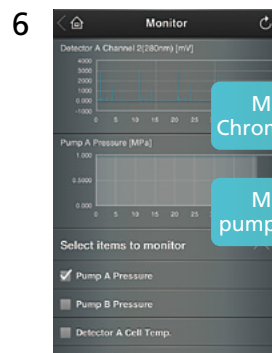
LC system can be power on. In addition, the autosampler can be rinsed and the mobile phase and rinsing solution can be purged.



Pump pressure values and column oven temperature can be monitored to check that the instrument has stabilized. The flow rate and oven temperature can be changed.



Select the batch file and execute data acquisition.

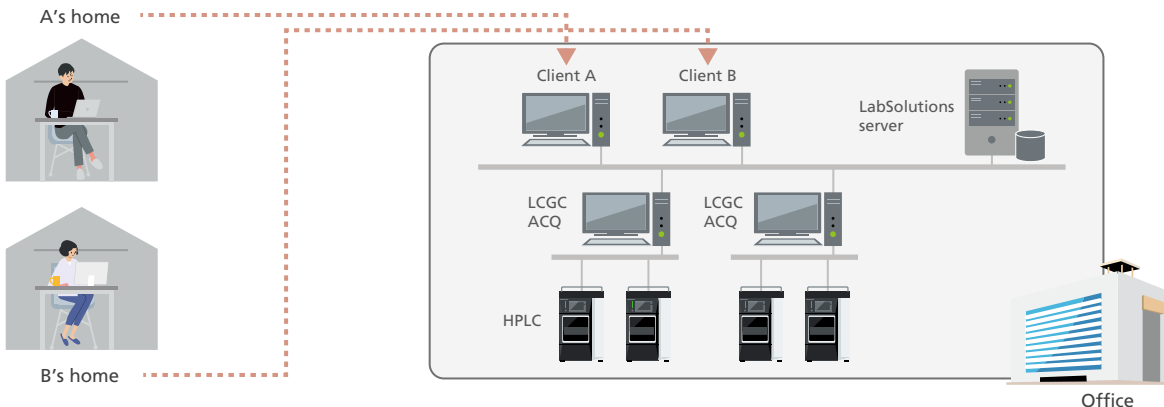


During data acquisition, chromatograms, pump pressure values, etc. can be monitored.

Fig. 2 LabSolutions Direct Operating Window

2-2-1. Remote Desktop Connection

With this method, the connection to LabSolutions CS client computers uses remote desktop functionality (Fig. 4). Although instruments and data can be accessed from any terminal, appropriate security measures are required for connections from home or other locations outside the network.



- ✓ It is not necessary to install software on business PC.
- ✓ Startup, method editing, monitoring, data processing and report creation for all LC, GC and LCMS instruments.
- ✓ All the results are stored in the LabSolutions server.
- ✗ Since multiple PCs are connected from the outside, it takes time and effort for security measures.

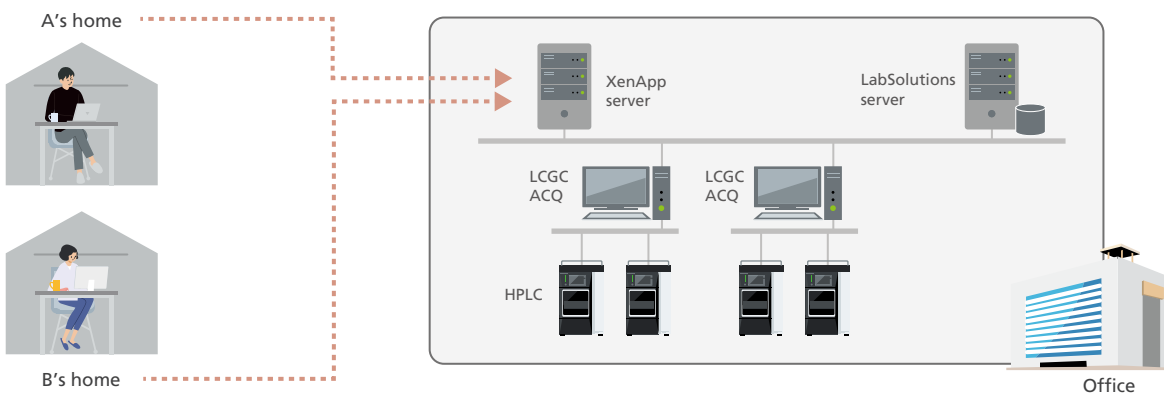
*1: It is assumed that you can connect with a VPN.

*2: For equipment except for chromatography system, connect to the corresponding ACQ via remote desktop.

Fig. 4 LabSolutions CS Case #1: Remote Desktop Connection

2-2-2. Citrix XenApp Connection

With this method, the connection uses a combination of LabSolutions CS and Citrix XenApp virtual platform software (Fig. 5). The Citrix XenApp system transmits only screenshots of the applications being run on a server to computers used for operations. Because it only enables remote operation of LabSolutions applications and uses proprietary data compression technology, it requires less network capacity and exposes the network to less risk than remote desktop connections.



- ✓ It is not necessary to install software on business PC.
- ✓ Startup, method editing, monitoring, data processing and report creation for all LC, GC and LCMS instruments.
- ✓ All the results are stored in the LabSolutions server.
- ✓ Regarding LC, GC and LCMS instruments, only XenApp server can be connected externally.

*1: It is assumed that you can connect with a VPN.

*2: For equipment except for chromatography system, connect to the corresponding ACQ via remote desktop.

Fig. 5 LabSolutions CS Case #2: Citrix XenApp Connection

3. Supporting a New Style of Analytical Operations

Analytical work using conventional LC systems involves commuting to work each day, starting up the system, and equilibrating the column, and then acquiring and analyzing the data. All the steps must be performed at the laboratory, which makes it difficult to work remotely from home or elsewhere. Accordingly, using i-Series integrated LC systems in combination with LabSolutions Direct or LabSolutions CS can improve operational efficiency and minimize travel to the office/laboratory (Fig. 6).

A new style of analytical operations can be achieved by combining the technology for remote and automated operability built into i-Series integrated LC systems with the networking technology described in this article.

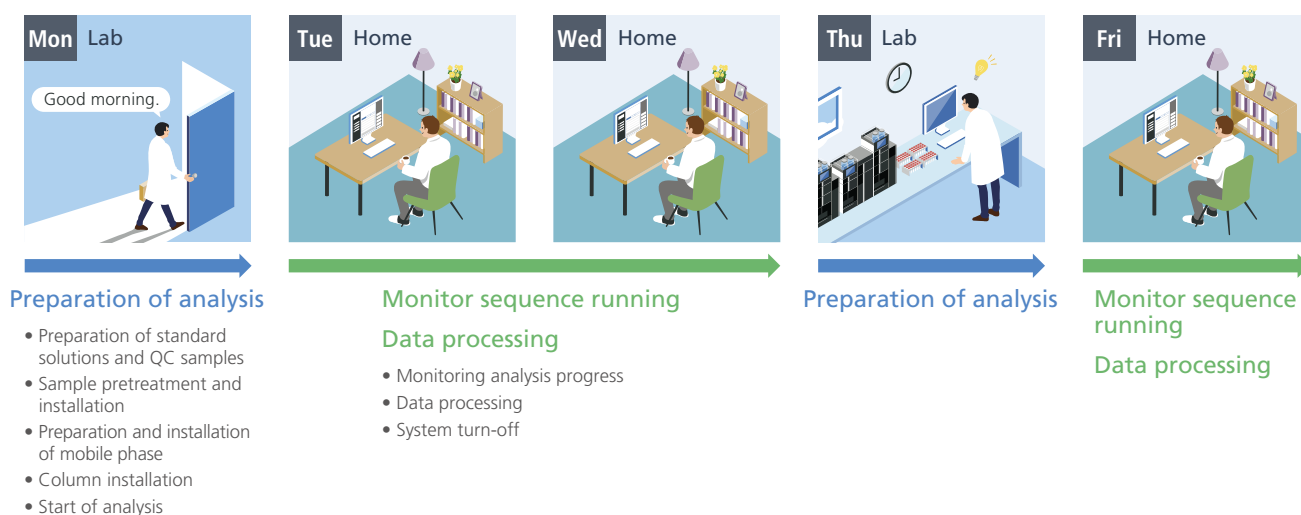


Fig. 6 Example of Work Style Using an i-Series and LabSolutions CS

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