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Agilent InfinityLab Assist: A Local User Interface to Control and Automate Your HPLC System

Abstract

Modern liquid chromatography (LC) instruments rely on a permanent connection to a PC that runs the chromatography data system (CDS) and provides a comprehensive set of controls and instrument diagnostics. In large laboratories, the CDS is often set up as a client/server system, composed of a central data storage (server) and multiple PCs (clients) that can in turn control multiple LC instruments. This setup makes it harder for users to control the LC and monitor what is happening with the instrument at the same time. Adding a tablet-style user interface to each LC solves this issue by bringing important controls and diagnostics to the user's fingertips right at the instrument. The Agilent InfinityLab Assist not only fulfills these functions, but also incorporates automated, guided, and scheduled features that enable the user to perform daily tasks easier, faster, and with increased confidence.

Introduction

Laboratories with many different analytical instruments often have their instruments connected to a central data system that allows sample submission and data analysis from a remote PC. Using an Agilent OpenLab client/server system, multiple instruments can be controlled from a single client or Agilent Instrument Controller, which is not necessarily located at the same bench, or even in the same room as the instrument. This setup might be advantageous with respect to safety and optimal use of lab space. Tasks that require interaction with both the instrument and the controlling PC, however, become more tedious and error-prone if the user needs to swap positions constantly. A local user interface resolves this issue and adds confidence and convenience to instrument control. This white paper describes how typical laboratory workflows benefit from InfinityLab Assist, a module that adds local control and automation to any InfinityLab LC system.*

Operating the LC using the InfinityLab Assist interface

Controlling an LC directly at the instrument enables the user to interact with the interface while doing daily tasks, visually inspect the hardware during operation, and perform maintenance more easily. The InfinityLab Assist features a large touchscreen (the Assist interface) that puts instrument control, status monitoring, and maintenance and troubleshooting guides at the user's fingertips. A tilting, height-adjustable holder improves ease of operation whether the user is standing or sitting in front of the instrument.

*The Agilent InfinityLab Assist is compatible with Agilent 1260 Infinity II LC, Agilent 1260 Infinity III LC, Agilent 1290 Infinity II LC, and Agilent 1290 Infinity III LC systems.

Connection

The InfinityLab Assist is an easily installable upgrade to the Agilent 1260 Infinity II LC, Agilent 1260 Infinity III LC, Agilent 1290 Infinity II LC, and Agilent 1290 Infinity III LC systems. With the same footprint as the LC stack, the Assist Hub fits between the topmost InfinityLab LC module and the solvent cabinet, and features a slide-in holder for the Assist interface. As part of the InfinityLab LC system stack, the InfinityLab Assist is connected to the other modules by a controller area network (CAN) connection. An integrated local area network (LAN) switch establishes a fast data connection from the Assist to the LC detectors and pump. A single LAN cable connects the Assist with the CDS using the laboratory network or a direct link to a workstation PC. If required, the connection between CDS and Assist can be authenticated and end-to-end encrypted using access tokens. When this feature is active, any CDS that connects with the Assist for the first time must be acknowledged by a registered user of the Assist. If a sample analysis has been started by the CDS, the Assist will be restricted to read-only mode. No sample run can be aborted from the Assist.

In addition to the Assist Interface, users may access the Assist from any device within the laboratory network using a web browser (Figure 1). This connection can also optionally be encrypted by HTTPS/TLS.

Figure 1. Accessing the Agilent InfinityLab Assist in a browser on any mobile device within the laboratory network.

User roles

An important aspect when running a large analytical laboratory is to maintain documentation and traceability. Analytical results must be stored, including system suitability tests. In addition, any maintenance performed on the system needs to be tracked. When instruments are accessible by touch screen, access should be restricted based on user roles with different privileges.

The InfinityLab Assist allows for different PIN-protected user roles that may be activated on-demand. The default is an administrator role. The simplest user role is the Viewer, who cannot control the LC or run any tasks. Lab Analysts, on the other hand, can control the LC and run predefined tasks, but cannot run maintenance procedures. Maintenance Technician and Agilent Service Technician roles can access different maintenance procedures and diagnostics. The complete set of tests, tasks, and settings is available to the administrator role. No user, however, may interfere with any instrument settings from the InfinityLab Assist when a sample is running.

If no user is logged in, the system will display a customizable ambient screen (Figure 2). This view will display the status of the system (for example, idle or running) and show information widgets of the different modules. The administrator configures the ambient screen to display parameters such as pressure, column temperature, or a detector signal in a graphical or numerical style. This screen facilitates quicker checking, whether a system is running, waiting for samples, or experiencing an error.

Figure 2. Ambient screen, displaying status information in customizable widgets.

Home screen

In contrast to the ambient screen, any user role may define their own home screen to show important status parameters of the entire LC in a dashboard-style window (Figure 3). The screen is customizable with any number of widgets that each display one or multiple selectable parameters. The online plot and run control widgets are available in different sizes to accommodate, for example, multiple signal traces as an overlay.

Once configured, the home screen of the Viewer user is visible by two taps on the screen without entering a passcode. This view makes it easy for any user to quickly check the status of the LC. Another tap will slide in the Run Control window (Figure 3), immediately showing if the LC is available or if a task or analysis is in progress.

Figure 3. Home screen of the Agilent InfinityLab Assist, with the run control panel at the bottom showing that an analysis is in progress.

Instrument Status screen

While the home screen provides read-only information about the status of the LC, the Instrument Status screen also gives control over parameters of the single modules. This screen is similar to the status view in Agilent OpenLab CDS Acquisition , allowing the user to switch the modules on or off, set the flow rate and composition, and more. Each module of the connected LC instrument is represented by a tile that displays important information and up to five module-specific quick-action soft buttons (Figure 4). If more quick actions are available, they can be accessed by tapping the name of a module. This will show more information, such as installed options, and offer a shortcut to module-specific maintenance procedures (Figure 5).

The intuitive operation with quick action buttons enables the user to carry out frequent tasks much more quickly and easily than when using the control PC. Take, for example, the exchange of a solvent bottle, which requires purging the solvent line. Using the InfinityLab Assist, the user can be confident that by tapping the purge soft button, the correct instrument will purge the selected channel only. The Smart Purge procedure of the InfinityLab Assist will divert the flow to the needle wash port, which enables purging, independent of the purge valve in the pump. The pressure and ripple/tuning signals will be monitored internally; an algorithm determines if the signals are stable and stops the procedure when the selected channels have been purged successfully. The Smart Purge procedure adds convenience to all LCs, and even facilitates remote purging of LCs without an automatic purge valve. After purging individual solvent channels, Smart Purge can restore the original solvent composition and flush the flow path up to the sampler needle tip to ensure consistent equilibration of the system.
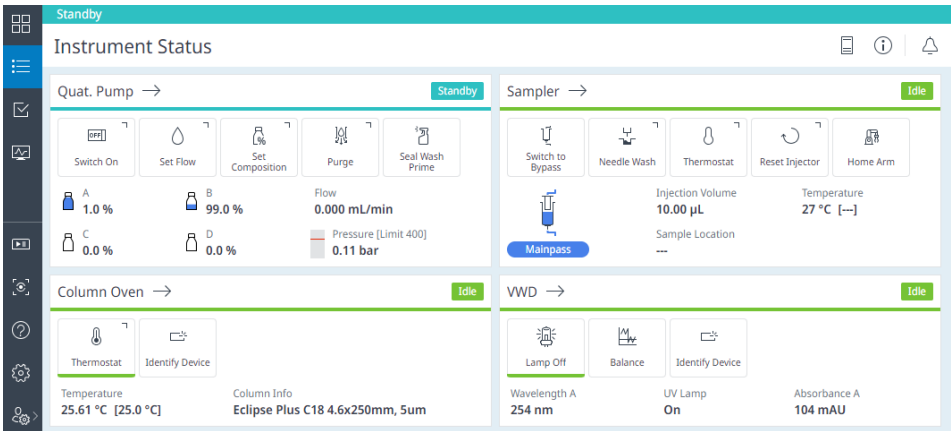

Figure 4. Instrument Status view, displaying information and quick-action soft buttons specific to each module.
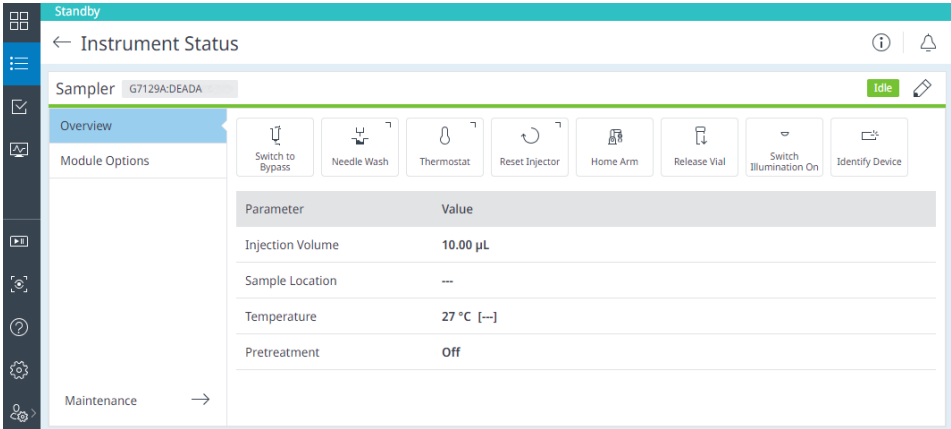

Figure 5. Detailed instrument status view for an autosampler. Note the quick-action soft buttons and the shortcut to maintenance.

Tasks

If more than one solvent bottle has been exchanged, and the system is to be prepared for analyses – to ignite the detector lamp, cool the samples, heat the column, flush it, and equilibrate with defined starting conditions – the user does not have to perform each of these steps separately. InfinityLab Assist introduces tasks, which help automate typical procedures when operating an LC (Figure 6).

The Make Ready task will automatically equilibrate the system at defined starting conditions, with options to purge and preflush the system at different composition and flow settings. Equilibration comprises the following steps:

- Running the pump at freely settable conditions until either a defined volume has been pumped (manual) or stable conditions have been reached (automatic)
- Cooling the samples to a defined temperature
- Heating (or cooling) the column to a defined temperature
- Switching on detector lamp(s)

The Standby task can optionally flush the system and the column at different conditions, which facilitates preparing the column for storage. Afterwards, the system can either be put to sleep (everything turned off except electric power) or put into standby mode. This mode will continue to pump solvent at a defined flow rate, avoiding, for example, the precipitation of buffer salts, which can happen if the pump is switched off. To reduce energy consumption in standby mode, the column and sample thermostats, as well as the detector lamps, may be switched off separately.

Tasks with different steps and conditions can be created by technicians and administrator users and stored with meaningful names. Any user except the Viewer may run existing tasks. A scheduling function allows the user to run tasks on a regular basis, and have them start at a defined time. This function helps labs act more economically and sustainably by having the system ready once the users start in the morning, and putting it to standby in the evening. If the instrument is busy running samples at the time a task is scheduled, the task can be skipped or appended after the samples. No task will ever interrupt a running sample.
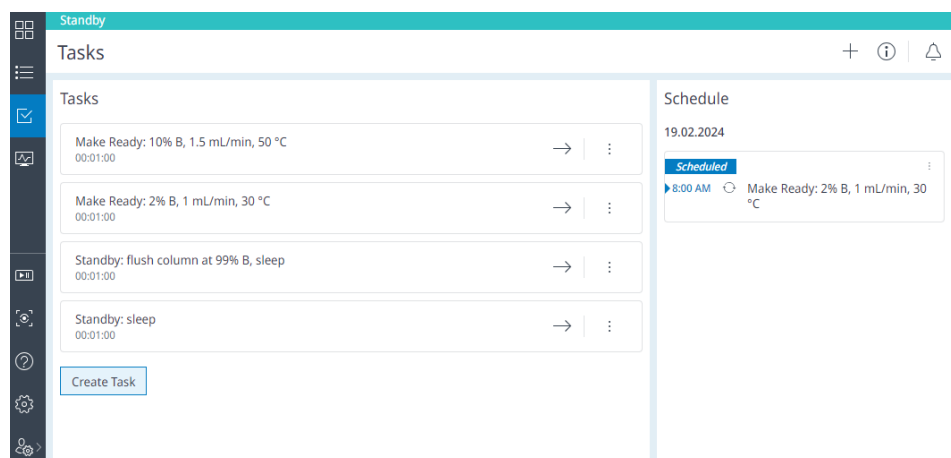

Figure 6. Tasks view, showing different Make Ready and Standby tasks, as well as scheduled tasks.

Health

The Health view contains the instrument log and gives access to troubleshooting, maintenance, diagnostics, and instrument insights (Figure 7). Only technicians and administrator users have access to maintenance and diagnostic tests, whereas the activity log, troubleshooting, and instrument insights are visible to every role.

Insights

Instrument insights comprise early maintenance feedback (EMF) counters and trends, as well as instrument trends. EMF counters track the wear and tear of wearing parts, such as valve switches, liters pumped, or burn time of detector lamps. Technicians and administrators may define a maximum for each EMF counter. Upon reaching this value, a notification can be displayed. This feature improves ease-of-use and reduces errors by displaying counters and notifications of maintenance due, directly at the involved instrument.
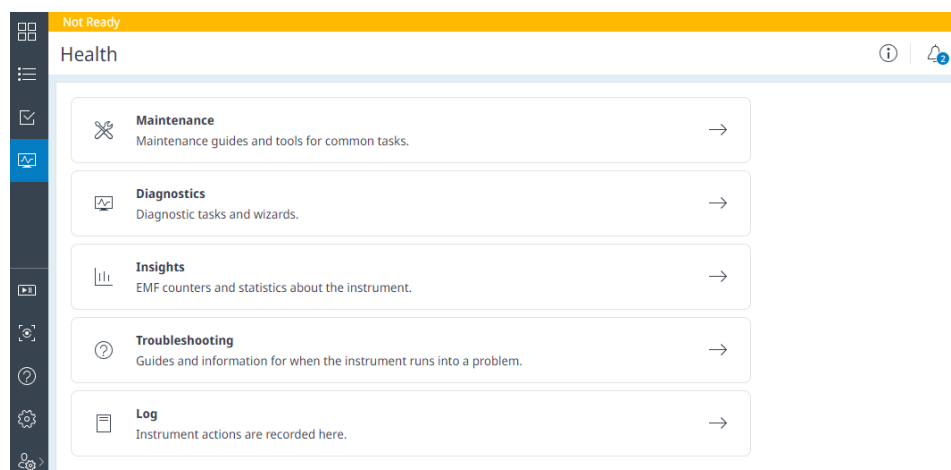

Figure 7. Health view, giving access to logs, insights, and a troubleshooting guide for every user. Technical roles may launch diagnostics and maintenance procedures.

Instrument trends are a different type of insight that provides information on how economically the system is being used. Two factors are evaluated for this purpose: solvent efficiency and runs per day. The latter metric is shown as a simple counter that can be displayed as a curve over the last twelve months. Solvent efficiency, on the other hand, is defined as the percentage of pumped solvent that is used to separate samples.

If, for example, the instrument equilibrates the column for one hour before a three-hour sample sequence, the solvent efficiency will be 75%. Up and down arrows briefly show if the daily trend of these metrics is increasing or decreasing. Instrument trends provide valuable information on how efficiently an LC is being used, and thus help decide if a system really needs to run, or if the samples should instead be distributed to other systems. This decision can help lab managers act more economically and sustainably.

Troubleshooting and maintenance

One of the biggest advantages of the InfinityLab Assist becomes evident when any of the maintenance, diagnostics, or troubleshooting procedures are started. If any of the modules in the LC stack encounters an error, a notification on the display will show what the problem is, and which module is involved. In many cases, a troubleshooting guide can be launched directly from within this notification and will help the user fix the problem by giving possible causes and how to solve them (Figure 8). Another more general troubleshooting guide has been ported from the popular Agilent InfinityLab HPLC Advisor app, which is freely available on the Apple App Store and Google Play Store.[1] This guide starts with a selection of the error symptoms (for example, drifting peaks) and will present the user with different solutions starting with the most likely cause for the problem. If necessary, diagnostic procedures, such as a lamp intensity or leak tests, may be launched directly from the diagnostics screen. For many repairs, the maintenance screen provides step-by-step instructions on how to perform tasks such as exchanging a detector lamp or autosampler gripper. With the Assist interface folded down, following the on-screen instructions is more convenient and saves time (Figure 9).
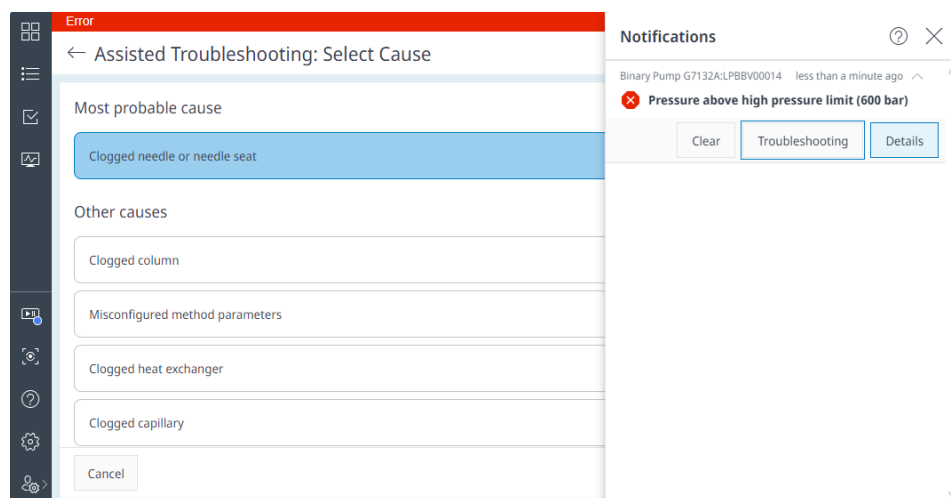

Figure 8. Clicking the Troubleshooting button in the error notification launches a list of possible causes and instructions for how to fix them.
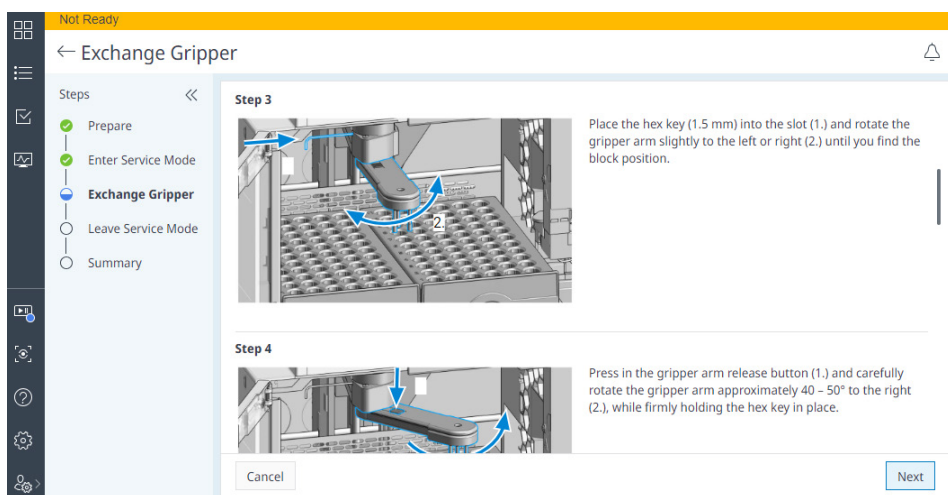
Figure 9. Example of guided maintenance: exchanging a vialsampler gripper with on-screen instructions.

Logs

The InfinityLab Assist features a dedicated log that is independent of a connection to a controlling PC. If the LC is connected to OpenLab CDS Acquisition software, the instrument log and any maintenance and diagnostics activity will be stored and synchronized with the OpenLab data storage on the PC. The log can be searched and filtered by date, result (warning, info, error, done, or failed), executing user, and category (task, maintenance, diagnostic). This easy-to-use log, accessible directly at the instrument, is another great example of how InfinityLab Assist helps speed up and facilitate troubleshooting, system checks, and audits.

Conclusion

The Agilent InfinityLab Assist is the direct interactive access point to control Agilent InfinityLab LC systems. Monitoring instrument actuals, setting system parameters, and executing daily tasks such as purging are accessible through an adjustable multitouch display at the instrument. Automated tasks to equilibrate the system or to induce a standby can be customized, saved, and scheduled on-demand. Integrated guides for maintenance and troubleshooting facilitate these tasks and, if required, point the user to the solution without the need to consult external documentation. These features make daily laboratory work faster, easier, and less error-prone, even for inexperienced users, and thus help labs act more efficiently and economically.

Reference

1. Agilent InfinityLab HPLC Advisor app, https://www.agilent.com/en/product/liquid-chromatography/hplc-advisor

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