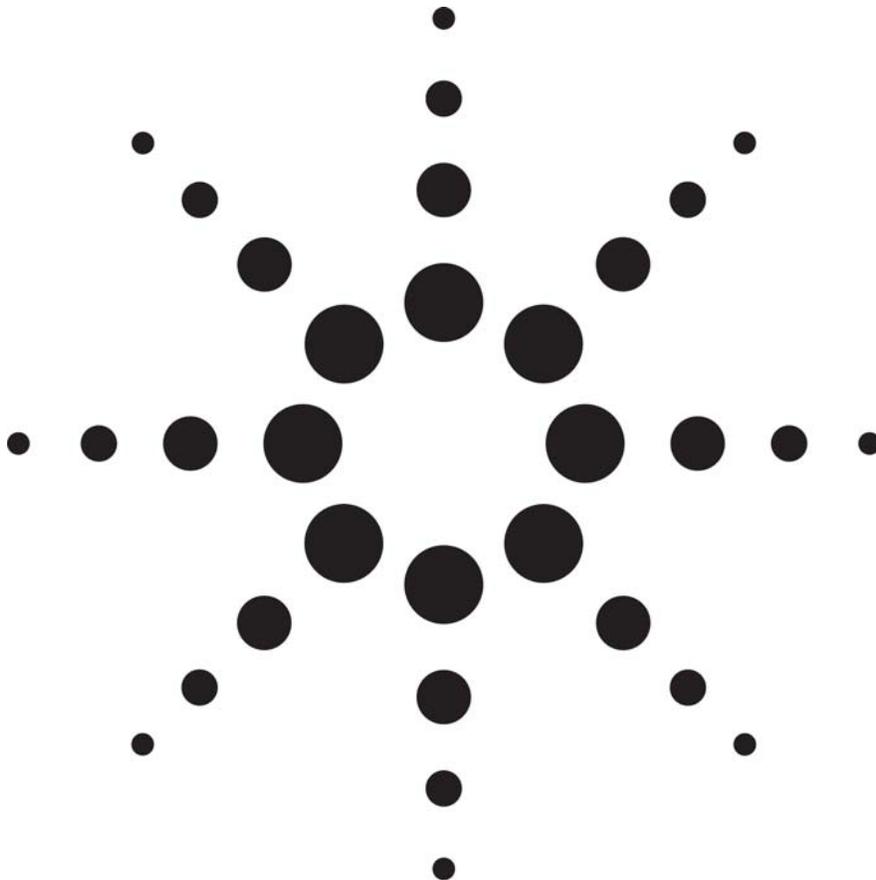


# Instrument Management Design Features of Agilent OpenLAB

White Paper



Agilent Technologies  
Software & Informatics  
Life Sciences & Chemical Analysis Group

# Instrument Management Design Features for Agilent OpenLAB

Agilent OpenLAB is designed as an “operating system” for the laboratory. It is intended to provide a scalable, flexible, and adaptable platform for laboratory instruments, laboratory operators, and laboratory work processes. Incorporating some of the most up to date design concepts in computing and database architecture, OpenLAB provides a feature-rich framework for instruments and laboratory information — a strategy for integrating instrumentation, local data systems, and other laboratory electronic information into a fully protected, searchable system.

In addition to managing the information in a laboratory, OpenLAB provides a number of software features and capabilities for managing instruments. This white paper will discuss some of these major features and benefits to instrument management for end users, system and laboratory managers. A companion paper is available that discusses OpenLAB design features from the standpoint of managing content.

## Software Control for More Than 300 Instruments

OpenLAB takes advantage of a vast library of control software that has been developed for more than 300 different instruments from leading chromatography manufacturers. Instruments ranging from Agilent 6890 GCs, 1100 HPLCs, Waters Alliance HPLC, Thermo HPLC and GCs and chromatography devices ranging from Alltech and ESA detectors, Alcott Autosamplers, Valco VICI valves, and PE Nelson Intelligent Interfaces can all be added to any OpenLAB framework.

OpenLAB’s extensive instrument control software provides software driven control of the pump functions, detector settings, and autosampler controls. This enables laboratories that incorporate a multi-vendor, heterogeneous mixture of instruments to integrate everything under a single software platform, simplifying end user training and operations.

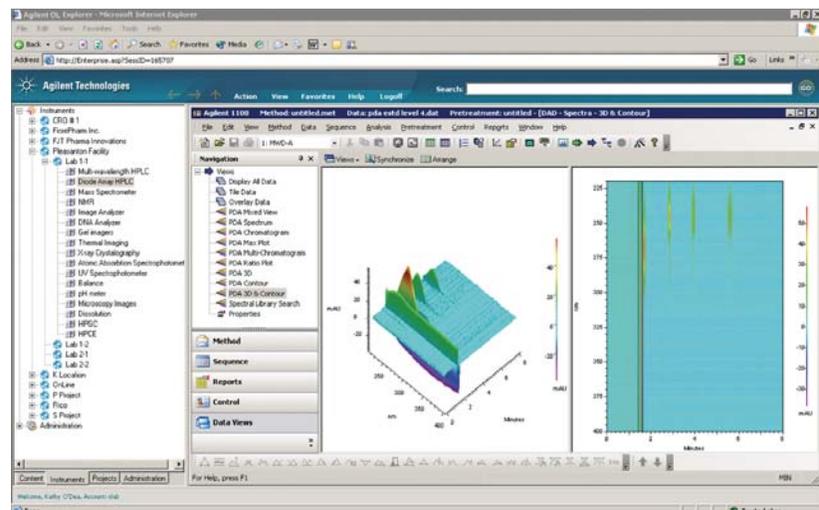


Figure 1: Typical OpenLAB provides both an “instrument” view of the enterprise as well as a “content” view. In this example, an authorized user has accessed the main OpenLAB instrument view. Instruments can be located in the convenient OpenLAB left pane in the hierarchy of “LOCATION / CABINET / DRAWER / FOLDER” so that instruments can be easily assigned into a project or location folder.

A list of commercial instruments controllable by OpenLAB is shown in the Appendix of this paper. A current list is maintained on the Agilent web site.

In addition to instrument control, OpenLAB provides complete data analysis, processing, and review of chromatography data. Graphic review of data, flexible report summaries, and extended treatment of even PDA (photo diode array detectors) data is provided. A complete feature set based on over 15 years of chromatography software experience is provided in OpenLAB for all chromatography data.

### **Network Access to Instruments with the Agilent Instrument Controller**

Instruments in the OpenLAB framework connect to the network through the Agilent Instrument Controller (AIC). These network appliances provide LAN-based network access to all instruments and control the data acquisition process in a protected fashion so that even if the network is inoperative, the data acquisition and control of instruments can proceed through the AIC.

In OpenLAB, the AICs are, simply, networked instrument controllers. In OpenLAB, the AICs perform no data analysis or reporting. Their operation is dedicated to instrument control and data acquisition. Data are acquired locally through the instrument and transferred to the OpenLAB Analysis and Reporting Server for data processing and reporting.



Figure 3: The Agilent Instrument Controller is a network device used by OpenLAB to connect all instruments into the software framework. It has a small footprint and can connect up to 4 different instruments and it supports a variety of different communication protocols (RS232, IEEE, SCSI, Ethernet, USB).

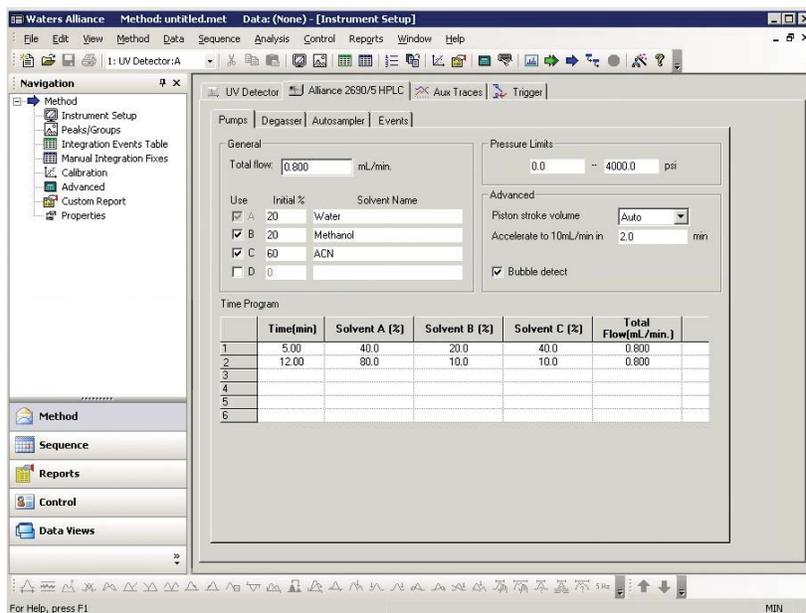


Figure 2: Typical OpenLAB client screen for instrument control. More than 300 different instruments from a variety of different instrument vendors can be controlled within OpenLAB through a uniform software interface.

The AIC still provides full instrument control in the absence of a network connection (or network failure). Once a sequence is submitted to the AIC, the AIC will process the entire sequence (including sequences based on multiple methods), buffering the data locally in memory if necessary. When the network connection is restored, the buffered data are transparently and automatically transferred to the OpenLAB File Servers.

From a network perspective, the OpenLAB AIC behaves similar to other network appliances such as routers and switches. The AIC does not need to be a member of the Windows domain and no domain login

credentials are required. No print drivers, device drivers or instrument control software are installed by the user on the AIC. In fact, the AICs themselves have no external access (no keyboard, monitor) other than their network connection.

System administration and support in OpenLAB for the AICs are also simplified. Instrument control software are “pushed” to the device by the OpenLAB server so that enterprises incorporating many AICs throughout a diverse facility can still administrate and control them easily.

Designed as a “closed system” in accordance with the FDA’s 21 CFR Part 11 requirements, the AIC simplifies deployment in an enterprise and reduces validation requirements with its “validate once – deploy many” capabilities. All AICs are the same structurally so that enterprises can validate one AIC type with the assurance that others of the same configuration can be safely deployed.



Figure 4: Typical instrument control screen from an OpenLAB web client. Real time status display of the instrument's condition can be instantaneously obtained. The above screen is taken from an OpenLAB web client in the act of initializing instrument control parameters to a supported Waters Alliance HPLC. OpenLAB instrument control of the Waters Alliance pump, autosampler, and detector is provided.

### **Network Access to Instruments from Web Clients**

OpenLAB is one of the first commercial software applications for the laboratory based on web clients. This provides the laboratory with more flexibility in deployment, since any hardware with a web browser can serve as a client. Validation is also simplified. Minimal software is actually loaded onto the OpenLAB client computers and it is not necessary to pre-load client computers with application software in order to run OpenLAB.

From an OpenLAB client, users with the appropriate security can access their instruments on the network. This not only facilitates ease in access to the instruments, but it can help preserve bench space by *removing the need to place PC controllers next to every instrument*. Only the low profile AIC is used to connect instruments to the network, and each AIC can support multiple instruments.

As part of the instrument control capability, OpenLAB web clients can display real time data from a given running instrument as well as real time status, all through the network. Users familiar with standard

Microsoft applications (Internet Explorer, Word, Excel) use a series of similar software controls in running OpenLAB sessions so that end user training is straightforward.

### **Integrating Non-Chromatography Instruments**

As a software framework, OpenLAB is designed to incorporate more than just the chromatography control software and analysis software modules from Agilent. Any laboratory instruments that create electronic records can be readily integrated with OpenLAB so that their electronic information or content becomes managed by OpenLAB's Content Manager. Devices as simple as pH meters and titrators to sophisticated data systems can be managed by OpenLAB.

Records from these instruments become securely protected, and the full power of OpenLAB's archiving and storage capabilities ensure that such data can be managed along with other laboratory information in a company. Electronic records are fully protected, searchable, and can be managed along with other laboratory content through the OpenLAB Enterprise Content Manager.

OpenLAB's content management features also extend to managing information from other software applications such as Microsoft Office, Adobe pdf files, graphic files, email, and more. This provides labs with management capability for all content generated by a laboratory.

In addition to this basic form of instrument integration, OpenLAB can integrate instruments to a deeper level. OpenLAB provides a number of optional Attribute Extraction Services and Scheduled Import Services for various instruments and data systems. These services ensure that the electronic records from the particular device or data system are "filtered" to the OpenLAB Enterprise Content Manager automatically without end user interaction. In filtering the information, key metadata from the record is extracted to the OpenLAB database record to extend the data searching and mining capabilities. Moreover, the Scheduled Import Services provide a flexible means for the laboratory to efficiently upload information to OpenLAB to primary repositories.

Similar in many respects to Agilent's OpenLAB instrument control development programs, Agilent is involved in an on-going development program for AES. Agilent regularly develops and releases new AES for particular instruments and data systems as they are developed.

A list of Automated Extraction Services for OpenLAB is provided in the Appendix of this paper. A current AES list is posted in the Agilent web site.

### **Managing Instruments in OpenLAB**

Once instruments under OpenLAB instrument control and data analysis software or those which operate as non-chromatographs are connected into the OpenLAB framework, their electronic records can be put into the OpenLAB Enterprise Content Manager. If Automated Extraction

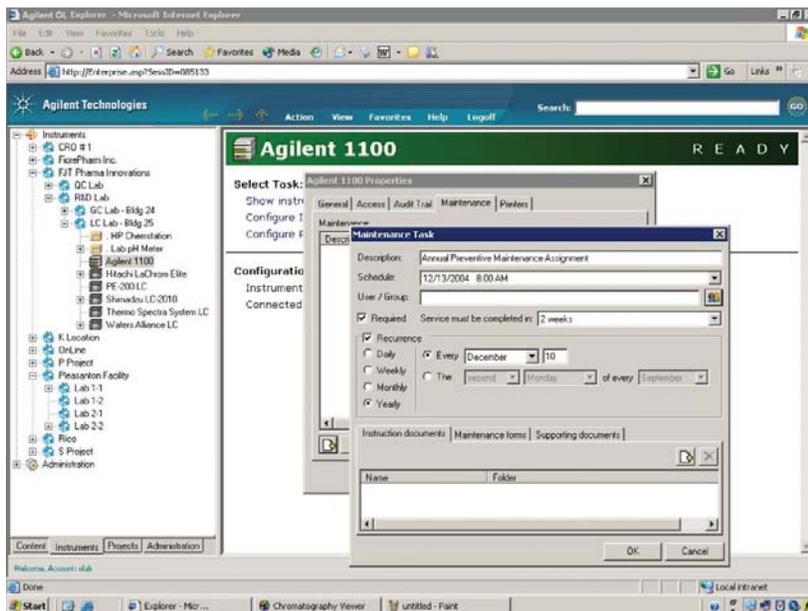


Figure 5: OpenLAB instrument maintenance setup screens allow creation of maintenance tasks including links with other documents (instructions, checklists, etc.) managed by the OpenLAB Enterprise Content Manager. If desired, instruments can be managed by OpenLAB such that the scheduled maintenance must be performed or the instrument cannot be run by users.

Services are in operation, extended metadata is deposited in the OpenLAB Enterprise Content Manager for each data.

Laboratories can then perform a variety of content searches on the instrument data. This ensures that data from these instruments can be incorporated as part of the total laboratory content of information and included in extended searches or queries and complex reports.

Using OpenLAB's unique architecture, all instrument data is available in "on-line" archives so that these laboratory data can be treated and moved into various primary, secondary and archiving storage locations. Nevertheless, end users with appropriate permissions can still access this information easily and quickly.

These features and more for managing instrument data are discussed more specifically in a companion white paper focusing on Content Management design Features of OpenLAB.

### ***Instrument Maintenance Operations in OpenLAB***

GLP/GMP laboratories can greatly benefit from OpenLAB's Instrument Management by streamlining and automating instrument maintenance operations. Virtually every laboratory instrument will have some recommended maintenance procedures from the manufacturer. Such operations can involve specific recommendations as part of routine preventive maintenance (e.g., changing pump seals after a set number of pump cycles or pump volume is reached), or it can involve specific steps to take in the event of routine component replacements (e.g. steps to perform to switch columns).

OpenLAB's management of instruments and other electronic content makes possible the integration of specific instrument maintenance operations to assist any laboratory.

OpenLAB provides for a "Maintenance" property to be defined for each

instrument in the OpenLAB framework. Laboratory managers can specify specific instructions as defined by their standard operating practices (SOPs) for end users. These instructions can be electronic documents defining step by step procedures, captured documents from manufacturer's instruction manuals, and even required sign off forms for the end user to address following completion of a maintenance assignment.

### ***Integrating other Data Systems to OpenLAB***

In addition using Automated Extraction Services to pass electronic information from some separate laboratory data systems into OpenLAB's Enterprise Content Manager, some laboratories may wish to operate these data systems within the framework of OpenLAB.

OpenLAB is more than an application - it is an application framework. This means that separate third party applications can be added to the instrument hierarchy view of OpenLAB and take advantage of the power of OpenLAB.

Applications configured in this way are under the control of the overall OpenLAB security environment. Just as with native OpenLAB control software, users without OpenLAB permission will not see the legacy instrument control when they navigate the instrument view. As the application generates data and other instrument information, the OpenLAB scheduling agents automatically harvest the files, transferring them to the content management system. There, they are archived and indexed for secure, searchable, easy access. Automated Extraction Services and built-in Data Viewers are provided for accessing detailed information from dozens of analytical applications, without the need to invoke the original application.

All of this is possible without making any changes to the legacy application itself.

A higher level of integration is available through the use of application serving software such as Citrix MetaFrame or Windows Terminal Server. In addition to the previous benefits, the legacy application appears inside the right pane of the OpenLAB Navigation screen, rather than in a separate window. Furthermore, access can be restricted so that the user can ONLY run the legacy application from within the OpenLAB framework, providing a further degree of security and control. Again, no changes are required to the legacy application.

## **SUMMARY**

The OpenLAB Operating System for the Laboratory provides a number of design features for laboratory instruments:

- Instrument control software and chromatography data analysis of more than 300 different HPLC, GC, and other chromatography systems from more than 25 different leading manufacturers.
- Networked data acquisition of all instruments through the Agilent Instrument Controller networked appliance.

- Client access to all instruments through web clients to enable real time access and control of instruments.
- Application of OpenLAB's enterprise content management to non-chromatographic instruments (as well as electronic information from other software applications).
- Content management for instruments including full searching and sorting of information, on-line archiving, integration of instruments and maintenance operations, and more.

## ***OpenLAB Instrument Control Software***

<b>Vendor</b>	<b>Device</b>	<b>Device Type</b>
Agilent	5890, 6890, 6850, MicroGC, 3000 GC, 7890	GCs (detectors, autosamplers, ovens, valves)
Agilent	1100 HPLC	LC (pumps, detectors, autosamplers, ovens, valves)
Agilent	1200 LC	LC (pumps, autosamplers, detectors)
ASI	MicroFAST GC	GC
GBC Scientific	LC	LC (pumps, detectors, autosamplers)
Perkin-Elmer	Series 941, 950, 960, 970, NIC 901/902	Intelligent Interfaces
Perkin-Elmer	Series 200	LC (pumps, detectors, autosamplers) and GC systems
Shimadzu	GC 14, 15, 17, 17A, 2010	GC (detectors, autosamplers, ovens and more)
Shimadzu	LC-10Avp, LC-2010	LC (pumps, detectors, autosamplers, ovens and more)
Thermo Electron	SpectraSYSTEM, Surveyor	LC (pumps, detectors, autosamplers)
Valco	EMHCA-CE, EMTCA-CE, EMHA-CE	Valves
Waters	2690, 2695 Alliance, Acquity UPLC	LC (pumps, detector, autosampler, ovens, valves)

## OpenLAB Attribute Extraction Services

AES	Vendor	Versions Supported	Group
Beckman Coulter 32 Karat™	Beckman Coulter	Up to 7.0	Data System
ACCESS*CHROM™	PerkinElmer, Inc.	ALL	Data System
ACD/HPLC, MS, NMR, IR	Advanced Chemistry Development, Inc. (ACD/Labs)	ALL	Chrom, MS, NMR, UV/IR
Adobe® PDF	Adobe Systems Incorporated	4.05 - 6.0	Desktop App
Bitmap (.bmp) Files	n/a	n/a	Desktop App
Bruker BioSpin XWIN-NMR™	Bruker BioSpin GmbH	ALL	NMR
Agilent ChemStation®	Agilent Technologies, Inc.	ALL	Data System
Agilent ChemStore™	Agilent Technologies, Inc.	ALL	Chrom
Dionex Chromeleon®	Dionex Corporation	6.8	Data System
Thermo Electron ChromQuest™	Thermo Electron Corporation	Up to 4.1	Data System
Shimadzu Class-VP™	Shimadzu	Up to 7.2	Data System
Waters® Empower	Waters Corporation	2.0	Data System
EZChrom Elite	Agilent Technologies	2.0 and above	Data System
Varian® Galaxie™	Varian, Inc.	ALL	Data System
General Files	n/a	n/a	SSZIP
GIF Files	n/a	n/a	Desktop App
JCAMP-DX IR, MS, NMR Files	n/a	n/a	UV/IR, MS, NMR
Waters MassLynx™	Waters Corporation	3.5	MS
Metrohm TiNet	Metrohm	5	Titration System
Microsoft® Office	Microsoft Corporation	ALL	Desktop App
Waters Millennium®32	Waters Corporation	3.2, 4.0, 5.0	Data System
PCX Files	n/a	n/a	Desktop App
Varian Saturn® MS	Varian, Inc.	5.41 - 5.51	MS
Sciex™ Analyst® 1.1, 1.2	MDS, Inc.	1.1	MS

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