

Using emulation mode to control Agilent 1260 Infinity LC Systems through Waters Empower software

Application Note

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Abstract

Agilent 1260 Infinity LC Systems can be operated using the Waters Empower 2 chromatography data software with ICS 1.05.

An Empower client/server system provides:

- Easy installation and configuration of the Agilent 1260 Infinity LC System; modules with new product number need emulation mode via a special firmware (possible limitations of some features)
- Evaluation of two-dimensional, three dimensional and spectral raw data acquired by Agilent 1260 Infinity UV detectors, except the Agilent 1260 Infinity DAD
- Support of maintenance and diagnostics through Agilent Lab Monitor and Diagnostic software
- Fast access to the Agilent 1260 Infinity LC System through the instant pilot controller



Introduction

Today, a key requirement of HPLC users is the control of new equipment through the software already deployed in their laboratory. This helps to reduce the cost of user training and costs related to software licenses, IT effort and comparability of results. As a consequence, suppliers of software and instrumentation are working to make their systems more compatible. This publication describes how and to what extent the Waters Empower chromatography data software can control the Agilent 1260 Infinity LC Systems. Configuration and operation of an Agilent 1260 Infinity LC Systems through Empower is demonstrated.

Supported Agilent 1200 Infinity Series LC modules

For details on supported 1200 Infinity Series LC modules please follow this link:

http://www.chem.agilent.com/en-US/ Support/Downloads/firmware/Pages/ LC.aspx

The content of this website is constantly updated and contains information on compatibility issues as well as instructions for emulating instruments for use with new modules with Empower. In addition, downloads of firmware are possible using this link. The Agilent firmware revisions for the 1260 Infinity modules must be A.06.32, B.06.32. The Agilent 1260 Infinity DAD (G4212B) is not supported as of this publication date. The following Agilent 1260 Infinity LC modules allow emulation of Agilent 1200 Series modules:

- G1310B Isocratic Pump (replaces G1310A)
- G1311B Quaternary Pump (replaces G1311A)
- G1311C Quaternary Pump VL (replaces G1311A)
- G1312C Binary Pump VL (replaces G1312A)
- G1314F Variable Wavelength Detector (replaces G1314D)
- G1321B Fluorescence Detector (replaces G1321A)
- G1367E Autosampler (replaces G1367A/B/C/D; for D hardware upgrade is required)

The following already existing Agilent 1260 Infinity LC or Agilent 1290 Infinity LC modules allow emulation of Agilent 1200 Series modules:

- G1316C Thermostatted Column Compartment (G1316A/B)
- G1314B Variable Wavelength Detector (G1314A)
- G1314C Variable Wavelength Detector (G1314A/B)
- G1329B Autosampler (G1329A)
- G1312B Binary Pump (G1312A)

The following Agilent 1260 Infinity LC modules require special firmware for downgrade due to hardware changes:

- G1312B Binary Pump
- G1376A Capillary Pump
- G2226A Nanoflow Pump

Currently not controllable modules

The new Agilent 1260 Infinity DAD (G4212B), all Agilent 1220 Infinity LC Systems and all Agilent 1290 Infinity LC modules besides the Agilent 1290 Infinity Thermostatted Column Compartment are not yet controllable. Regular updates are available at

http://www.chem.agilent.com/en-US/Support/Downloads/firmware/Pages/LC.aspx

Configuration used for testing

Module	Emulation mode required	Comment	Limitation
Pump G1311B	×	was directly recognized as G1311A	Max pressure 400 bar
DAD G1315D	×	already supported	Max data rate <0.01 min (0.1 s)
Oven G1316C	√	was emulated as G1316B	door-open sensor not supported
Autosampler G1367E	×	was directly recognized as G1367C	No needle wash option

This system as well as additional Waters Acquity HPLC systems were controlled by Waters Empower 2 chromatography data software with Instrument Control Software (ICS) version 1.05.2154, Service Pack A-D installed.

Support of maintenance and diagnostic features

In contrast to Agilent ChemStation software, third-party software typically does not control all diagnostic and maintenance features of the Agilent LC systems. To help users bridge this gap, Agilent offers the LabAdvisor software, which runs on a separate PC and can control maintenance functions such as Early Maintenance Feedback (EMF) as well as all diagnostic features. Agilent LabAdvisor software runs completely independent of instrument control software such as Waters Empower software. The use of Agilent LabAdvisor software and Waters Empower software in parallel requires a special setup that involves multiple network interface cards in the LC instruments and dedicated PCs for the LabAdvisor software. In a Waters Empower software environment, it is recommended to use the LabAdvisor software for instrument maintenance and diagnostics, but not for continuous instrument monitoring. To access the LC instruments through the LabAdvisor software for maintenance and diagnostics, it is recommended to disconnect the LC instruments from Waters EmPower software. In this way no additional hardware or IT infrastructure are required.

Agilent 1200 Infinity Series Instant Pilot controller

The Agilent 1200 Infinity Series Instant Pilot controller (G4208A) provides fast access to any 1260 Infinity LC System. Chromatographic parameters and MAC addresses can be verified as well as the instrument status and error messages. The Agilent 1200 Infinity Series Instant Pilot is also a powerful tool whenever the user needs to react quickly to a certain situation. For example, it can turn off the pump immediately if the control software goes down.

When connecting the instant pilot to an Agilent 1260 Infinity LC System that is controlled by third-party software, the software may generate an error indicating detection of an unknown module in the system configuration. This error can be prevented by making the instant pilot invisible to other controllers. To change the setting, open the **Configure–Controller** menu, scroll to the item "3rd party software" and change to ON.

Backward compatible: OFF visible to other controllers (default) ON invisible to other controllers

System requirements

An Empower client-server system is required to control an Agilent LC System (Figure 1). For details on how to install the instrument control software, refer to release note 716002507, Rev A or newer, available from Waters. When connected to the Empower chromatographic data system, the Agilent 1260 Infinity LC (all dip switches to off) receives an IP address from the LAC/E bus automatically through DHCP or BOOTP. In this example, the Agilent 1260 Infinity LC System was connected to the Empower chromatographic data system using a LAN cable. The modules of the Agilent 1260 Infinity LC were interconnected using CAN cables.





Installation of the Agilent 1260 Infinity LC Systems within the Empower client-server environment .

Agilent equipment

The Empower software incorrectly labels the Agilent 1260 Infinity LC as "A1100". This is a software defect that has not yet been corrected. The functionality and performance is not influenced by this incorrect label.

The full functionality of the Agilent 1260 Infinity LC System is available, including operation up to 400 bar and a data rate up to 20 Hz for the Agilent 1260 Infinity Diode Array Detector VL. During this test the Agilent 1260 Infinity LC System was running in the emulation mode.

Setting the communication protocol

The Agilent 1260 Infinity LC System is configured by clicking *Configure System* in the Empower main menu (Figure 2).

To check whether the Agilent 1260 Infinity LC System has received an IP address after connection through a LAN cable to the LAC/E bus, click *Configure System* > LAC/E 32 controller > Properties > Configure DHCP.

Figure 3 shows that the Agilent 1260 Infinity LC System, labeled as *A1100*, has received the IP address 192.168.0.7 (last line of the list). This confirms that the Empower software has recognized the new LC system. To give the system a correct name, highlight *A1100*, click *Edit* and then type, for example, *A1260new*.





Empower software main menu.

,	📲 Waters DHCP Server Configuration 📃 🗆 🗙					
F	ile Server Help					
Г	-					
	IP Address	MAC Address	Туре	Name		
	192.168.0.3	00-00-C4-03-2D-ED	ACQ-BSM	A05UPB564M		
	192.168.0.4	00-00-C4-04-07-14	ACQ-PDA	A06UPD868M		
	192.168.0.5	00-00-C4-03-38-89	ACQ-SM	A05UPS526N		
	192.168.0.6	00-00-C4-04-48-AF	ACQ-CM	E07UPM389M		
	192.168.0.8	00-00-C4-04-91-64		E08UPO085M		
	192.168.0.9	00-00-C4-04-92-38	ACQ-SM	C08UPA420M		
	192.168.0.10	00-00-C4-04-94-1F	ACQ-PDA	C08UPD725M		
	192.168.0.11	00-00-C4-04-7C-A6	ACQ-FLR	C08UPF295M		
	192.168.0.12	00-00-C4-04-8D-15	ACQ-BSM	CO8UPB561M		
	192.168.0.7	00-30-D3-06-01-00	A1100	A1260new		
	•			•		
		Add Fdit	Remove	OK L		
1						



Checking the IP address of the Agilent 1260 Infinity LC System.

The next step activates the Agilent 1260 Infinity LC System for use (Figure 4a). In the configuration menu, click *System* and then *New Instrument*. When the configuration screen appears, drag-and-drop the *A1260new* system from the left to the right. Click the *Access* tab to share the instrument and define users (Figure 4b).

Drag Components to/from the System Configuration list to alter its configuration. Note that you may open the other systems and move their components also.



Figure 4a

Activating the Agilent 1260 Infinity LC through drag-and-drop in the configuration screen.

Chromatographic System 'A12060DADC' Properties						
General Configuration Access Share System with Other Network Us Allowed Access ○ Owner Only ○ Owner Only ○ Owner, Group and World Password Protect Access □ Password Required Password Required	ers Owner: alab Allow Access to Group(s): Administrators AppLab FIELD Guests Marketing Pton RandD RandD					
	OK Cancel Help					

Figure 4b

Defining share and user parameters.

Figure 5 shows how to test if communication is ready to use by clicking *Empower Nodes* > *Czc7424s3r* > *Properties* > *Instrument.* The column labeled *OK*? indicates the readiness: *Yes* or *No.* If new modules are attached to the existing *A1260new*-system with *SCAN Instruments* the system indicates whether the new modules are recognized and accepted. If it turns to *NO* the new module is not recognized. In this case use the emulation mode.

Empower support of Agilent equipment

The Empower software supports all functionality of the Agilent 1260 Infinity LC Systems with the exception of:

- · Injector programming
- EMF and other diagnostic tasks
- RFID tags on lamps and detector cells
- · RFID tags on columns
- · DAD recovery card
- Creation of additional compressibility curves by the user

Support of the Agilent 1260 Infinity quaternary pump

Figures 6 and 7 show the main setup screens for the Agilent 1260 Infinity Quaternary Pump. The gradient, flow and stroke settings are entered. In this test, water and acetonitrile were selected as solvents. All other modules are supported through a similar menu design (Appendix A).



Figure 5

Checking if communication is active.



Setting up the main functions of the Agilent 1260 Infinity Quaternary Pump through the Empower software.

Application example

This application example used the following workflow:

- Setting up the instrument
- Running a sample
- Finding the data
- · Reviewing the results

The chromatographic parameters for the individual modules are set up through *Instrument Method* > *Edit* (Figure 8).

1260emulation in A	AppLabData\tuv on WAT6 as alab/Chemist - Instrument Method Editor	_ 8
He Eat View Hep □⊯⊫ ≌×		
	Flow Channel Solvents	
Quaternary Pump	Solvent A Description: Vater	
DA Detector VL	Solvest B	
Column Heater SL	Description: Acetonitrile	
WP Autosampler SL with Heater	Solvest	
	Solvert D.	
	Description: QSolventD	
	Seal Wash Parameters	
	Mode: Of s Single Wash Time: Diff. Min.	
	Wash Period: 10 Mm. Wash Active Time: 12 Mm.	
Done		

Figure 7

Selecting and defining solvent channels.



Figure 8 Editing instrument method parameters and sequences.

The setup screens for the modules appear and the parameters can be set. The parameters are saved as an instrument method. After saving an appropriate Method Set, a sequence can be created. Using the Method Set, the sequence lines are filled out as in the upper left section of Figure 9. The sequence is then saved as a Sample Set. After equilibration of the system the sequence can be started and all data files are stored under the selected Sample Set name. When the sequence has been completed the two-dimensional and three dimensional data can be reviewed and evaluated (Figure 9).

In the *Review* screen, the parameters for integration, calibration and other data evaluation are set and saved as a Process Method. The report editor creates a report and Figure 10 shows an example based on the data created using the sequence and process method described in this example.



Figure 9

Review screen for data evaluation and creating a process method.





Example report created using the report editor.

Conclusion

The Agilent 1260 Infinity LC System can be controlled through the Waters Empower chromatographic data system software, and all chromatographic parameters required for optimum performance can be set. The emulation mode is required for control of modules with new product numbers. The new Agilent 1260 Infinity DAD (G4212A) is not yet supported. Several specific features such as injector programming are still not supported. An immediate support of all Agilent hardware modules and all of their features will be provided as soon as the Agilent Instrument Control Framework (ICF)¹ is supported by the Waters Empower software. The maintenance and diagnostic features of the Agilent 1260 Infinity LC System are supported by the Agilent LabAdvisor software, which runs on a separate PC and is completely independent from the LC control software. Overall the combination of the Agilent 1260 Infinity LC System and Empower software is an equivalent alternative for laboratories where this software is deployed for instrument control and data evaluation.

References

1

"The Agilent Instrument Control Framework (ICF) - A short introduction for end users of Agilent HPLC instrumentation as well as third party instrument control providers", Agilent 2010, pub. no. 5990-5756EN

Appendix A

This appendix contains additional setup screens (Figures 11-14) for additional modules of the Agilent 1260 Infinity LC System.

A1100	
Lieneral Temperature	
General Stringa Siza (ul) - 100 -	Sant Canillany Volume (ul) : 23 V
Loop Capillary (ul) : 200	Fouribration Time (sec) :
Injection Mode : Inject	Automatic Delay Volume Reduction : C Emphad @ Disphad
Overlap Mode : C Enabled C Disabled	Overlan Wait Time (min) · [100
Compartment Light : C On C Off	
Needle Inject Options	
Bottom Sensing : @ Enabled C Disabled	
Draw Position Offset (mm) : 0.0	Sample Elush Out Factor : 5.0
Samgle Draw Speed (ul/min) : 200.0	Sample Eject Speed (µl/min) : 200.0
Wash Option : Wash needle in flush port 💌	Flush Time (sec): 3.0
Wash Cycles : 1	Tray Type : 10 Val + Dual Well Plate 💌
Wash Location Type : Vial	Vial Number: 1
Row Number : 🗛 💌	Column Number : 1 💌
Cany Over Reduction	
Vaive Cycles : 1 💌	
Tame <u>1</u> (min) : [0.0]	Trime 2 (min) : 0.02
Lime 2 (mm) : [0.00	Linne ± (min) : [1.00

Figure 11

Setup screen for Agilent 1260 Infinity High Performance Autosampler.

🐴 1260emulation in Ap	pLabData\tuv on WAT6 as alab/Chemist - Instrument Method Editor		_ <u>8</u> ×
File Edit View Help			
	A1100		
	General Channel Events		
	Peakwidth: < 0.01 min(0.1s)	Margin for Negative Absorbance (mAU) : 100	
See 1	Slit (nm) : 1	UV Lamp Required : C Yes C No	
Quaternary Pump	Auto Zero Prerun : @ On C Off	UVLamp: © On C Off	
	Auto Zero Postrun : C On C Off	Vis Lamp Reguired : @ Yes @ No	
	Temperature Control : © On © Off	Vis Lamp : 💿 On 🕤 Off	
DA Dietector VL	Analog A	Analog B	
	Voltage Range : 1.0V full scale Zero Offset (%): 5	Voltage Range : 1.0V full scale Zero Offset (%): 5	_
	Attendation (mAC).] 10000	Attenuation (mAC) : 1000.0 S	
Column Heater St			
WP AutosamplerSL with Heater			
Done			

Figure 12 Setup screen for Agilent 1260 Infinity Diode Array Detector VL Plus.

1260emulation in Ap	ppLabData\tuv on WA	r6 as alab/Che	mist - Instrument Meth	nod Editor					_ 0
ile Edit View Help	- File Allo								
1	General Channel Ev	ents							
	Channels		Waveleng	Sample (th (nm)	Bandwidth (nm)		Wavelengt	Reference h (nm)	Bandwidth (nm)
	Channel <u>1</u>	⊙ On C Off	254	10		⊙ On ⊙ Off	360	100	
DA Detector VL	Channel 2	○ On ● Off	254	16		🖲 On 🖸 Off	360	100	
	Channel <u>3</u>	℃ On ④ Off	210	8		© On © Off	360	100	
Column Heater SL	Channel <u>4</u>	⊂ On ⊙ Off	230	16		© On © Off	360	100	
	Channel <u>5</u>	⊂ On ⊙ Off	280	16		© 0n © 0ff	360	100	
WP AutosamplerSL with Heater	Channel <u>ó</u>	⊂ On ⊙ Off	280	16		C On	360	100	
	Channel 7	⊂ On ⊙ Off	280	16	1	C On	860	100	
	Channel <u>S</u>	○ On ⊙ Off	280	TE		© On © Off	360	100	
	– Spectra Enable Spectra: Starting Waveleng	şth :		C On @ Off 210		Step: Ending Wavele	ngth :	1.0	_
Jone									

Figure 13

Additional setup screen for Agilent 1260 Infinity Diode Array Detector VL Plus.

al260emulation in	AppLabData\tuv on WAT6 as alab/Chemist - Instrument Method Editor	
File Edit View Help		
Quaternary Pump	General Events Temperature Left C Not Controlled C Value (C) 55 00 Lesk Detection: C On C Off Enable Analysis V(th Am Tercenture	Temperature Eight C Not Controlled Same as Left Value (*C): [2:00] Setuent (*-**0): [2:0]
Column Heater SL		

Figure 14 Setup screen for Agilent 1260 Infinity Thermostatted Column Compartment.

www.agilent.com/chem/lc

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