

Controlling Agilent 1200 Series Rapid Resolution LC systems through Waters Empower chromatography data software

Technical Overview

	Flow Channel Solvent: Solvent <u>A</u> Selection Valve :	©1 C 2	Solvent <u>B</u> Selection <u>V</u> alve :	©1 C 2
Binary Pump SL	Description:	water 🔺] Description :	Acetonitrile
Auto Injector with Heater	Compressibility Mode: Preset Solvent: Constant Value: Known Values:	Preset Solvent H20 (10 ⁻⁶ per bar) Sediment S	Compressibility Mode: Preset Solvent: Constant Value: Known Values:	Preset Solvent ACN 15 (10 ⁻⁶ per bat) Splant Get
DA Detector SL	Seal Wash Parameters Mode: Single Wash Time:		Periodic • 0.00 Min.	
olumn Heater SL	Wash Period: Wash Active Time:		0.5 Min.	

Abstract

The Waters Empower 2 chromatography data software with ICS 1.05 fully supports Agilent 1200 Series Rapid Resolution LC (RRLC) systems with the exception of some special functionality. An Empower client-server system provides for:

- Easy installation and configuration of the Agilent 1200 Series RRLC system
- Support of all important parameters of the Agilent 1200 Series SL modules
- Evaluation of 2D, 3D and spectral raw data acquired by Agilent 1200 Series UV detectors
- Support of maintenance and diagnostics through Agilent Lab Monitor & Diagnostic software
- Fast access to the Agilent 1200 Series RRLC system through the instant pilot controller



Introduction

Today, a key requirement of HPLC users is the control of their equipment through the software deployed in their laboratory. This helps to reduce the cost of user training and also reduces 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 Empower chromatography data sofware can control the Agilent 1100 Series HPLC, 1200 Series HPLC and 1200 Series RRLC systems. Configuration and operation of an Agilent 1200 Series **RRLC** system through Empower is demonstrated.

Supported Agilent LC modules

Table 1 lists the Agilent LC modules that are supported by Empower software with ICS 1.05. "Agilent LC ICS v1.05 was tested with the following versions of Empower Software: Empower build 1154 SP L, Empower build 1154 SP M, Empower 2, FR3, Empower 2 FR4, Empower 2 SP D. If your Empower or Empower 2 system is at an earlier service pack or feature release level, then the ICS will not install." (Waters release note 716002507, rev A)

The Agilent firmware revisions A.06.02/03/04, B.01.02/03/04 and B.02.01 were tested with Empower software.

Non-supported Agilent LC configurations

The following configurations and functionality are not supported by Empower software:

Agilent 1100 Series LC Modules	Agilent 1200 Series LC and RRLC Modules
Isocratic Pump (G1310A)	Isocratic Pump (G1310A)
Quaternary Pump (G1311A)	Quaternary Pump (G1311A)
Binary Pump (G1312A)	Binary Pump SL (G1312B)
Second isocratic pump for automated column	Second isocratic pump for automated
regeneration (G1310A)	column regeneration (G1310A)
Autosampler (G1313A), includes G1313A-60004	See Standard Autosampler (G1329A)
extension for extra vials only	
High performance autosampler vial and well plates	High performance autosampler vial and
and series A and B autosamplers (G1367)	well plates and series C autosampler (G1367)
Variable Wavelength Detector (G1314A)	Variable Wavelength Detector (G1314B) Variable Wavelength Detector SL (G1314C)
Diode Array Detector (G1315A and G1315B)	Diode Array Detector SL (G1315C)
•	Diode Array Detector (G1315D)
Thermostatted Column Compartment (G1316A)	Thermostatted Column Compartment SL
	(G1316B)
Fluorescence Detector (G1321A)	Fluorescence Detector (G1321A)
Vacuum Degasser	Vacuum Degasser
(G1322A, compatible, no control)	(G1322B, compatible, no control)
Thermostatted Autosampler	Thermostatted Autosampler
(G1327A, equivalent to G1329A and G1330A)	(G1327A, equivalent to G1329A and G1330A)
Standard Autosampler (G1329A)	Standard Autosampler (G1329A)
	Standard Autosampler SL (G1329B)
Autosampler Heater/Cooler Module	Autosampler Heater/Cooler Module
(G1330A and G1330B)	(G1330B)
Quaternary Pump with Degasser (G1354A)	Quaternary Pump with Degasser (G1354A)
Refractive Index Detector (G1362A)	Refractive Index Detector (G1362A)
Multiple Wavelength Detector	Multiple Wavelength Detector SL (G1365C)
(G1365A and G1365B)	Multiple Wavelength Detector (G1365D)
Micro Vacuum Degasser	Micro Vacuum Degasser
(G1379A, compatible, no control)	(G1379B, compatible, no control)
2Ps6P Solvent Selection Valve (G1159)	2Ps6P Solvent Selection Valve (G1159)
12Ps13P Valve (Solvent Selection) (G1160)	12Ps13P Valve (Solvent Selection) (G1160)
Handheld Controller (G1323B)	Instant Pilot Controller (G4208A)

Table 1

Agilent LC modules supported by Empower software.

- Injector programming
- Purge kit (G1373A)
- Fraction collectors
- Early Maintenance Feedback (EMF)
- RFID tags on lamps and detector cells
- RFID tags on columns
- DAD recovery card
- Creation of additional compressibility curves by the user
- Sample capacity extension module (G2257A)

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 Lab Monitor & Diagnostic (LMD) 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 Lab Monitor & Diagnostic software runs completely independent from the instrument control software such as Empower. Every Agilent 1200 Series binary pump SL is delivered with a basic version of Lab Monitor & Diagnostic software, which can be upgraded to the avanced version through purchase of a license.

Using Agilent Lab Monitor & Diagnostic software and Empower in parallel requires a special setup that involves multiple network interface cards in the LC instruments and dedicated PCs for the Lab Monitor & Diagnostic software. In an Empower environment, it is recommended to use the Lab Monitor & Diagnostic software for instrument maintenance and diagnostics, but not for continuous instrument monitoring. To access the LC instruments through the Lab Monitor & Diagnostic software for maintenance and diagnostics, it is recommended to disconnect the LC instruments from Empower. In this way no additional hardware or IT infrastructure are required.

Agilent 1200 Series instant pilot controller

The Agilent 1200 Series instant pilot controller (G4208A) provides for fast access to any 1200 Series RRLC system. Chromatographic parameters and MAC addresses can be verified as well as the instrument status and error messages. The instant pilot is also a powerful tool whenever the user needs to react quickly to a certain situation. For example, to turn off the pump immediately if the control software goes down. When connecting the instant pilot to an Agilent 1100 Series or 1200 Series system that is controlled by thirdparty software, the software might 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



Figure 1

Installation of the Agilent 1200 Series RRLC within the Empower client-server environment.

A1100 Comprehensive Status

Sample: isocratic Vial: 1 Inj: 3
Component Revision 1.04.1035
Module G1312B
Product Serial Number DE63057449
Firmware Revision "A.06.06"
Module G1315C
Product Serial Number DE73456902
Firmware Revision "B.01.06"
Module G1316B
Product Serial Number DB60557110
Firmware Revision "A.06.04"
Module G1329B
Product Serial Number DE64155367
Firmware Revision "A.06.04"

Figure 2

Hardware and firmware information obtained through the Empower software.

Installation

System requirements

An Empower client-server system is required to be able to control an Agilent LC system, (figure 1). For details of how to install the instrument control software, refer to release note 716002507, Rev A, available from Waters. When connected to the Empower system the Agilent 1200 Series RRLC receives an IP address from the LAC/E bus automatically through DHCP or BOOTP. In this example the Agilent 1200 Series RRLC was connected to the Empower system using a LAN cable. The modules of the Agilent 1200 RRLC were interconnected using CAN cables.

Agilent equipment

Figure 2 shows the Agilent equipment that was used for the test. The Empower software incorrectly labels the Agilent 1200 Series RRLC 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 1200 Series RRLC system is available, including operation up to 600 bar and a data rate up to 80 Hz for the Agilent 1200 Series diode array detector SL. During this test the Agilent 1200 Series RRLC system was NOT running in the socalled emulation mode.

Setting the communication protocol

The Agilent 1200 Series RRLC system is configured by clicking *Configure System* in the Empower main menu (figure 3). To check whether the Agilent 1200 Series RRLC 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 4 shows that the Agilent 1200 Series RRLC system, labeled as A1100, has received the IP address 192.168.0.11. This confirms that the Empower software has recognized the new LC system. To give the system a correct name, highlight A1100, press *edit* and then type, for example, AGILENT 1200 SERIES RRLC.

In the next step the Agilent 1200 Series RRLC system is activated for



Figure 3 Empower software main menu.

IP Address	MAC Address	Туре	Name
192.168.0.2	00-00-C4-03-38-89	ACQ-SM	A05UPS526N
192.168.0.4	00-00-C4-03-33-E1	ACQ-TUV	D05UPT357M
192.168.0.5	00-00-C4-03-2D-ED	ACQ-BSM	A05UPB564M
192.168.0.8	00-00-C4-04-07-14	ACQ-PDA	A06UPD868M
192.168.0.9	08-00-09-9C-8D-3B	A6850	GCMSleft
192.168.0.11	00-30-D3-10-40-B8	A1100	AT1200SL
•			1



Checking the IP address of the Agilent 1200 Series RRLC system.



Figure 5

Activating the Agilent 1200 Series RRLC through drag-and-drop in the configuration screen.

use, (figure 5). In the configuration menu, click *System* and then *New Instrument*. When the configuration screen appears, drag-and-drop the Agilent 1200 Series RRLC system from the left to the right. Figure 6 shows how to test whether communication is ready to use by clicking *Empower Nodes – WAD 5 – Properties – Instrument*. The column labeled *OK*? indicates the readiness: Yes or No.

Empower support of Agilent equipment

The Empower software supports all functionality of the Agilent 1100 Series and 1200 Series 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 Agilent 1200 Series binary pump SL

Figures 7 and 8 show the main setup screens for the Agilent 1200 Series binary pump SL. The gradient, flow and stroke settings are entered in the first screen (figure 7). In the next screen (figure 8) the solvents are selected together with the corresponding compressibility data for lowest baseline noise. In this test, water and acetonitrile were selected. All other modules are supported through a similar menu design, see appendix.



Figure 6

Checking whether communication is active.

	A1100				
	Flow Channel Solvents				
	Miranun Mannun	Pressure (bar): 0		Mazimum Flow Ogad	ient (nd/nin²) [100.00
Brary Pure IL	Aunliary Punp				
Dest 1	Minimum Stroke	Channel A		Chause	elB
	C Automatic		CAutor	natic	and Taxa
Auto Injector with Negter	≪ Value (µt): 20		(* Vabue	GLQ: 20	
		P	unp Mode : C Isocratic @	Gradient	
	Time (min)	Flow (ml/min)	96A	¶ø₿	Maximum Pres
	Sintup	1.000	30.0	10.0	() all the state of the state of the
EA Detector III	1 1.00	1.000	50.0	50.0	800
The second s	2 2.00	1,000	90.0	10.0	600
6	3 3.00	1.000	10.0	30.0	600
			Add Bow		

Figure 7

Setting up the main functions of the Agilent 1200 Series binary pump SL through the Empower software.



Figure 8

Setting up the auxiliary functions of the Agilent 1200 Series binary pump SL 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 9). 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 (figures 10 and 11). 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. Figure 11 shows an example of a sequence.

When the sequence has been completed the 2D, 3D and spectral data can be reviewed and evaluated (figure 12). In the Review screen, the parameters for integration, calibration and other data evaluation are set and saved as a process method. The report is created using the report editor and figure 13 shows an example based on the data created using the sequence and process method described in this example.



Figure 9

Editing instrument method parameters and sequences.

File Edit View Inject Actions	s Customize	Help			
B B B O O	<u>*</u> b			K 🖻	
Run Only	Continue on Fa	ult	1		
Run Only	Continue on Fai Run Time (Minutes)	Next Inj. Delay (Minutes)	SampleWeight	Dilution	Level
Run Only Method Set / Report Method set stimulation	Continue on Fai Run Time (Minutes) 1,50	Next Inj. Delay (Minutes) 0,00	SampleWeight	Dilution	Level

Figure 10 Creating a sequence.

10	20	0	0		3 16					
flur	Only		•	Continue on Fault						
-	SampleName	H Vol (AJ)	# of injs	Function	Method Set / Report Method	Run Time (Minutes)	Next Inj. Deley (Minutes)	Sarçiei/inigit	Dilution	Leve
1	isocratic	2,0	3	Inject Samples	testinctrumentset	6,00	0,00	1,0000	1,0000	-
2	isocratic	2,0	3	Inject Controls	testinstrumenteet	6,00	0,00	1,0000	1,0000	
3	calb	2,0	3	Inject Standards	testinstrumentset	6,00	0,00	1,0000	1,0000	
-	1000	20		Internet Changing of a	intere mante	200	0.00	4,0000	1.0000	

Figure 11 Example of a sequence.



Figure 12 Review screen for data evaluation and creating a process method.

. Proc

Cloce

Project: AppLabData\A1200RR Individual

ing Server... 💼 AppLabOata(A120...) 📻 isodiad report in 🗕 🕎 🔽 📷 🏵 🚳 🏨 💌 13

2 3 4 6 1 8 6 1 8 6

Summary

The Agilent 1200 Series RRLC system can be controlled through the Waters Empower software, whereby all chromatographic parameters required for optimum performance can be set. The emulation mode previous required for control is no longer needed. A few specific features such as injector programming are not currently supported. However, support of these features and other currently non-supported modules is increasing. The maintenance and diagnostic features of the Agilent 1200 Series RRLC system are supported by the Agilent Lab Monitor & Diagnostic software, which runs on a separate PC and is completely independent from the LC control software. Overall the combination of the Agilent 1200 Series RRLC system and Empower software is an equivalent alternative for laboratories where this software is deployed for instrument control and data evaluation.

Appendix

This appendix contains additional setup screens (figures 13-18) for further modules of the Agilent 1200 Series RRLC system.

Ge	neral Stringe Volume (ul) : 100 -	Seat Canillanz Volume (u) 23
	Multiple Draw: C On C Off	Wait Time (sec) : 2
ary Pump SL	Injection Mode : Standard Injection	Wash Vial :
		Number of Washes
uto Injector with Heater	Prefetch Vial Mode : Off 💽 Compartment Light : C On © Off	Prefetch at Time (min) :
	xiliary	71
Detector SL	Draw Speed (µJ/min): [200 Draw Position (mm): [0.0	Eject Speed (µJ/mm): [200

Figure 14

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Figure 13

Start 📴 Empower Pro

Setup screen for Agilent 1200 Series high-performance autosampler SL.

27458

AT1200RR in App.

An example report created using the report editor.

	General Temperature		
	General	Enable <u>T</u> hermostat :	Coff
Binary Pump SL			• Value (°C): 20
Auto Injector with Heater			
DA Detector SL			
Column Heater SL			

Figure 15

Setup screen for Agilent 1200 Series thermostatted high-performance autosapler SL.



Figure 16

Setup screen for Agilent 1200 Series diode array detector SL.

		Sample				Reference		
		Wavelength (nm)	Bandwidth (nm)		W	avelength (nm)	Bandwid	ł
Channel 1	© On [2 C Off	54	10	€ On € Off	450		80	
Channel 2	°on ∏ ⊛onr ∏	54	15	Cor	1980 1980		F (0)	
Channel 3	Con F	10.	P	Con	200			
Channel <u>4</u>	Con F	30	<u>10</u>	Cor Cor	D 20		100	
Channel 5	⊂on [⊂onr [-	[TE]	Cor.	1 Peri		107	
Channel <u>6</u>	Con ⊂onr F		I 10	Cor.	100		100	
Channel Z	⊂on F ⊙off F	<u>(</u>		C.Off	100		100	
Channel §	°on ∣ ⊂on ∣	87	16	Con Coff	1997		100	
Spectra								
Enable Spe	ctra:	(On	Off	Step:			2.0	

Figure 17

Additional setup screen for Agilent 1200 Series diode array detector SL.

Brury Purp St	Temperature Left • Net Controlled • Value (PC):	Temperature Right (* Not Controlled (* Same as Left (* Value (*C): [60.00	
	Leak Batection : © On C Off Enable Analysis : When Temperature Is Wit	in Sepore Column Switching Valve : Column 1 Column Switching Valve : Column 1 Une Column 2 Une	Setpoint (+/- *C) : 0.8
Column Heater St			

Figure 18

Setup screen for Agilent 1200 Series thermostatted column compartment SL.

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