

Using the Agilent Instrument Control Framework to control the Agilent 1260 Infinity LC through Waters Empower software

Instrument set up and performance

Technical Overview

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Abstract

The Agilent Instrument Control Framework (ICF) enables other providers of LC data acquisition and processing software to simplify the development of the control of Agilent LC instrumentation. In this Technical Overview we demonstrate how Agilent ICF facilitates enhanced control of the Agilent 1260 Infinity LC through Waters Empower chromatography data software versions 2 and 3. The combination of Agilent ICF and Waters Empower software provides easy access to advanced features of the 1260 Infinity LC such as overlapped injections, automated delay volume reduction.



Introduction

The Agilent Instrument Control Framework (ICF) is a software component that makes it easier and faster for software providers to implement control of Agilent LC equipment in their chromatographic data systems or workstations^{1,2}. Based on new standard instrument drivers from Agilent, ICF eliminates much of the delay and effort of using low-level instrument control codes and the need of software developers to write their own native drivers.

In this Technical Overview we demonstrate:

- What prerequisites have to be fulfilled to ensure seamless interaction between Agilent 1260 Infinity LC systems, Waters Empower software, and ICF software
- Which modules and instrument features are supported
- How instruments are configured and methods are created for the Agilent 1260 Infinity LC system using Waters Empower software in combination with ICF
- That the performance of the Agilent 1260 Infinity LC system fulfills expectations using Waters Empower data acquisition and processing tools

Experimental

An Agilent 1260 Infinity Binary LC system with the following modules was used for the precision measurement:

- · Agilent 1260 Infinity Binary Pump
- Agilent 1260 Infinity Thermostated Column Compartment
- Agilent 1260 Infinity Diode Array Detector
- Agilent 1260 Infinity High Performance Autosampler

 Agilent ZORBAX RRHT Eclipse Plus C-18 column packed with 1.8-μm particles

Chromatographic conditions for precision measurement

Compounds: Uracil, Phenol,

methyl-, ethyl-, butyland heptylparaben, toluene and N,Ndiethyl-m-toluamide

Column: Agilent ZORBAX

Eclipse C18 RRHT, 4.6 x 100 mm, 1.8 μm

Mobile phases: Water+0.05%TFA/

Acetonitrile +0.045%TFA

Gradient: 30% to 90% in 8 min,

at 8.01 min 30%

Flow rate: 1.2 mL/min

Stop time: 11 min

Column

temperature: 30 °C

Injection volume: 3 µL

DAD: 254/10 nm

Ref.360/100 nm,

20 Hz

Software: Empower 2 Build

2154, Installed Service Packs: A-D

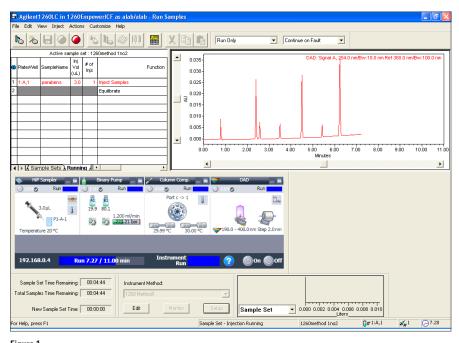
Installed feature

releases: 1-4, with ICF version

A.01.02 SP1

Prerequisites for the combination of Empower and ICF

- All Agilent LC modules must have firmware version A.06.32, or B.06.32, or B.06.41, or higher
- All Agilent LC modules must have RC.Net drivers
- Agilent Infinity LC ICS 1.0.0
- Empower 2, feature release 3 or higher or Empower 3 software³
- Windows XP with service pack 3 or higher³



rigure i Agilent Instrument Status screen under Empower and ICF software, captured while a sequence was running.

Results and discussion

Agilent ICF facilitates access to advanced features of Agilent LC instruments that were previously not supported by earlier revisions of Empower with drivers provided by Waters. Now, all features are supported and available through the new *On Line* screen, which has been added to the familiar Empower screen, see Figure 1. A right-click on one of the module fields gives access to all control, method and other advanced features of the module. RFID tags can be seen if the cursor is moved over the label pictogram for the lamp and cell of the DAD module.

For supported modules and functions, refer to the Appendix.

Configuring the Agilent 1260 Infinity LC system

- 1. Set up the DHCP of the Empower node.
- Set all DIP switches of the Agilent module to "0". This module is connected to the Empower node through LAN.
- 3. The LC receives an IP address from the DHCP server.
- 4. To connect the Agilent instrument, configure the DHCP server through *Properties* of the *Empower Nodes*, see Figure 2.
- 5. Use *Edit* to set the instrument type and a unique name.
- Click File and New chromatographic system to make the new LC system accessible for data acquisition.

After this last configuration step, the Agilent 1260 Infinity LC system is *On Line* and ready for use, see Figure 3.

These configuration steps have to be followed whenever a new module is added or removed. Previously, the old configuration has to be deleted from

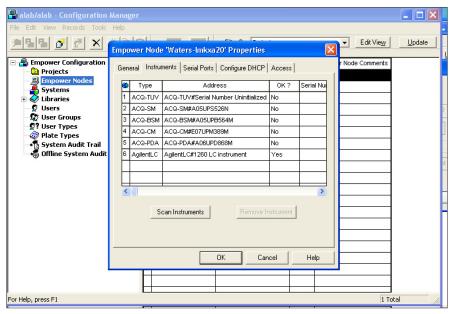


Figure 2 Configuring the DHCP server.

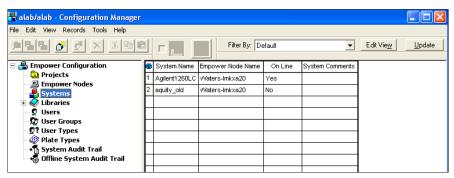


Figure 3
After the configuration process the Agilent 1260 Infinity LC is online.

the DHCP server configuration. Then the Empower software has to be shut down and the LAN connection to the module has to be switched off and on again. When the LAN connection has been restored the new configuration procedure can be started.

Creating an instrument method and a method set

Having configured the instrument, the instrument method and the method set can be created in the *Empower Run Sample* screen. The Instrument method is set up through the *Edit Method*. The pump and autosampler screen for setting appropriate parameters is shown in Figures 4 and 5. All parameters that are available in the Agilent ChemStation are now accessible in Empower, such as overlapped injection and automated delay volume reduction, see Figure 5.

To use Agilent well/vial plates, the dimensions of the plates have to be configured, see Appendix.

The instrument method that has been created is saved and used to set up a method set. The method set can then be used to create sequences.

Creating a sequence

A sequence is created by filling the sample set table with name of sample, position of vials, number of injections per vial, method set to be used, and so forth.

Performance of Agilent LC systems using Waters Empower data processing tools

To demonstrate that the Agilent 1260 Infinity LC system fulfills the expected performance the following tests were done using a paraben sample:

- · Precision of retention time
- · Precision of areas

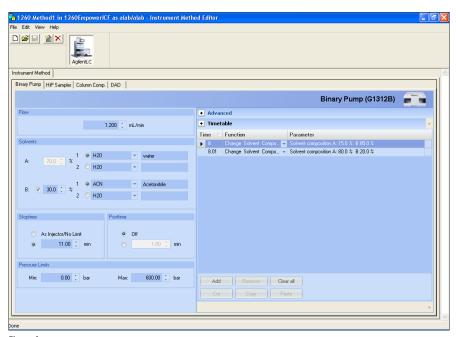


Figure 4
Parameter selection screen for the binary pump of the Agilent 1260 Infinity LC.

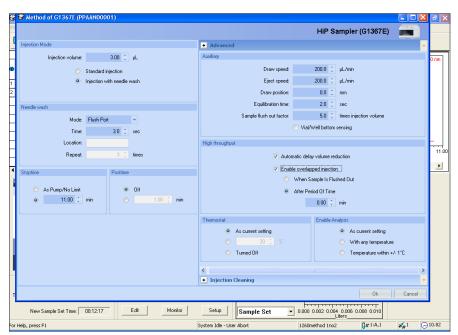


Figure 5
Selection of automated delay volume reduction and overlapped injection in HiP Sampler method screen.

Precision of retention time and areas

The chromatogram of the paraben sample is shown in Figure 6. Precision of retention times and areas for a 3 μ L injection are combined in Table 1. Data were evaluated using the *Empower Component Summary Report*. The precision for the retention times for six consecutive runs is <0.055%RSD, for the area the precision is <0.25%RSD, except for the last peak.

Conclusion

The Agilent Instrument Control Framework (ICF) is a software component that makes it easier and faster for software providers to implement control of Agilent liquid chromatography systems in their chromatographic data systems or workstations. In our application example, ICF was used to control the Agilent 1260 Infinity LC system in combination with Waters Empower software. The instrument was configured in Empower and data were acquired and processed. The combination of ICF and Empower software facilitates access to most available Agilent instrument features such as external needle wash, overlapped injection, and automated delay volume reduction. The Agilent Instrument Status screen is used to set up On Line methods, to switch the system on or off, to equilibrate columns, to view the status of single module, and to access special features using the Control function available for each Agilent LC module. As expected the Agilent 1260 Infinity LC system shows the same excellent performance for data acquired and processed using Empower and ICF.

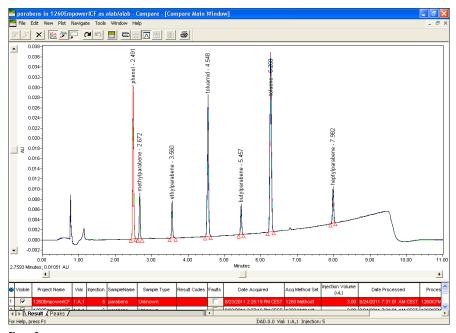


Figure 6

Overlay of six chromatograms of the paraben sample for evaluation of retention time and area precision.

Peak name	RSD RT (%)	RSD area (%) (3 μL Inject. vol.)
Phenol	0.054	0.095
Methyl-	0.061	0.184
Ethyl-	0.043	0.199
Toluamid	0.045	0.146
Butyl-	0.039	0.219
Toluene	0.037	0.165
Heptylparaben	0.030	1.682

Table 1
Precision of retention times and areas for six consecutive runs.

References

1.

"The Agilent Technologies Instrument Control Framework", Technical Overview, Publication number 5990-6504EN, November 2010

2

"The Agilent Technologies Instrument Control Framework" Short overview, Publication number 5990-5756EN, June 2010

3

"Agilent Infinity LC Instrument Component software Version 1.0 for Empower software" Waters Installation note, Publication number 716003453 Rev.A, August 2011

4

"Using the Agilent Instrument Control Framework to control the Agilent 1290 Infinity LC through Waters Empower software - Instrument set up and performance", Agilent Publication, Publication number 5990-9093EN, November 2011

Appendix

Supported and tested Agilent modules

				Modules tested by Waters	Modules tested by Agilent
1260	Pumps	Isocratic pump	G1310B	OK	
		Quaternary pump	G1311B	OK	OK
		Active seal wash	#030	OK	
		Binary pump	G1312B	OK	OK
	Autosampler				
		Standard ALS	G1329B		OK
		HiP ALS	G1367E	OK	OK
		Thermostat	G1330B	OK	
	Thermostatted column compartment	TCC	G1316A		OK
		TCC	G1316C	OK	OK
		2-pos/6-port valve 600 bar	G4231A/B		OK
		6 column selector valve	G4234A/B		OK
		8-pos/9-port valve	G4230A/B		OK
		2-pos/10-port valve	G4232A/B		OK
	Detector	VWD VL	G1314B		OK
		VWD VL+	G1314C		OK
		1200 VWD	G1314D		OK
		1290 VWD	G1314E	OK	
		1260 VWD	G1314F	OK	
		DAD VL+	G1315C		OK
		DAD VL	G1315D		OK
		1290 DAD	G4212A	OK	OK
		1260 DAD	G4212B		OK
		FLD	G1321B	OK	

Table 2
Supported and tested Agilent LC modules.

Newly supported and not yet supported functions and instrument features

The following configurations and tasks are now accessible by Empower with ICF as tested in the application laboratory in Waldbronn, Germany.

Features not yet supported in the current version used for this Technical Overview.

- System with second pump, for example, for alternating column regeneration
- Dual detector application is possible to configure and run (but this functionality is not officially supported by Waters).
- 2-pos/10-port, 2-pos/6-port, 8-pos/9-port and six column selector valve built in column compartment valve heads
- · External needle wash
- All eight signals for acquisition on a DAD or MWD are supported.
- Early Maintenance Feedback (EMF) can be set up in the Agilent Lab Adviser. Warnings and limits are displayed in the Agilent System UI in Empower.
- · Automated delay volume reduction
- · Overlapped injections
- · Autosampler valve cleaning
- RFID tags: Lamp and detector cell tags and column tags can be accessed in the Agilent instrument status screen by clicking on the label pictograms.
- "None" or "All spectra" can be selected for DADs module control functions.
- Pump bottle filling

- Configuration such as UIs, needed for clustering of pumps and column compartments, are not yet available.
- Creation of additional compressibility curves by the user not yet available.
- Manual injection as single sample run, that is, Empower always requires a sequence if Agilent LC instruments are used.
- · Fraction collectors
- Purge kit G1373A
- DAD data recovery card
- Clustered column compartments for method development solution not supported.
- "Post time" available in the pump set up screen of Agilent pumps.
- · Clustered pump with solvent selection valve
- · Injector programming

Table 3

Supported and not yet supported instrument features.

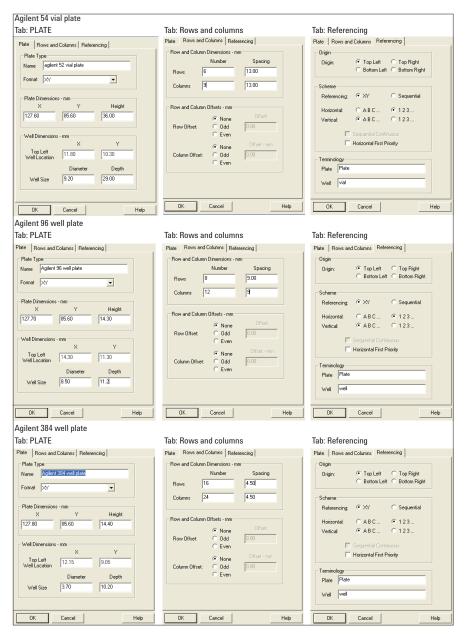


Table 4
Configuration of Agilent well/vial plate types in Empower.

Plate dimensions of Agilent plates

In Empower, go to *Create New Plate Type*, and enter the dimensions in Table 4 for the Agilent vial/well plate types.

www.agilent.com/chem/icf

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