Getting More Out of One UHPLC System—Fast and Unattended Method Switching

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Summary
Each time mobile or stationary phases differ from one method to another, they have to be exchanged. Furthermore, flushing the system and equilibrating it to the new conditions of the next method is required. Most often, these steps are done manually. Thermo Scientific™ Dionex™ UltiMate™ 3000 Dual LC systems with Automated Application Switching configuration allow users to easily automate switching from one analytical method to the other within only a few minutes when combined with Thermo Scientific™ Dionex™ Chromeleon™ Chromatography Data System (CDS) software. Hence, Automated Application Switching can be performed overnight or even during the weekends without any manual interaction, allowing for maximum instrument utilization.

Background
Usually, more than one HPLC method is needed to obtain a variety of parameters from the same sample set. Manual switching from one method to another is time consuming and labor intensive. Typically, the current analytical column is washed, eluent lines are flushed, and, finally, the next column is equilibrated to the start conditions of the next method. These tasks require frequent operator interaction when done manually. Furthermore, it is impossible to run methods consecutively, unattended, overnight or over the weekend if manual method change-over is an essential part of the workflow.

The use of separate, dedicated HPLC systems to run several methods simultaneously requires high initial costs and sufficient bench space. After starting an instrument, basic system parameters like pressure ripple, baseline noise, and drift have to be monitored before the first sample can be injected.

Automated Application Switching leaves original methods untouched and can be accomplished with minimal effort. Each method switching is fully documented for regulatory compliance. Automated Application Switching is based on a Dual UltiMate 3000 LC system and, thereby, occupies the bench space of a single LC system. The operator sets up both methods. After the system has automatically started and equilibrated, the first method runs. The system automatically switches to the second method without any additional operator interaction. This approach frees operator time, increases system usage time, and allows automation, thus boosting productivity.

Keywords
UltiMate 3000 Dual LC System, Automated Application Switching, UHPLC® Solution, Time Savings, Increasing Productivity

Figure 1. UltiMate 3000 dual-gradient pump.
**Equipment**

UltiMate 3000 Dual SD or RS system with UHPLC® Solution for Automated Application Switching.²

**Automated Application Switching Principle**

The core part of an UltiMate 3000 Dual LC system is a module that provides two ternary gradient pumps in a single housing. For Automated Application Switching, a column oven with two switching valves is needed. This allows the connection of two columns at the same time, each to one of the two different fluidic paths of the pump (Figure 2).

Automated Application Switching is ideal for laboratories that want to run two different analytical methods on the same instrument. The right pump and column 1 are used to run the first application and, after the automated switchover, the left pump and column 2 are used to run the second application.

For this purpose, initial instrument startup and equilibration conditions, automated switch-over steps, and well-defined shutdown procedures are required but easily created with the support of Chromeleon CDS software.

To demonstrate the Automated Application Switching principle, two typical methods for the analysis of soft drink ingredients are shown (Figure 3). The first application represents a method for the quantification of some of the most widespread substances in soft drinks. The second application is a USP method for the determination of some pharmacologically active compounds in drinks, including quinine as the most important analyte. The respective columns, mobile phases, detection parameters and gradients are optimized for each intended application and completely different.¹

When Automated Application Switching is applied, it is necessary to consider two different scenarios for the determination of the total time savings with the soft drink analyses. In the first scenario, the sequence is started during the work week. In the second scenario, the sequence is started on a day before a non-working day, for example before a weekend.

The time that is gained in both scenarios is the time it takes to convert the HPLC instrument from the first to the second application, followed by the equilibration of the system. Converting and equilibrating the HPLC system can take up to 3 hours of labor.

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**Figure 2.** Automated Application Switching workflow.

**Figure 3.** Automated Application Switching in action.
If the first application is run during the work week, it may not be finished until the end of the working day. Without Automated Application Switching, the instrument is idle for the remainder of the night. With Automated Application Switching the remainder of the night is used to run the next application, resulting in gained hours of HPLC productivity time.

If the first application is finished during the weekend without Automated Application Switching, the instrument is idle over the remainder of the weekend. With Automated Application Switching the remainder of the weekend is used to complete the next application. This can easily free more than one complete day of productive time.

Solution
The UltiMate 3000 Dual LC system in combination with the powerful Chromeleon 7.2 CDS software provides analysts with a robust and easy-to-use turnkey UHPLC+ Solution for Automated Application Switching. Automated Application Switching boosts lab productivity without the need to purchase additional HPLC instruments.

Automated Application Switching offers the following advantages over other approaches to improve productivity:

- Automated Application Switching kits include all required tubing and instructions
- Can easily be used with existing methods
  - No additional method development
  - No extra validation effort
- Autosampler is flushed before switching to the other application
- Low standby flow rate on non-active column prevents precipitation of eluent buffers
- Automated Application Switching can be scheduled for ultimate flexibility
  - Can be run off the normal business hours (e.g., over the weekend)
  - Frees operator time
  - Minimizes manual errors
- Optimizes system use time and return on investment

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References