

# Chromatography

## Doubling the sample throughput with AI/AS 1610 Gemini configuration Simplified operational modes and Chromeleon CDS control

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### Goal

To illustrate the simplified usability of the Thermo Scientific™ AI/AS 1610 autosampler in the Gemini configuration to meet high-throughput demand for analytical testing laboratories.

### Introduction

A confident automation of liquid sample injection in a GC or GC-MS through a robust, reliable, and easy-to-use autosampler is what a high-throughput testing laboratory needs to respond to a heavy workload. The enhanced usability of the Thermo Scientific AI/AS 1610 liquid autosampler (Figure 1) makes this platform the fit-for-purpose solution, combining operational simplicity with injection mode flexibility. In order to support analytical testing laboratories facing high sample throughput demand, the dual-tower AI/AS 1610 Gemini configuration allows for simultaneous injection on two channels, doubling the throughput achievable on a single GC system, or confirming the same sample on two simultaneous runs.

This Technical Note summarises the main features of the Gemini configuration in combination with the Thermo Scientific™ Chromeleon™ Chromatography Data System (CDS) version 7.3, describing the different ways of operations.



Figure 1. (A) AI 1610 autoinjector with 8-vial capacity; (B) AS 1610 autosampler with 155-vial capacity.

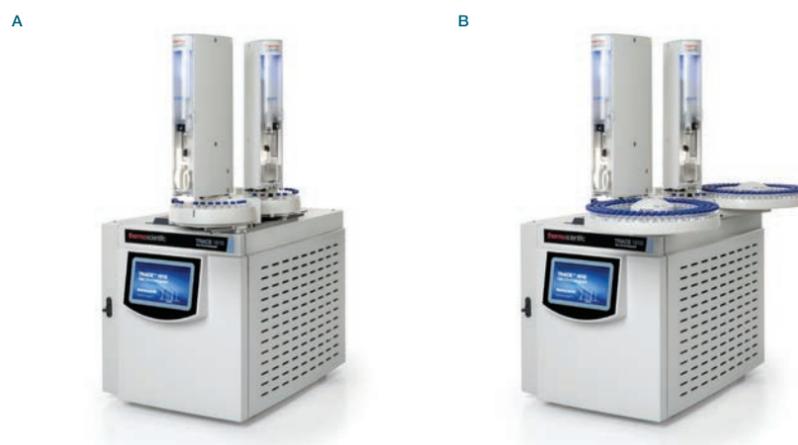


Figure 2. Thermo Scientific TRACE 1610 GC equipped with (A) Gemini AI 1610 (total of 8-vial capacity); (B) Gemini AS 1610 (total of 310-vial capacity).

### AI/AS 1610 Gemini operational modes

In the Gemini configuration, two AI 1610 autoinjectors (with a total of 16 vials capacity) or two AS 1610 autosamplers (with a total of 310 vials capacity) can operate at the same time on the Thermo Scientific™ TRACE™ 1600 Series GC, each using a dedicated injector (Figure 2). The system is fully controlled by Chromeleon CDS, which offers a series of features to streamline the operations in Gemini mode.

The Gemini configuration allows operation in two different modes, which display some key differences according to the way they exploit the Gemini setup (Table 1).

**High-throughput mode:** In this modality, the system is considered as composed of two autosamplers separately configured. Autosampler methods can be the same for the two channels or they can vary: in both cases, sample handling is synchronised in such a way the injections take place simultaneously. The injections follow two separate sample sequences, with data acquisition and processing achieved separately. The two channels (inlet, column, detector) may also have different components. The only obvious limitation is that the GC oven program needs to be the same in the two methods. This mode is generally used to support processing of large batches of samples, and therefore the two sample trays are typically loaded with different samples.

**Confirmation mode:** In this modality, the injector, column, and detector of the two channels can still be different, but a single autosampler is configured for both the flow paths, so that the autosampler method is the same for the two channels. This mode is typically used to run the same sample on two channels for confirmation purposes. The uniqueness of this operation mode lies in the fact that data obtained from the two channels running simultaneously are stored in a single data set, thus simplifying direct comparison of the results. Typically, a given position in both trays is occupied by vials containing the same sample.

Table 1. Main differences between the AI/AS 1610 Gemini operation modes

	High-throughput mode	Confirmation mode
Sample location	Samples are independently placed on AS tray	Position 'x' on each AS tray has an aliquot of the same sample
Injection settings	Different injection methods can be used on each AS	The same injection method is used on each AS
GC configuration	Front and back flow paths can have different components	Front and back flow paths can have different components
AS configuration in Chromeleon CDS	Two AS are set up in the instrument configuration page	One AS is set up in the instrument configuration page
Sample sequence setup in Chromeleon CDS	Two sample sequences are set up, one for each channel (front/back)	One sample sequence is set up, with two channel acquisition for each sample type

## AI/AS 1610 Gemini: easy configuration path

### Hardware setup

In the Gemini configuration, regardless of the operational mode, the two autosamplers are placed on the front and back injectors by means of a dedicated mounting bracket with a quick and easy slide-in installation and self-alignment on the inlet port and the vials. The setup is further simplified with power supply, communication, and handshaking carried out through a single-cable connection between each autosampler and the GC system. Either in a single tower or Gemini configuration, the design of the AI/AS 1610 autosampler allows for an easy access to the inlet port, facilitating maintenance operations. This is achieved through a sliding support to easily move aside the tower from the injector (Figure 3).

### Configuration in Chromeleon CDS

Gemini configuration in Chromeleon CDS is carried out differently according to the operation mode.

Under High-throughput mode, two autosamplers need to be configured, corresponding to the 'Front' and 'Back' channels, setting the same IP address and specifying which com port is used to connect to the GC. When using the Confirmation mode, a single autosampler needs to be configured. Its method parameters will be fully shared between the two autosamplers.

### Confirmation mode data review

When working in Confirmation mode, data obtained from the same sample on the two channels can be easily visualised for direct comparison. Data originating from two parallel channels are collected within a single data file, facilitating the data review. This analytical mode is particularly useful for comparing two different detector types having different characteristics in terms of sensitivity and selectivity, or comparing separations achieved on two different analytical columns for identification confirmation. Figure 4 shows an example of the same standard mixture simultaneously analysed on two channels, with different selective detectors as FID and ECD, and the easy comparison of the data from the two channels.



Figure 3. Design of the AI/AS 1610 autosampler. Easy access to the inlet port is achieved through a sliding support.

### Easy switch from dual to single mode operation

When the High-throughput mode is configured, switching from dual to single mode operation is possible by simply flagging the dedicated option in the Instrument pane: each autosampler, either front or back, can be employed in a single-autosampler operation to run sequences on a single channel without changing hardware settings or Chromeleon configuration.

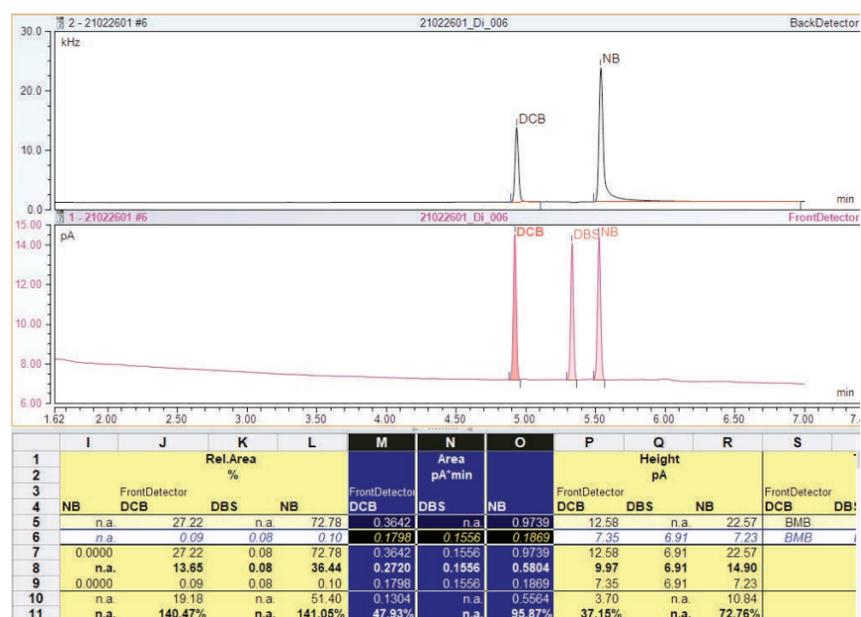


Figure 4. Analysis using Gemini Confirmation mode. A standard mixture containing dichlorobenzene (DCB), dibutylsulfide (DBS), and nitrobenzene (NB) is analysed using GC-ECD (top) and GC-FID (bottom). Data obtained on the two parallel channels are collected within a single data file and the results can be visualised by clicking on the respective chromatogram (here the front channel chromatogram is selected). Processing methods can be applied to both channels or single channels only.

## Enhanced sequence operations with Chromeleon CDS

Chromeleon CDS is a powerful chromatography data system software for qualitative and quantitative applications combining chromatography and MS workflows in a very intuitive and productive way.

Chromeleon CDS 7.3 offers additional features to streamline sequence operations. Those functionalities are of particular interest for users running multiple parallel instruments within the same laboratory, such as in the case of several Gemini configurations.

- The instrument status visualisation is facilitated by a new Overview tab window displaying all instruments and their status within a single view (Figure 5).
- Streamlined sequences start is achieved with just two clicks from the Overview tab. Also, it is possible to launch eWorkflows and view instrument queues from each line of the tab.
- Enhanced operativity with the Detach View function allows the Overview tab to be visualised as an independent floating window. The user can thus perform other operations on the screen (e.g., data processing) while keeping an eye on the status of the instruments of the lab.
- The monitoring of selected instruments is facilitated by setting them as 'Favorites' under Instrument view of the Chromeleon Console. In a laboratory with many instruments, this allows visualisation of only those that are worth monitoring.

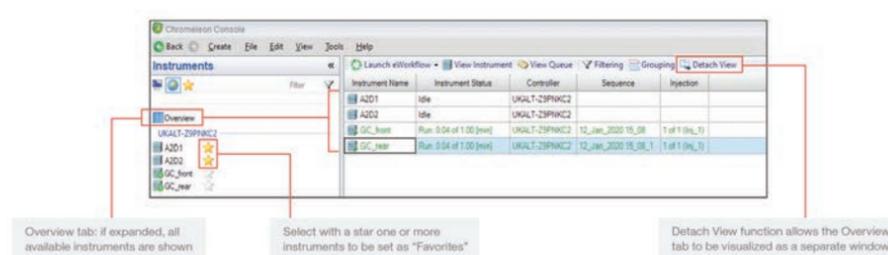


Figure 5. Screenshot of the Overview tab in Chromeleon CDS 7.3. Lines highlighted in green refer to a system running samples on both injectors in High-throughput mode.

## Extended applicability of the AI/AS 1610

The AI/AS 1610 liquid autosampler meets the highest requirements of ruggedness, reliability, and ease of use and fulfils the needs of high-throughput testing laboratories. New operational capabilities are available to expand the applicability in analytical testing laboratories and increase reliability, robustness, and productivity.

Safe operation and improved usability are guaranteed by:

- The automatic selection of the best injection settings through recognition of the injector type and injection mode
- Easier syringe viewing and replacement thanks to the illuminated syringe compartment
- Facilitated syringe scale reading through a built-in magnifying lens
- At-a-glance monitoring with enhanced colour-coded instrument status indication

The AI/AS 1610 autosampler offers the flexibility to cover a wide variety of applications, methods, and samples thanks to enhanced sample handling capabilities and high-throughput features:

- Minimised injection-to-injection cycle time with pre-injection operations performed in advance the GC ready conditions
- Expanded applicability with large sample volume injections up to 80  $\mu$ L
- Optimised solvent consumption with modifiable syringe washing volumes
- Optimised solvent washing capabilities with the selection of up to four different solvents
- Optimised viscous samples management with selectable sample drawing speed (Fast/ Slow) and programmable viscosity delay (0–7 s)
- High sampling flexibility with two-layer injection mode, with layers and air gaps user definable volumes (for sandwich injection, internal standard addition, or in-needle derivatisation)

## Conclusions

The Gemini configuration provides a simple and cost-effective solution to increase laboratory throughput. The simultaneous injections in two channels for unattended analyses of up to 310 samples is achieved with easy-on/off set up and connectivity thanks to the usage of a single, multi-purpose connection between each autosampler and the GC. High-throughput mode or Confirmation mode are easily enabled through Chromeleon CDS, which facilitates the monitoring of multiple parallel sequences on the same GC as well as multiple systems within the same laboratory.

Additional usability features and benefits of AI or AS 1610 liquid autosamplers in single tower or Gemini configuration, in combination with the TRACE 1600 Series GC are key to streamlining daily operations and providing what is required in a high-throughput laboratory for liquid sample injection automation.

Find out more at [thermofisher.com/aias](http://thermofisher.com/aias)



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