

Automating High-Throughput DoE Execution on the iDOT

Case Study

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Executive Summary

A manual data transfer bottleneck between Design of Experiments (DoE) software and an iDOT liquid handler cost researchers up to six hours of setup time per experiment. By developing a universal data translation pipeline, this workflow was fully automated. The solution eliminated manual data entry, neutralised the risk of software crash-induced data loss, and enabled the scalable execution of complex fractional factorial designs.

The Objective

To build a reliable digital bridge that automatically translates the output matrix from standard DoE software into a ready-to-run import file for the iDOT, removing human intervention from the data transfer process.

The Challenge

Executing complex experimental designs requires seamless communication between digital planning tools and physical lab hardware. In this instance, the laboratory was attempting to run a fractional factorial DoE involving six distinct compounds across more than 20 unique runs (excluding replicates).

The existing workflow presented critical bottlenecks:

- **Manual Data Entry:** The iDOT software required the manual assignment of a liquid class and dispensing volume for every single compound in every run.
- **Time Drain:** Configuring the hardware for a single multifactorial DoE required approximately six hours of manual input.
- **Fragility:** The hardware's software was prone to crashing during extended manual programming sessions. When a crash occurred, all unsaved manual progress was lost, forcing the researcher to restart from zero.
- **Hardware Avoidance:** The high administrative burden caused researchers to actively avoid using the iDOT, defeating the purpose of having high-throughput hardware in the lab.

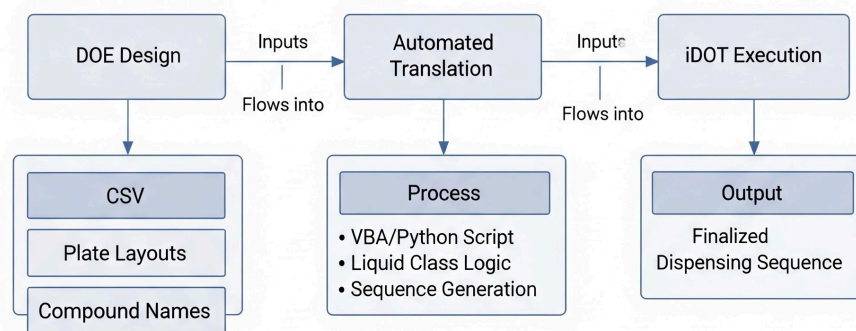


Figure 1 : DoE to iDOT Automation Workflow Architecture

The Solution

Over a one-week development period, a custom data pipeline was engineered to standardise the import process.

1. **Workflow Mapping:** The exact input requirements of the iDOT (liquid class designations, volume calculations, and well-plate mapping) were defined and standardised.
2. **Universal Template Creation:** Instead of hardcoding a script for the specific 6-compound DoE, a dynamic template in MS Excel was constructed.
3. **Data Integration:** The template takes the raw export from the DoE software, calculates the required volumes based on target concentrations, assigns the correct liquid classes, and formats the data into the exact file structure required by the iDOT.

The Impact

Metric	Before Automation	After Automation
Setup Time	~6 Hours	< 1 Minute
Data Transfer	100% Manual	100% Automated
Error Rate	High (Human transcription risk)	Zero
Scalability	Limited by human endurance	Unlimited (Handles any n compounds)

Key Takeaways

- **Elimination of Administrative Waste:** The automation reclaimed six hours of scientific time per experiment, allowing researchers to focus on data analysis rather than data entry.
- **Universal Scalability:** Because the solution was built as a flexible template rather than a single-use script, it can be immediately deployed for any future experiment, regardless of the number of compounds or combinations.
- **Increased Hardware Utilisation:** By removing the usability friction, the automation shifted the iDOT from being an avoided, frustrating piece of equipment to a preferred, high-value asset in the laboratory's daily operations.

Reclaim Your Lab's Bandwidth

If your team is losing valuable research time to manual data normalization, tedious layout programming, or fragile data workflows, let's connect for a technical mapping session.

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