WHITEPAPER

How to Effectively Incorporate Automation into Your Flow Cytometry Workflows

Automated Flow Cytometry Solutions: Advantages and Considerations

Cell analysis is an important focus area for many research and development laboratories. Cell and phenotypic screening techniques are essential to identifying sources for biopharmaceuticals. Bead-based screening serves an important role in therapeutic antibody development. High-throughput screening processes are critical for lead compound identification and drug discovery.

Many labs are beginning to incorporate automation to enable large-scale, high-throughput screening applications. There are both major advantages and key considerations involved in incorporating automatable systems like flow cytometers into cell analysis labs.

What Are the Major Advantages of Automating a Workflow?

Just as the complexity of cell analysis labs has expanded, the need for automation-ready equipment capable of multiplexed, high-throughput processing has grown.

Key benefits of automating workflows include:

- Increased assay throughput and scale-up
- 24/7 operation and optimized use of equipment
- Consistent results with higher precision and lab protocol standardization
- Extended walk-away time

What Are the Key Considerations in Automating a Workflow?

While there are obvious advantages to automation, there are also several factors to consider when automating a workflow. These include:

- Identifying steps of a workflow to automate by targeting those that limit the time to result
- Considering whether it is wise to automate the entire workflow, a single step, or multiple steps in the workflow
- Mapping out details critical to the assay or screening protocol, including timing, temperature, reagent mixing, and others

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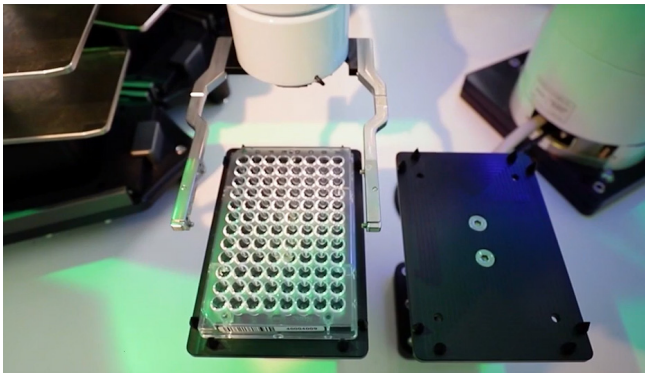
Ask yourself several questions to determine the specific needs of the workflow you are looking to automate. Some important questions include:

- Is maintaining samples or reagents in wells at a constant temperature important for sample integrity?
- Would this ability lead to processing larger sample volumes and increase assay scale-up?
- Does the equipment offer the ability to run smaller sample volumes, if needed?
- Are there steps that take an inordinate amount of time, for example, sample preparation or cell staining?



"Consideration should be given with regards to time savings, increased productivity, reduced waste, and reduced downtime compared to the upfront costs of purchasing and integrating the automation equipment," says Veronika Kortišová-Descamps, global marketing manager at Bio-Rad™ Laboratories, Inc. "The demands on space required for an automated workflow have evolved. Modern robotic equipment is smaller and more flexible. Flow cytometers with integrated fluidics and other high-efficiency components can serve to reduce space requirements even further."

How Can Flow Cytometers be Implemented in Automated Workflows?

Flow cytometry is considered the gold standard for cell analysis. Historically, flow cytometry lacked the ability to handle high-throughput applications due to limited color detection, large sample volumes, and manual loading challenges.

Advanced flow cytometers, despite having increased capabilities, have suffered from a lack of automation readiness. For these reasons, the use of flow cytometers in high-throughput screening applications has traditionally created workflow bottlenecks.

State-of-the-art high-parameter flow cytometers are now available that enable simultaneous detection of dozens of colors and markers. An entire plate of 384 samples can be analyzed in 60 minutes or less, saving precious samples and processing time. These systems are well-suited for automated workflows.

"Integrating state-of-the-art flow cytometers through automation has taken high-throughput screening to another level," explains Kortišová-Descamps. "Therapeutics development, antibody screening, and biomarker discovery can greatly benefit from high-throughput, high-parametric flow cytometry analysis interfaced with robotic automation."

"A somewhat unexpected benefit comes from the repetitive nature of manual flow cytometry work," continues Kortišová-Descamps. "Customers have told us they have seen issues with employee turnover, and automating those repetitive steps has improved morale and productivity in the lab. Other customers have noted that starting entry-

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level staff with a highly repetitive task such as manual flow cytometry has led to requests for more interesting work, an issue that has been addressed with automation."

Which Software Considerations Are Important When Automating a Flow Cytometry Workflow?

Scheduling software allows users to interact with and control the workflow components, an important piece of the user experience during operations. An API allows flow cytometers to be integrated easily with scheduling software. The instruments, scheduling software, and API function together, to form an integrated workcell. A third-party integration partner helps in the setup of a workcell and serves a key role in making sure it operates as intended.

"The design and functionality of an automation workcell is the result of successful collaboration between the instruments, the customer, and their integration partner," states Kortišová-Descamps. "When selecting integration partners, customers should consider scheduler intuitiveness and training support availability. A user-friendly and intuitive scheduling software can make even complex workcells easy to use with little training."

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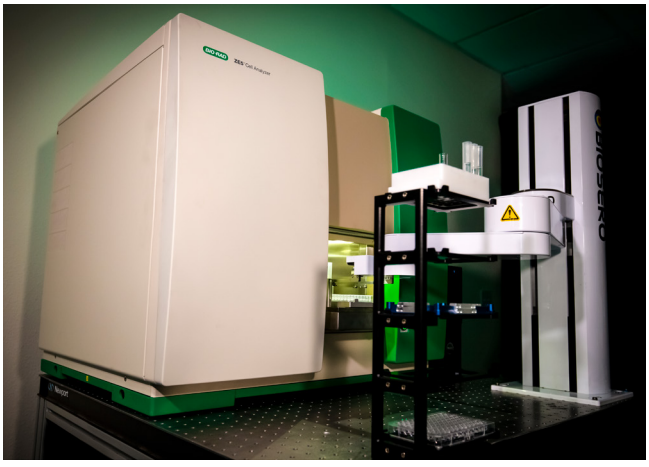
"High-throughput data acquisition requires high-throughput data analysis tools," continues Kortišová-Descamps. "Customers should consider the complexity and quantity of the data they expect to generate and whether their integration partner offers tools compatible with these needs. They should also consider whether third-party data handling and analysis tools may be needed to supplement the workcell."



Which Automation-Ready Flow Cytometry Solutions are Currently Available?

The ZE5 Cell Analyzer from Bio-Rad is a high-performance, automation-ready flow cytometer that accommodates a wide range of experiment complexities and throughput needs. The ZE5 Cell Analyzer enables researchers to scale up multiple assays when analyzing thousands of samples. System features include:

- Expanded external fluidics as an option for customers who wish to run in 24/7 fashion
- Temperature control and vortexing abilities to keep cells viable and uniform to support sample integrity
- Built-in maintenance features, such as processes to clean the sample line and probe when a clog is detected, automatic sample path cleaning at shutdown to prevent contamination, and automatic probe crash detection to prevent probe damage
- Rapid decision-making, where data from each analyzed sample is available immediately following analysis, allowing users to make decisions quickly

The ZE5 Cell Analyzer supports true high-throughput, multiplexed processing, with performance features including:

- Fully integrated sample loader that supports tube racks and multiple plate formats

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- Acquisition rates of up to 100,000 events per sec without data aborts
- Five lasers and 30 detectors to permit the design of small and large panels
- Rapid processing rates for 96-well (<15 min) or 384-well (<60 min) plates, with no drop-off in data quality

Also available for the ZE5 Cell Analyzer is the Everest Software Development Kit (SDK), a set of software development tools and sample code for application creation. The Everest API is a software communication interface that enables local or remote client applications. It provides all the basic ZE5 Cell Analyzer functionality and many advanced features designed for automated environments.

"The ZE5 Cell Analyzer is completely automation-ready," says Kortišová-Descamps. "It's hardware and software agnostic. API is the key to making integration into any laboratory system simple and straightforward. The Everest API and SDK together provide ZE5 Cell Analyzer customers with all the tools necessary for integrating the ZE5 Cell Analyzer into an automation laboratory"

The Everest API allows customers to customize and integrate the ZE5 Cell Analyzer into an automation workcell with their choice of hardware elements by working with their preferred integration partner. In addition, the API requires zero third-party components or specialized configurations.

What About Concerns Regarding Working with Integration Partners?

"Customers are sometimes concerned when buying multiple pieces of equipment from multiple suppliers," explains Kortišová-Descamps.

"Bio-Rad is committed to providing support throughout installation, integration, and ongoing use of automated flow cytometry tools. We have developed relationships with many integration partners and have open lines of communication between Bio-Rad and automation service providers. We prepare integration partners with the Everest API and SDK and all the tools needed to get the automated system up and running. Bio-Rad engineers are available to help with integration whenever needed. Most importantly, we are always available to answer customer questions before and after their automation journey."

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Summary

There are major advantages and important considerations to evaluate when incorporating automation into your lab. When it comes to automated flow cytometry for cell analysis and screening workflows, instrument capabilities and integration are paramount to successful operations.

Flow cytometers should be equipped to support sample integrity, process efficiency, and true high-throughput functionality. Integration tools should provide seamless access and communication between the instruments, users, and integration partners. Above all, the automated flow cytometry solutions provider should go the extra distance to ensure all details align to deliver the best possible automation experience.

Visit www.bio-rad.com/en-us/feature/high-throughput-screening-flow-cytometry.html to learn more about Bio-Rad automated flow cytometry solutions.

Visit https://info.bio-rad.com/ww-ze5-GBL-twas.html to speak with a flow cytometry specialist.

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