



AT THE HEART
OF LABORATORY
AUTOMATION

**ENHANCING CELL
SCREENING PIPELINES
WITH MODULAR SMART
CARTS AND MOBILE ROBOTS**

WHITEPAPER

Enhancing Cell Screening Pipelines with Modular Smart Carts and Mobile Robots.

1 / Introduction

The traditional architecture of static automated platforms has not altered much over time. They consist of either a liquid handler centric platform or a robot based automated system. Either way valuable assets are tied into platforms in hard-to-reach positions, idling, when they could be used more efficiently.

The rapid advancements in biotechnology demand equally advanced methods for cell screening to keep pace with research and development. For many cell maintenance and high throughput cell systems incubator capacity is a major issue which can be exacerbated with long incubation / cell growth times so that you often have cells sitting on an extensive automation platform taking up space while they get to the next process level. This is further complicated with the advent of systems for gene therapy where it can be critical for cell lines to be kept separated during the growth / expansion and test procedures.

One transformative innovation by Peak Analysis and Automation (PAA) in this area is the integration of modular automated systems, which significantly enhance the efficiency and accuracy of cell screening pipelines. These systems utilise mobile benches called the SMART CART, operated by mobile robots to streamline the movement of incubators and plates of cells, facilitating tasks such as imaging and media replenishment.

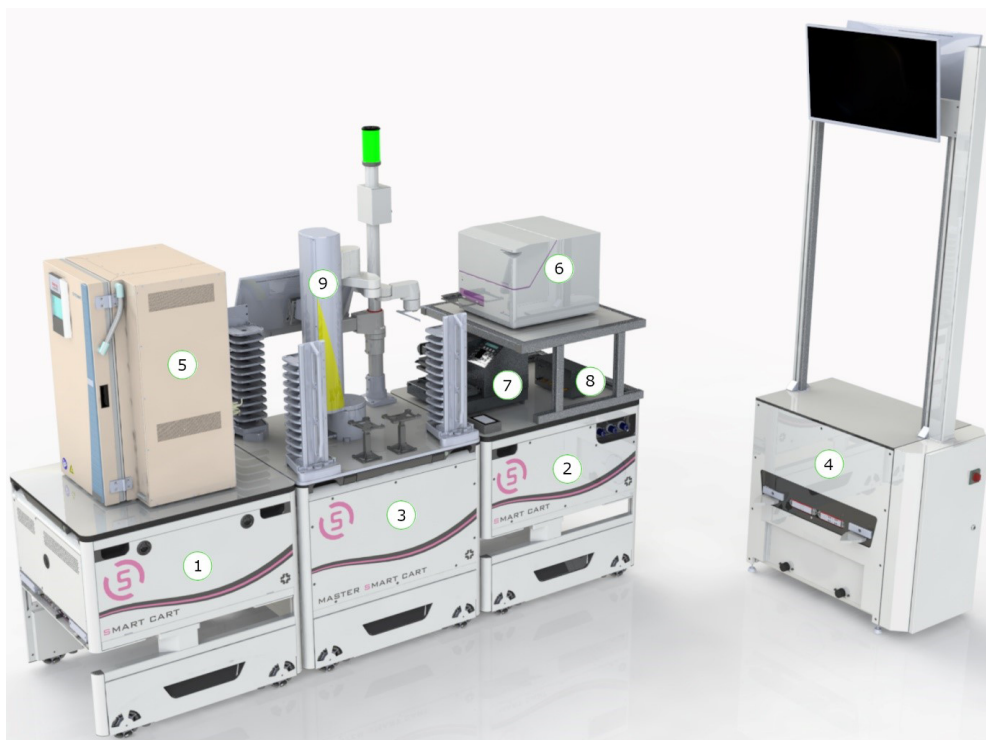


Figure 1: Example system layout showing primary equipment:

1. Smart Cart #1
2. Smart Cart #2
3. Master Smart Cart
4. Docking Station
5. Cytomat 2C LIN automated incubator
6. Plate Reader
7. Bulk reagent dispenser
8. Buffer Switching Module
9. KX-2 500

The SMART CART is a fully mobile life support system for lab equipment or lab robots, designed and manufactured by PAA. It reimagines modular automation, eliminating the need to place high value equipment in fixed locations inside automated workcells. It offers the framework for a more productive, efficient & dynamic use of instrumentation.

With the implementation of incubators on the SMART CART, PAA can provide a much more flexible approach to automated cell culture systems. The incubators can be docked to the automated system when cells need to be processed, and during long incubation periods removed and docked offline for the cells to grow. Here, we explore the key benefits of this approach.

2 / Benefits of Modular Automated Systems for Cell Screening

1. Increased Throughput and Efficiency

Traditional cell screening methods are often labour-intensive and time-consuming, limiting the throughput of experiments. Modular automated systems, equipped with a mobile robot, can continuously transport cell cultures to various processing stations without human intervention. This constant movement enables simultaneous handling of multiple samples, drastically increasing the throughput of cell screenings. Researchers can conduct more experiments in less time, accelerating the pace of discovery and development.

2. Precision

Human error is a significant factor in manual cell screening processes, potentially leading to variability in results. Automated systems ensure that cell cultures are handled with precision and consistency, reducing the risk of contamination and human error. Mobile robots follow pre-programmed routes and schedules, ensuring that each sample receives the exact same treatment and exposure. This uniformity is crucial for reproducible and reliable experimental outcomes.

3. Flexibility and Scalability

Our modular automated systems offer unparalleled flexibility. The configuration of mobile benches can be easily adjusted to accommodate different experimental setups or to scale operations up or down based on demand. A range of incubators can be implemented on the SMART CART with incubator capacities up to 200 cell plates, which massively expands the effectiveness of the cell maintenance platform. New modules can be integrated into the system without disrupting ongoing processes, making it adaptable to a wide range of cell screening applications. This scalability ensures that the system can grow alongside the needs of the laboratory. The SMART CART system is vendor agnostic and can be fitted to existing platforms. This enables the sharing of expensive equipment between multiple automated systems from any vendor.

4. Enhanced Data Collection and Analysis

With automated imaging and data collection integrated into the cell screening pipeline, researchers can gather comprehensive data sets in real-time. These systems often incorporate advanced imaging technologies and software for immediate analysis, providing valuable insights into cell behaviour and characteristics. PAA's integration and scheduling software can help manage, analyse, and integrate this data more effectively, minimising the likelihood of missing critical data points, facilitating more thorough and accurate analysis.

5. Collaborative Platforms

PAA's automation platforms can support collaborative research efforts by standardising processes and data formats, facilitating easier sharing and integration of data across different research entities. This enhances collaboration in the clinical research field, accelerating innovation and development.

6. Cost-Effectiveness

The SMART CART offers modular automation with lower initial investment, enhancing its versatility compared to existing solutions. Existing mobile robots are limited to one task at a time. With PAA's approach, one mobile robot can service multiple remote processes by decoupling it, transforming it into a universal transport system. The sharing of expensive equipment between multiple automated systems increases equipment productivity with rapid ROI. Increased throughput, reduced labour expenses, and minimised errors lead to substantial cost savings over time. Additionally, the ability to quickly adapt and scale the system ensures that laboratories can optimise their workflows without frequent, costly overhauls.

7. Regulatory Compliance

Our S-RUN control and scheduling software can manage and optimise the entire workflow process. S-RUN can prioritise tasks, allocate resources efficiently, and schedule equipment usage to maximise throughput and minimise downtime. It also enables complete traceability through audit trails, error logs and documentation which is crucial for meeting regulatory standards.

3 / Conclusion

The integration of SMART CARTS with autonomous mobile robots marks a significant advancement in cell screening pipelines. By increasing throughput, ensuring consistency, providing flexibility, enhancing data collection, improving safety, and offering cost-effectiveness, these systems revolutionise the way cell screenings are conducted. As biotechnology continues to evolve, embracing automation and modularity will be key to maintaining and enhancing productivity and innovation in the field.

For more information, visit our website or contact our team directly. Let's innovate together!

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