

## Digital Twin for Advanced Automation and Virtual Commissioning

### Abstract

HERZOG has introduced a new Digital Twin solution, designed to integrate robotic simulation seamlessly with the company's PrepMaster Core SCADA system. This innovation enhances the efficiency and reliability of industrial automation systems by enabling virtual commissioning, comprehensive system analysis, and performance optimization.

### Key words

• Digital Twin • Virtual Commissioning • Robot • SCADA System • RobotStudio

### Introduction

The increasing complexity of industrial automation systems demands innovative tools to meet growing expectations for precision, efficiency, and reliability. The concept of the Digital Twin, which connects physical systems with their digital counterparts, has become a vital instrument in addressing these challenges. HERZOG has embraced this approach to create a virtual model that not only mirrors the physical systems but also interacts dynamically with its SCADA software, PrepMaster Core. By doing so, HERZOG aims at developing solutions that reduce commissioning time, optimize processes, and enhance overall system performance.

### Key Innovations

HERZOG's Digital Twin technology is built to address the specific challenges of automating sample preparation systems.

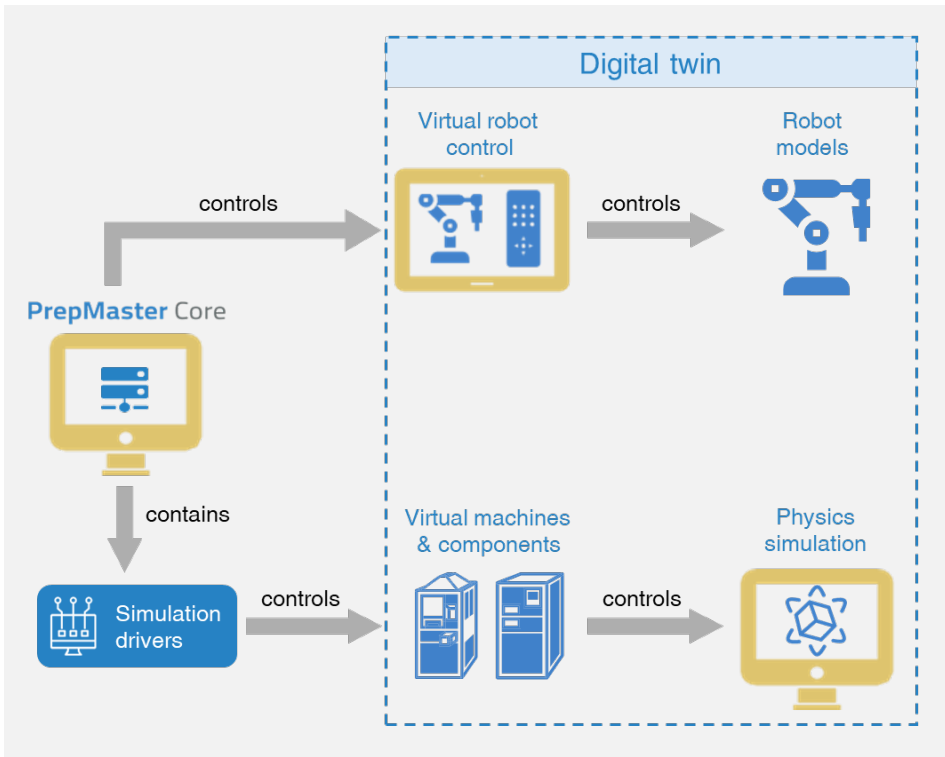
One of its most significant features is the ability to perform virtual commissioning, allowing all robotic workflows and system operations to be tested and refined in a controlled digital environment before they are implemented in the physical system. Using RobotStudio (ABB, Zürich, Switzerland), a detailed virtual model of the robotic circuits is programmed offline, enabling engineers to identify and resolve potential issues at an early stage. This capability significantly reduces the time and resources required for on-site commissioning while improving accuracy and reliability.

Another crucial aspect of this technology is its seamless integration with the PrepMaster Core software. PrepMaster Core acts as the central SCADA system, responsible for monitoring system status, managing sample routing, and ensuring smooth communication between

various automation components (Figure 1). The Digital Twin expands these capabilities by enabling real-time interaction between PrepMaster Core and the virtual environment (Figure 2). This integration allows the routing logic of samples to be fully tested and optimized within the digital model, ensuring that workflows are efficient and free of bottlenecks before physical implementation. The advanced simulation capabilities of HERZOG's Digital

Twin further enhance its utility. The system includes physics-based simulations that model complex interactions within robotic workflows like, e.g., movements of grippers (Figure 3) or operation of the conveyor systems.

These simulations enable dynamic analyses, including cycle time investigations and robotic load calculations, which are critical for an optimal system performance.



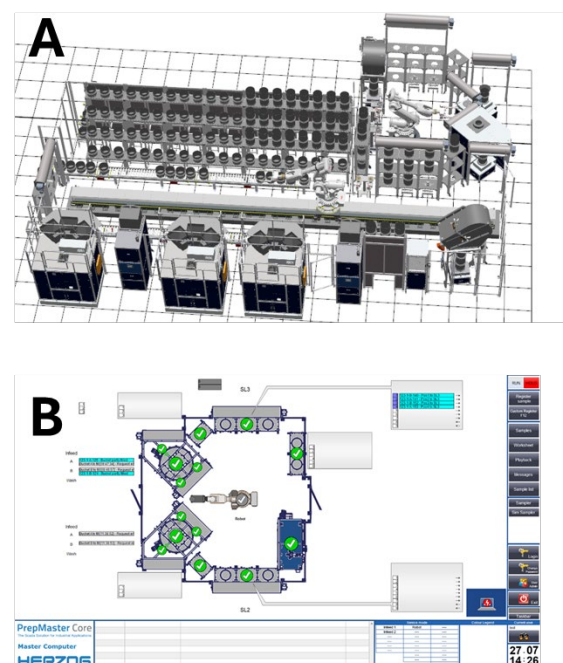
**Figure 3:** Schematic structure of the Digital Twin for simulating robots and system components in a virtual environment.

PrepMaster Core controls the virtual robot control in ABB RobotStudio, which in turn moves the corresponding robot models in the virtual environment. Via simulation drivers, PM Core controls the virtual machines and components like sensors. These in turn are moved in a physics simulation. This makes it possible to test the processes against physical limits and supports virtual commissioning of the system.

## Results and Achievements

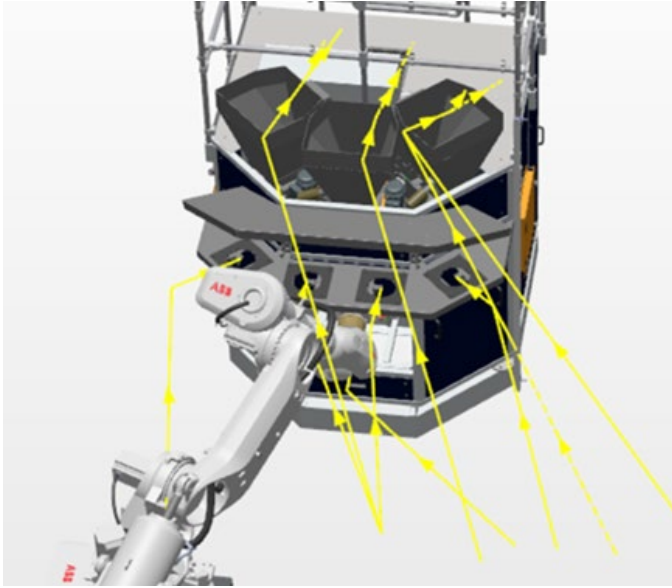
In this Application Note, the Digital Twin has been applied to two robotic circuits of a larger sample preparation system for the mining industry. The results demonstrated significant benefits, including a reduction in commissioning time through offline programming and teaching of robot positioning. The integration of the Digital Twin with the SCADA system allowed engineers to virtually test and optimize workflows. In addition, certain processes in automation can be discussed with the client at an early stage and, if necessary, modified and optimized.

This approach has also provided a new level of visibility into system performance, enabling early identification of potential inefficiencies and the implementation of targeted improvements. By



**Figure 2:** (A) Digital twin of the two robot circuits, (B) PrepMaster for control of robots and machines

simulating complex workflows and routing scenarios, HERZOG has been able to validate system designs and operational goals.



**Figure 3:** Interaction of the robot with the virtual machines within the Digital Twin automation

## Future Outlook

This approach will enable full-system integration and provide clients with a comprehensive tool for performance monitoring, predictive analytics, and ongoing system optimization. The potential to tailor Digital Twin models to specific customer requirements further underscores the flexibility and scalability of this solution.

HERZOG's commitment to innovation ensures that the Digital Twin will remain a central component of its strategy to deliver cutting-edge automation solutions. By leveraging the synergy between digital and physical systems, HERZOG aims to constantly improve efficiency, reliability, and performance of its automated laboratory systems.

For more information about HERZOG's Digital Twin technology and its applications, please contact [info@herzog-Maschinenfabrik.de](mailto:info@herzog-Maschinenfabrik.de).

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