



Fully Automated Tablet Production

The Shop Floor Is Getting Smart: Glatt and Bayer Are Digitizing Operator Intelligence

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Pushing heavy containers and manually supplying materials are things of the past at Bayer—at least in the new tablet production facility, Solida 1. Here, intralogistics work fully automatically. This is made possible by a unique software solution that orchestrates the robotic systems for material flow.



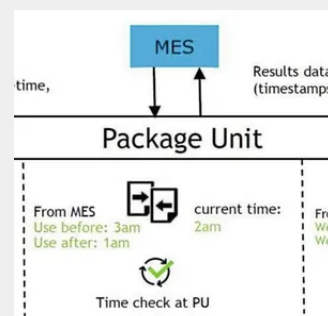
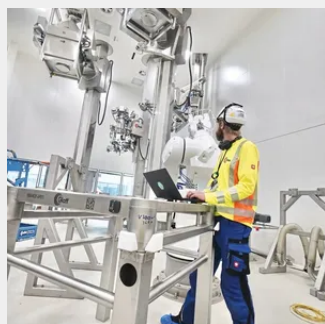
A look into Bayer's new tablet production, Solida 1, during construction: The robots and lift columns for material handling are being installed.

(Source: Bayer)

In tablet production facilities here in Germany and around the world, operators push heavy barrels and containers into cleanrooms and ensure that each production unit is supplied with the right materials at the right time. What sounds simple is, however, extremely demanding. Highly qualified staff members are in short supply and bear a great deal of responsibility. A wrong decision or a seemingly small oversight can render an entire batch of potentially very expensive medications and precursors unusable.

To minimize human errors on the shop floor, pharmaceutical companies and plant manufacturers are working on comprehensive automation concepts. The pharmaceutical manufacturer Bayer has achieved a significant milestone towards a “lights-out factory” with its new tablet production at Solida 1 in the Chempark Leverkusen. This was made possible by a newly developed system from Glatt, which takes over the orchestration of intralogistics. Anton Kopitzsch, Team Lead Automation Engineering at Glatt in Weimar, and his colleague Thomas Geier, Product and Business Development Manager Automation & Digital Solutions, from Binzen, were involved from the start.

GALLERY



SOLIDA 1: BAYER'S TABLET PRODUCTION OF THE FUTURE

In June 2021, Bayer began constructing one of the most advanced production facilities for solid pharmaceuticals at Chempark Leverkusen. The aim of the approximately 275 million investment in the Supply Center Leverkusen was to set new benchmarks for efficiency, quality, supply security, and sustainability. Initially, medications for the treatment of cancer and cardiovascular diseases will be produced on a total area of 15,000 square meters for offices and production once the facility becomes operational. The highlight of the new solid pharmaceutical production facility: It is fully automated and modularly constructed. The single-story factory consists of a central building component with modularly connected function buildings. The central access module, among other things, handles the supply and disposal of utilities as well as access for personnel. The modular design of the highly automated factory allows the pharmaceutical company to flexibly and as needed connect new production buildings to the central supply tract.

Gamechanger Ballroom

It is already in the name of the project: If there is a Solida 1, more Solida productions may follow. Eventually, these will be connected to a central development module, the Spine, to function as independent production rooms. The trick: The different production stages, such as granulator or

tablet press, all produce the same product in the same room—also called a ballroom. “With the ballroom concept, we move away from thinking in batch units to a campaign concept. In campaign production, several batches of the same product run one after the other in one production room,” explains Kopitzsch. For Glatt, this was also something new, but it opened up new possibilities.

“The new concept allows the intralogistics to be handled much more efficiently. In a ballroom, we have fewer locks and barriers for material transport,” Geier explains. Every lock costs time—not only when employees enter and exit but also in automated material flow processes. Even the Autonomous Guided Vehicles (AGVs) must adhere to the strict protocols. “They log in with the door control systems and go through a classic lock process with air exchange and everything,” emphasizes Kopitzsch. “This can be saved if these transports are done in the same room.”

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Thomas Geier, Product and Business Development Manager Automation & Digital Solutions at Glatt

In terms of area as well, the ballroom is a gamechanger, as it requires less space for paths and walls, benefiting the production area. This gave Glatt developers more room for the layout of intralogistics, such as container parking spaces.

Missing Link for Shopfloor Processes

But back to automation. Bayer and Glatt have been partners for many years. They know and trust each other. “The mutual trust relationship was crucial for the success of the complex project,” emphasizes Kopitzsch. The full automation of the shop floor was a major challenge, especially in the pharmaceutical industry, that system integrator Glatt faced. The partners analyzed in detail which work steps needed to be automated. “It was only during the conception phase,” says Kopitzsch, “that we recognized something was missing in the construct between MES and the ballroom.” The tasks between the MES and the Package Units of the ballroom are clearly distributed. In the MES, as an overarching production management system, recipes and production instructions are stored—a classic batch process. The Package Units (PU) serve as

executing units: weighing, mixing, granulating, coating, or tableting according to the production instructions. But who supplies the PUs, ensures that the right container is at the right place at the right time, or knows which of the five clean containers should be used? Correct: the operator. But in the factory of the future, the operator should not deal with the transport and selection of containers—there was a “missing link.” “When we realized that, 'Karl' was born,” smiles Kopitzsch. “Karl” virtually represents the operator's intelligence as a digital surrogate. The experts from Bayer and Glatt first scoured the market for systems like “Karl” that could make operator decisions, but to no avail. “We couldn't rely on existing software, so we had to develop a system ourselves,” Geier summarizes.

As a system integrator, Glatt has decades of experience and has developed more than one new solution for the production of pharmaceutical powders, including automation. Therefore, the team around Kopitzsch and Geier collaborated with the experts from Bayer, and six months later, “Karl” materialized as a system. The result is the Production Flow Control (PFC) system. It's clear that the PFC requires a rethink. Unlike the classic batch process, characterized by a sequential succession of individual process steps, preferably in a vertically arranged system, the ballroom concept allows multiple batches to be processed simultaneously on one production level. “We see a paradigm shift in this concept. A batch is no longer the result of individual package units but the result of the entire production level,” explains Kopitzsch. For this, containers and barrels must be at the right place at the right time, without any operator intervention. A specially developed gate application tracks every movement: When does which container leave which room and enter the ballroom? This always allows for tracking which container was in which room at what time. On the shop floor, Autonomous Guided Vehicles transport containers and pallets through production to the Package Units – the PFC orchestrates bin locations, fill levels, time limits, and all other necessary information for fully automated production, similar to a conductor indicating the cues to his musicians with a baton.

Bilateral Communication: How MES, PFC, and Package Units Play Together

To ensure the music piece does not descend into chaos—to stay with the image—, communication between MES, PFC, and the Package Units must function smoothly in all directions. For example, the MES notifies the PFC when cleaned containers are available again. Since the PFC can also be used for other pharmaceutical productions, the developers chose the platform-independent standard protocol OPC UA.

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However, how do the communication paths for a campaign work? Put simply, the MES provides the order data—recipe plus all process-relevant data—to the Package Units. Based on this information, the Package Unit orders the required container from the PFC. The PFC now sends a robot to pick up the corresponding container from the parking space and bring it to the Package Unit. The Package Unit automatically starts its respective production step as soon as all necessary conditions are met.

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Anton Kopitzsch, Team Lead Automation Engineering at Glatt in Weimar

A three-stage control mechanism ensures, on the one hand, that the Package Unit receives the correct material—in other words, the robot does not get the address wrong. For this purpose, the Package Unit checks the data on the container's RFID tag against the order data from the MES. Furthermore, the time and weight specifications of the MES are also checked at the Package Unit, and the actual times and weights are transmitted to the MES. RFID chips accompany each

container, similar to a digital identity card. “At strategic points, evaluation units read these tags,” describes Geier regarding bin recognition. This also works in conjunction with third-party systems. Glatt developers have integrated, for example, tablet presses from Fette Compacting and a roller compactor from Gerteis with regard to logistics and information technology into the entire system. In addition, there are handling systems from Glatt for all container systems and robot systems for smaller bins, such as barrels transported on pallets.

A look at the Solida 1 production level shows that the days when employees had to push heavy containers from cleanroom to cleanroom are numbered. “At Bayer, with regard to intralogistics, we no longer need anyone on the shop floor at all,” reports Kopitzsch with pride. What operators used to do laboriously by hand now happens fully automatically through the PFC system. As a result, Glatt and Bayer created a blueprint for the “lights-out factory.”

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