

Retrofit into warehousing spring

While the mechanical and electrical components of a warehouse are generally still capable of unrestricted operation even after ten years of operation, the control technology frequently requires considerable adaptation and modernisation after a comparable time. At the latest when the first spare parts discontinuation announcements have arrived, new control system solutions have to be sought to maintain reliable warehouse operation.

At the same time, such a retrofitting project opens up great potentials for boosting the efficiency and quality of warehouse operations. The example of the modernisation of a large mill's finished products store shows how it was possible to boost warehouse throughput by 20% by means of modern automation and, at the same time, implement a particularly powerful and convenient instrument for reliable product tracking.

At its Hamburg location, Diamant Mühle Hamburg GmbH operates a mill in which wheat and rye are processed to arrive at flours and baking mixtures ready for use. Operation of the mill also includes the area of the automatic finished goods store in which small receptacles and bagged product are buffered in a space-optimised fashion on Euro-pallets and are picked for truck transport. The store consists of a high-bay shelving warehouse with 24 lanes of six storeys each. The pallets arriving from the system's automatic palletisers are fed via a conveyor to the shelving conveyor at the input end. At the output end, an identical shelving conveyor and a further conveyor line ensure provision of the pallets for picking and truck loading.



Fig. 1.: Finished product store of Diamant Mühle

When discontinuation of spare parts jeopardises smooth warehousing operation

Conveying lines, the high-bay shelving store and the shelving conveyors were controlled by PLCs of the SIMATIC S5 type, which had become outdated. Now that the manufacturer Siemens no longer guaranteed deliveries of spare parts for some components of these models, there was a threat that a malfunction would considerably hinder warehousing operations for an unforeseeable time. To prevent, in good time, the related additional costs of restrictions in operation and delivery delays, the owner placed an order with ECKELMANN AG, Wiesbaden, for modernisation of the aforementioned control system components and integration of the entire warehousing area into a higher-level overall production control system.

To realise control technology that would be safe for the future, ECKELMANN drafted a modernisation solution based on industrially proven standards with SIMATIC S7 type PLCs. Besides the modern Step 7 development and programming environment, the WinCC package also consists of visualisation software that is optimally tailored to these systems. At the owner's request and to protect the owner's investments to the greatest possible extent, the power components of the affected system areas were completely retained within the scope of the modernisation concept.

An S7 now controls the conveyor lines for full pallet transport. To boost flexibility and the degree of automation, operation at one of the entry and exit stations for pallets located on the conveyor line was changed over from previously conventional operator controls to an operator panel.



Fig 2.: The conveyor lines for full pallet transport

A further S7 serves to control the high-bay shelving warehouse itself with its two shelving conveyors and their movement and lifting drive. During the modernisation project, the aforementioned drives including the transmissions were replaced by new, frequency-controlled three-phase systems. The movement drives were additionally equipped with laser-based absolute distance measuring systems to enable error-free and highly precise horizontal positioning with simultaneous optimisation of travel times.

Both new PLCs of the warehouse area were linked via Ethernet to the overall production system of the plant and thus also to the on-site ERP system. The complete changeover took place in individual steps on three weekends with minimum interruption of warehousing and loading operations.

Performance boost through retrofitting

The performance and quality advantages of this modernisation are:

1. Thanks to the use of improved drive technology for the two shelving conveyors in the warehouse input and output processes and their optimised control, consideration acceleration of motion operations was achieved and a boost in warehouse throughput in the order of magnitude of around 20% was realised.
2. Thanks to partly chaotic placement in storage strategies, optimum use is made of available warehouse volume, which is capable of accommodating the increased throughput of 20%. Among other things, a change of article from one aisle to another is possible without previously emptying it, which clearly increases the degree of utilisation of existing storage capacities considering the large number of articles.
3. The integration of all control system components into the higher-level production control system enables clearly arranged visualisation and complete documentation of the overall material flow. These elements warrant convenient and reliable automatic product tracking, fully complying with the sophisticated quality assurance specifications in the area of foodstuff production.
4. Fast, reliable and timely paperless transfer of picking orders to the warehouse and continuous storage status feedback to the central IT is ensured via the interface to the on-site ERP system, which was also realised.
5. Control of the material flow and of the warehouse is based on the latest PLC technology, for which spare parts and service guarantees of several years are provided. Thanks to the components used, it is compatible with the currently conventional industrial standard.

Automatic palletising with image processing

By order of Diamant Mühle Hamburg GmbH, ECKELMANN AG also modernised the control technology of an automatic sorting system for a multi-palletiser preceding the warehouse area, doing so in parallel with the measures described above.

Receptacles delivered in a chaotic order by packing machines via a conveyor measuring about 200 metres in length must be identified and distributed to accumulating roller conveyors after sorting. From these, they are then fed in layers to the palletiser and the completed pallets are then forwarded via the full pallet transport system already described to the finished goods store.

The sorting system's previous control system was based on the proprietary system of a small manufacturer which had encountered problems in the areas of spare parts supply, service and software maintenance.

Within the scope of the ECKELMANN modernisation concept, the sorting system was also equipped with a SIMATIC S7 type PLC, while retaining the existing power section. An image processing system compatible with the PLC was installed to identify receptacles. By means of two camera systems, incoming receptacles are reliably identified on the basis of their size and geometry and, after sorting, are distributed to the palletiser's accumulating roller conveyors by pushers. A new operator panel, which was also installed, not only offers personnel convenient operation in comparison with the old system, but also the possibility of swiftly and easily entering new forms of receptacles and of continuously keeping the system up-to-date.

On the one hand, by the changeover to the current generation of a standard PLC, this solution also offers the required protection against system down times as a result of maintenance operations.

On the other hand, modernisation was also exploited to substantially enhance the operating convenience and data maintenance of this subsystem and to reduce the time required for this. Thanks to the use of a modern image processing system, performance reserves were created to permit no-problem future increases in receptacle throughput, e.g. of additional packing machines.



Fig. 3: Accumulating roller conveyors of the multi-palletiser

Future-oriented warehousing technology and reliable product tracking by means of a retrofit

The examples described demonstrate that a retrofit is far more than just an annoying, but unavoidable, investment for preventing down times as a result of maintenance problems. Thanks to the changeover to modern warehouse and material flow automation, clever warehouse modernisation makes a performance boosting virtue out of the necessity arising from spare parts discontinuation. Time-saving, but reliable product tracking is warranted thanks to simultaneous implementation of automated process data documentation systems.

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