Beckhoff in control at Africa's largest retail distribution centre

In the retail industry, warehouse management and control systems have become critical operating components in the race for end-to-end supply chain efficiency. Under such pressure, it is impossible for any leading retailer's distribution centre (DC) to stay competitive without a little help from the latest in automated storage and distribution systems. Mr Price is such a retailer and its new DC in Hammarsdale, KwaZulu-Natal, is one such state-of-the-art facility, thanks in part to a warehouse execution system (WES) developed by Fortna and branded FortnaWES.

Fortna control systems utilising Beckhoff Automation

Fortna has been in the business of streamlining supply chain operations since it began as a forklift provider in 1946. Today, it focuses on assisting some of the world's largest brands to transform their distribution strategies into a profitable competitive advantage.

"Internationally, we work with top-tier companies across several market segments," explains Marc Austin, managing director for Fortna EMEA, "to help them design and optimise their global distribution networks. Our in-house expertise extends from supply chain strategy, DC operations, and material handling and storage, to automation and warehouse execution software solutions."

Distribution frontrunners today rely on warehouse execution and control systems that are able to optimise and manage the workflow through their DCs. The solution must be equipment agnostic to integrate with subsystems from many different material handling suppliers, and it must be built using an architecture that supports industry standards which can scale to meet the growth needs of the business.

"In order to meet the requirements for interoperability and scalability, Fortna took a strategic decision to standardise the automation layer of its solutions on Beckhoff's PC-based control platform and the EtherCAT fieldbus," outlines Austin. "We were impressed by the modular hardware approach, and the fact that we can run all the equipment interfaces over standard Ethernet cables makes network design quick and easy. On the software side, the TwinCAT automation suite allows us to implement the simultaneous real-time control functionality that we need to run on multiple real-time industrial controllers."

The Beckhoff solution bundles the following components which allowed Fortna to simplify the procurement, design and maintenance of its controls platform:
- Embedded controllers that can be mounted inside control panels alongside other electrical components.
- Robust real-time kernel provided by TwinCAT.
- I/O software stack with support for a variety of fieldbus technologies.
- Flexible coding environment (C++, C#, .net) as well all the IEC 61131-3 PLC languages (Ladder Logic, Structured Text etc).
- Seamless integration of physical I/O devices using EtherCAT.

- Windows embedded OS (native driver support for a large number of devices) allows for easier deployment and maintenance in the production environment.
- Integrated HMI/graphics package within TwinCAT provides HTML5-based rich UI screens.

"The Beckhoff solution was the most 'Open Standards' of all the control platform offerings evaluated by Fortna," adds Fortna software project manager, Daniel Opland. "In fact, one of the main drivers behind our choice of Beckhoff was their ability to work with a wide variety of I/O bus systems, which is crucial in retrofit situations."

The solution of choice for an ambitious Mr Price project

Locally, the retail group Mr Price is one of Fortna's key customers. "Our relationship with Mr Price began about seven years ago," reveals Austin, "through our involvement in the automation for the Riverhorse Valley DC, one of the main Mr Price warehouse facilities at that time."

"As our retail business grew, we realised that these legacy warehouses were reaching the end of their useful life," adds Mr Price logistics director, Werner Pelser. "This is when we got together with the consulting group at Fortna and the specifications for the ultra-modern DC infrastructure at Hammarsdale were drawn up and approved."

At 60 000 square metres (under roof), the

new multi-million rand warehouse is one of the largest automated general retail DCs in Africa. "This is one of the most complex distribution projects completed in South Africa to date," explains Opland, "It was designed to the exact requirements of the Mr Price logistics team and their business needs."

Operational overview

Elapsed time for order fulfillment is a measure of competitive advantage in the logistics business, Pelser explains: "The faster we can route goods accurately from the receiving depot onto the transport to our 1600 stores around the country, the more profitable our entire retail operation becomes."

Put into perspective, from the first time a box is loaded onto a conveyor and its barcode is scanned, the combination of FortnaWES and the Beckhoff control platform transports it accurately across the conveyors that criss-cross the Hammarsdale DC, and deliver it undamaged, to the correct truck, in less than four minutes.

"The speed and precision of the Fortna system utilising Beckhoff automation is compelling to watch," says Pelser thoughtfully. "We have a mix of conveyor types all running at different speeds. Managing those changeovers smoothly and without interruption is a critical part of the transport process. We depend on fast motion control capability from our system, one of the strengths of the Beckhoff control platform."

Things get even more interesting when the contents of an incoming box must be routed individually to fill an order. Then they must be opened and the items placed separately in the trays of a split tray sorter, whose two halves open like the bomb doors on a military aircraft, to let the contents fall into the packing crates waiting below. This high-speed continuous loop arrangement is used for its spatial efficiency, since the items are discharged into crates placed directly below the moving trays.

"This really tests the ability of the WES and the controls to work together," says Mike van der Walt, the branch manager of Beckhoff's Durban office. "First, the WES must send the order details for each crate to the sorter's control system. For instance, it may need to be filled with T-shirts of various sizes and colours for dispatch to a particular retail outlet. Then, items are placed by hand into the sorter trays as they move past and the FortnaWES software instructs where to route them. Finally, when that tray arrives above the appropriate crate, the doors must open so that the shirt can fall into it. Simultaneously, a running tally must be kept of the inventory in each crate, so that once an order is filled, it can be labelled and moved to the transport conveyors for routing to the next available truck."

"Thanks to the open nature of the Beckhoff network, it is easy for us to build interfaces from our WES to the sorting, conveying, scanning and labelling equipment from a variety of different suppliers," adds Opland. "This combination of fast control and standardised interfaces gives us the freedom to design complex systems, like the one at Hammarsdale, using standard off-the-shelf components."

Results and conclusions

"Thanks to the intelligent combination of manual processes and automation at our new facility, we are able to do more in the available space than our competitors could do in three facilities of comparable size," sums up Pelser. "The way we measure our efficiency is by the total logistics cost per unit. One of the most effective ways to minimise this is to combine high throughput with as small a physical footprint as possible."

At Hammarsdale this is achieved partly through physical construction – the use of mezzanine floors increases the effective area to 92 000 square metres – and partly through spatially effective well considered automation, mechanisation and conveyors.

"The challenge for us on the automation side is to combine all the different functionality we need as easily as possible," adds Opland. "For this we rely on our partner Beckhoff to provide the key hardware components that underpin our FortnaWES solutions with an architecture that is equipment agnostic, a crucial requirement when it comes to the design and maintenance of systems like the one we have just installed for Mr Price."

"That and local support," concludes Pelser. "Knowing that we have regional access to technical experts from both Fortna and Beckhoff makes us extremely confident in the ability of this new system to keep us operationally competitive. Logistics is a dynamic business, but through our partnership with these two technology leaders our position at the sharp end of retail is assured well into the 2020s."