Performance and flexibility boost warehouse logistics

The demands placed on warehousing and distribution processes are constantly increasing. In particular, customers expect online vendors to pick, pack, and ship ordered goods almost in real-time. As a leading material handling equipment provider that is up to this challenge, United Sortation Solutions, (USS) based in Owings Mills, Maryland, specializes in highly-automated distribution systems that help retailers and warehouses keep up with the fast-paced times.
Accordingly, the list of USS clients is impressive, including many high profile companies in a variety of industries that range from retail to pharmaceutical to food and beverage. “One of our largest customers is the Ascena Retail Group, Inc., a leading North American retailer of apparel for women and girls, which operates over 3,800 stores in the United States and Canada with annual revenue of over $4.5 billion,” says Howard Eisenberg, President, United Sortation Solutions.

The USS portfolio of material handling and sorting equipment includes many standard modules such as vertical lifts, stackers/de-stackers, flat sorters, and a sorter for small items. Depending on the application requirements, the individual modules are combined to make a custom-made material handling system. USS systems are designed to be flexible and compact for implementation in facilities with space-restricted layouts.

Controller retrofit provides higher performance and greater flexibility

USS has over a decade of experience developing advanced material handling technologies. “We were increasingly coming up against the limits with our original control concept, so we decided on a retrofit,” explains Jeff Zerr, Director of Engineering, United Sortation Solutions. “The existing system was overcomplicated in its architecture and not as flexible as we needed.” USS now uses a control platform that comprises a variety of Beckhoff Embedded PCs with TwinCAT automation software and EtherCAT as the communication system. The compact CP2907 Control Panel with a 7-inch display serves as the HMI hardware.

To move their I/O technology forward, USS examined the leading industrial Ethernet technologies. “USS determined that EtherCAT was even faster than what our requirements dictated. In addition, the number of I/O points that we can implement on an EtherCAT network is essentially limitless,” Howard Eisenberg explains. EtherCAT has become the all-purpose bus for all machine lines, covering control, I/O, drives, and even safety. The I/O system includes EtherCAT Terminals, EtherCAT Box modules and, for the integration of safety functionality, TwinSAFE terminals. Howard Eisenberg considers it a great advantage that the EtherCAT Terminals can be connected directly to the Embedded PCs. “Now we only need one standard Ethernet cable and addressing is done automatically, so the work has been considerably reduced,” he stresses.

Modularity and compact design save space and costs

The modularity of the High Density (HD) EtherCAT I/O terminals, offering 1 to 16 channels, is proving very convenient for the specialists in material handling
equipment: “At just 12 mm wide, HD Terminals save a substantial amount of space compared to conventional methods of implementing 16 I/O channels,” explains Jeff Zerr. “Also, depending on the amount of I/O required, we can easily switch to 2-, 4- or 8-channel terminals. That gives us additional flexibility and makes our spare parts management simpler.”

The IP 67-rated EtherCAT Box modules distributed down the length of USS machines are designed for harsh industrial environments. “We benefit in particular from the freely-configurable digital inputs or outputs in one device. For example, EP2338 modules have 8 configurable channels, and EP2349 modules provide 16 configurable channels.

Depending on the type of equipment and the required performance, USS alternatively uses the CX2030 Embedded PC with a 1.5 GHz Intel® Core™ i7 dual-core CPU, the CX5010 with a 1.1 GHz Intel® Atom™ Z510 processor or the CX9020 with a 1 GHz ARM Cortex™ A8 processor as the control platform. “With the CX2030s and CX5010s, we can leverage a full Windows OS environment which we sometimes need, depending on the application, for specific file management requirements,” Jeff Zerr says. “If an Embedded Windows OS is all that’s required, the compact CX9020s with Windows CE Embedded Standard, for example, offer surprisingly high performance with low hardware costs. We run all our PLC, HMI and motion control tasks on these Embedded PCs.”

**TwinCAT 3 as the universal software platform**

“We previously used numerous PLC programming environments and frequently switched platforms because no single software could do everything for us,” Jeff Zerr explains. “Today, TwinCAT 3 offers us a universal programming environment that we can use with our entire range of machines. We use structured text and ladder diagrams as programming languages, as well as various IT-oriented programming languages and tools, including Microsoft Visual Studio®. Using TwinCAT 3, we have also begun implementing source code management and are building up comprehensive software libraries for our different material handling solutions. Over time this will save us considerable programming and configuration time,” Jeff Zerr adds.

**Integrated safety solution with TwinSAFE**

Since distribution and warehousing facilities are hives of human activity, a robust safety system is a must-have. Replacing numerous hard-wired relay circuits, TwinSAFE I/O solutions in both IP 20 and IP 67 protection are now used to implement functional safety in USS systems. “Most of the sorters we manufacture are quite long and safety devices are installed down the length of the equipment, so distributed safety I/O pays off quickly,” Jeff Zerr explains. “It gives us excellent flexibility: as we add safety equipment today, we simply add more TwinSAFE I/O.”

**Integrated optimization through to the drive technology**

For the drive system of its machines, the company utilizes AX5000 EtherCAT Servo Drives, optionally in single or dual-channel versions, connected to AM8000-series synchronous servomotors via One Cable Technology (OCT). USS frequently implements electronic gearing in TwinCAT 3 to coordinate two servomotors on one drive, which simplifies the mechanical designs of equipment and lowers material costs.

**USS elevates PC- and EtherCAT-based control to the control standard**

After thorough testing and a successful initial implementation, USS has standardized on the PC- and EtherCAT-based control platform from Beckhoff. “Whether
Implementing a stacker, lift, or sorter of any size, Beckhoff PC-based control and EtherCAT is our control standard today,” Howard Eisenberg reports. “The EtherCAT network not only offers unlimited advantages with regard to performance and speed, it has made our distribution systems much more competitive with easy expandability,” Jeff Zerr adds. “We experienced a win-win with performance increases that went along with hardware and labor cost reductions.”

In Howard Eisenberg’s view, the use of TwinCAT 3 has also brought along a series of advantages for USS: “As our code continues its maturation and as we further leverage the programming versatility of TwinCAT 3, I expect we will measure new software projects in terms of weeks instead of months and machine startup tasks taking days instead of weeks,” Howard Eisenberg adds. “We have found the perfect solution for us in EtherCAT. The consolidation of all our machine programming into one feature-filled software environment also represents a significant technological step forward for us.”

USS utilizes compact Embedded PCs from Beckhoff to run all automation and control functions on its sortation and warehousing systems.

The CX5010 Embedded PC is directly connected to the TwinSAFE I/O system, allowing USS to implement a range of safety functions along sortation lines.

The IP 67 rated EtherCAT Box modules distributed down the length of USS machines are installed directly on the equipment, outside of electrical cabinets and designed to resist dust and moisture in industrial environments.

Further information:
www.unitedsortation.com
www.beckhofferautomation.com