Industrial Communication

With annual production of 10 million pumps and approximately 70 operating companies in 43 countries, Grundfos A/S, headquartered in Bjerringbro, Denmark, is one of the world’s leading pump manufacturers. As with so many large manufacturers, Grundfos’s distribution warehouse is a complex area in which thousands of orders must be carried out, packaged, and transported to the warehouse and from the warehouse to trucks around the clock. All this takes place with almost no manual intervention.

After the order has been entered into Grundfos’s SAP system by an employee, the process is fully automated up until the final inspection. Once an employee at the distribution warehouse has checked on the screen that the correct pumps have been packaged, the box continues its path through the system and technology takes over once more.

Good-bye to slip rings

If the system fails, there is a congestion of pumps and the distribution warehouse turns into a bottleneck. That is why Grundfos control engineer Steffen Schmidt was given the assignment to conduct a risk analysis of the 10-year-old systems and to develop suggestions for a future-proof alternative. “We had daily downtimes, and it was becoming increasingly difficult to get hold of spare parts,” he explains. The manufacturing execution system (MES) that was in place at the time was very specific, and the control system as well as the Interbus I/O devices had been discontinued. Schmidt recommended rebuilding the system from scratch, choosing a solution based on modern standard components and integrating it into the company’s SAP system. Grundfos decided to convert the warehouse to wireless technology. The main reason was that the cars that automatically transport the boxes with the pumps from the packaging area to the high-rack storage area had previously been controlled serially with the help of high-maintenance slip rings. “We were constantly busy cleaning those slip rings,” says Schmidt.

A market analysis revealed that Siemens offered the only viable wireless solution. Now a fail-safe Simatic S7-416F-3PN/DP is being used and all the logistics systems are based on the open Industrial Ethernet standard Profinet with PROFIsafe. Scalance X204 switches are used in a redundant ring. A Scalance X414-3E switch is used for the high-performance link with the higher-level control system. The slip rings have been replaced by an antenna on each car; the antennas pick up signals from the Scalance W access points, which cover the entire warehouse. The access points have process response times of 32 ms, as the entire security solution is based on Industrial Wireless LAN (IWLAN). The emergency stop systems of the driverless cranes are compliant with Safety Integrity Level (SIL) 3, Cat 4, and are also operated via the wireless network. This is possible because the Profinet solution ensures data transmission in real time.

The fact that safety-related and standard communication are now based on the same CPU is a significant advantage for the technicians at Grundfos. Now they have to monitor and maintain only one PLC, one network, and one technology. “The current safety system is a lot simpler than the previous one and fulfills all our requirements,” says Schmidt. “Personnel are protected by light curtains and the safety solutions in the packaging areas, the emergency stop systems, and all other components within the car area work with Profinet.”

Simple diagnostics, improved maintenance

The benefit of Profinet and standard technology extends far beyond the safety aspect. “Since all system components come from Siemens, we had integration possibilities we would not have had otherwise,” the safety engineer explains. “One big advantage is the detailed hardware diagno-
tics. We can immediately see what errors have occurred and where. If a cable breaks, for instance, we can locate the break to within a meter.” Thanks to the Profinet-based solution, the status of the machines and components is also easier to monitor. “If a crane fails, we can easily see how many hours it has stood still since the beginning of the year. So we no longer have to make assumptions when it comes to whether a machine is prone to failures.” The main advantage of this traceability, however, is that disturbances can be recognized before they lead to serious problems. Runtime analysis has enabled Grundfos to make the change from failure-based to scheduled maintenance.

The system has saved the technicians a lot of time and work, not least because it stores all data centrally. “The PLC and all other components are available in the Simatic WinCC SCADA system,” Schmidt says. “And thanks to an integrated web server we can even check the diagnostic data from home – something that has saved us quite a few nighttime drives and further serves to increase the unit’s availability.”

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The entire logistics system in the high-rack storage area consists of a comprehensive Profinet solution with Safety Integrated.