Application Report

Goodbye index cards!

Leuze electronic sensors help to automate the book-lending process in modern libraries

In large libraries, self-service dominates everything from check-out to return. But very few users stop to think about how the returned media are sorted. Assisting here are automated processes with flexible transport systems from Swisslog-Telelift and sensors from Leuze electronic.

The German National Library in Leipzig makes nearly 25 million pieces of media available to its users. Every day, thousands of these are used, lent out and returned. This massive quantity can only be handled by means of automated processes. Moreover, fast access times, shorter paths and more economical processes are demanded – this is true not only at the German National Library, but also at the Jacob-und-Wilhelm-Grimm-Zentrum of the Humboldt University of Berlin ("The Grimm Library") and the Berlin State Library.

Transport solutions from Swisslog-Telelift make a key contribution in these large, renowned libraries towards ensuring that order processing is accelerated and that personnel are relieved of manual transport tasks (figures 1a and 1b). The highly automated operational procedure, which spares the users of unnecessary wait times at the loading and unloading points, calls for reliable, highly-integrative sensor solutions from Leuze electronic (figure 2). For Jörg Franke, project manager for transport systems for light goods at Swisslog-Telelift, the advantage is obvious: "Returned books can again be made available more quickly. This brings the users a trued added value and is, without a doubt, a quality feature of the library."

Specialist in the area of light transport technology

Headquartered in the Bavarian city of Puchheim, Swisslog-Telelift is part of the Swisslog Group and is a leading manufacturer of conveyor systems for the in-house transport of lightweight goods and documents. In addition to rail-based transport systems, this manufacturer also produces driverless transportation systems with a maximum capacity of 500 kg.

In the library sector, the company handles the entire logistics process, from book return, to sorting, to the targeted transport to the stacks. All Swisslog-Telelift transport systems can be integrated according to individual requirements in the now-standard self-service lending logistics systems used in libraries – i.e. even in the customer terminals where media are checked out and returned (figure 3). Jörg Franke describes the service portfolio: "We develop and manufacture modular systems for nearly all requirements and offer the customer everything from a single source – from design and planning to construction and start-up. In the area of sensor systems, we have, for a long time, worked together successfully with the specialists from Leuze electronic."

MultiLift with Leuze electronic sensor systems

At the two large libraries in Berlin – the university library and the state library – as well as at the German National Library in Leipzig, solutions were implemented during the course of renovation work that allow books to be transported in non-driven transport boxes on conveyor systems and in lifts ("vertical conveyors") to the intended location. The "MultLift" system was used in these applications. This fundamental technology concept from Swisslog-Telelift consists essentially of conveyor belt sections and roller conveyors for the horizontal transport within a building floor as well as fully automatic container lifts for the vertical transport between individual building floors (figures 4 and 5).

Book transport containers with a maximum capacity of 25 kg are used to transport the media. The MultiLift system operates with a direct destination control (figure 6). Jörg Franke explains how it works: "The transport destination is set on code carriers that are located directly on the transport container. These can be either slider coding bars or rotary coding discs. The contactless destination queries performed by the Leuze electronic BCL 34 barcode readers detect the destination setting at all decision points along the transport system. As a result, the containers reach their destination quickly and reliably."

In the Grimm Library in Berlin, rotary coding discs from Leuze electronic are used (figure 7). With these, the codes can be quickly and easily set by hand with a turning motion. In contrast, the slider coding bars used at the state library and at the German National Library offer unlimited "nesting" capability (figure 8). This means that the containers can be optimally stacked horizontally within one another. Jörg Franke says: "This saves an enormous amount of space, for example in the German National Library, where some 350 containers are used."

Data transmission via PROFIBUS

The barcode readers are equipped with an integrated PROFIBUS interface. This eliminates the need for PROFIBUS gateways and RS-232 components, considerably reducing the costs for the entire system. The BCL 34 barcode readers read the codes that have been manually preset on the slider coding bars (figure 9) and transfer the data via PROFIBUS directly to the control. This can then positively identify the destination of each detected container. The barcode readers support a maximum signal transmission rate of 12 MBd.

The devices are programmed directly with the software tool of the PROFIBUS master, i.e. no other tools are needed for configuration. If necessary, it is possible to exchange a barcode reader in just seconds without any special technical knowledge. The BCL 34 state can be queried and monitored directly by the PROFIBUS diagnostics tool.

Distance measurement in the lift

For a high transport capacity and to overcome the large transport heights between the individual building floors, a continuous container lift that functions similar to a paternoster is used in the Berlin State Library. In the Grimm Library, on the other hand, a linear lift is used to connect the eleven floors to one another. The MultiLift lift systems are loaded and unloaded fully automatically during both upward as well as downward travel. During this process, the doors automatically

and reliably close by means of an electromotor after each loading and unloading operation. For the vertical movement of the containers in the lift, the control uses the signals provided by the AMS 200 laser distance measurement devices from Leuze electronic. With these devices as well, the signals are transmitted via PROFIBUS. Thanks to the integrated interface, they can be easily and economically integrated in the PROFIBUS network. The sensors achieve an absolute accuracy of +/- 2 mm over a measurement distance of 120 m. Due to the extremely fast position calculation in the device, the high dynamics of modern drive technology can be used to their full potential (figure 10).

AMS 200 distance measurement devices increase system safety through the use of prefailure messages. With these warning signals, the devices inform the user in good time of decreasing laser diode performance, impermissible temperatures or soiling of the optics. The early warning and subsequent maintenance work provide additional reliability and availability.

Good results right from the start

All in all, the technological alliance between Swisslog-Telelift and Leuze electronic ensures that a visitor to the library quickly obtains his or her book at the check-out/return terminal and can again return it there with ease after reading. By using the type of automation described here and by networking the control via PROFIBUS, books can be returned to the stacks and again made available for use in just minutes, even over long distances in multiple buildings and over several floor levels. This should make future book readers happy, even if the technology that makes it possible isn't apparent at the customer terminal.

Selection of images and captions

((Alternative lead photo:))
Handling area for books: the reader terraces in the Jacob-und-Wilhelm-Grimm-Zentrum of the Humboldt University Library in Berlin ("Grimm Library")

Figure 1 a, b. Swisslog-Telelift light conveyor systems for the automated transport of books in libraries

Figure 2. Transport solutions with Leuze electronic coding bars for the barcode readers provide greater efficiency in handling the book quantities encountered in large libraries.

Figure 3. Service terminals for checking out and returning books

Figure 4. The container moves quickly towards the vertical conveyor – a fully automatic lift that functions similar to a paternoster to transport books between the individual levels of a building.

Figure 5. The inner workings of the vertical conveyor contains highly dynamic drive elements and reliable sensors at the PROFIBUS.

Figure 6. Barcode readers on the transport path read the preset codes as the containers pass through and transfer the data to the control via PROFIBUS.

Figure 7. The presetting on the container can be made with either slider coding bars or, as shown here, with rotary coding discs. With the latter variant, the worker can easily and quickly set the destination for the container transport with a turning motion.

Figure 8. Unlike rotary coding discs, containers with side-mounted coding bars can be optimally stacked inside of one another, i.e. they can be nested and stored in a space-saving manner.

Figure 9. The coding bars are set by sliding red positioning elements so that they cover certain barcodes for the readers.

Figure 10. The AMS200 laser distance measurement device from Leuze electronic transmits the signals for moving the vertical conveyor to the control via PROFIBUS.

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