

Pluggable hybrid cable connection

Mobile transfer units on a long leash

For 60 years, GEA Lyophil GmbH in Hürth near Cologne has been developing and building freeze-drying systems for the pharmaceutical industry. The company holds a leadership position in the field, particularly in the area of automated loading and unloading systems for freeze dryers. It has been able to improve mobility for its newest units by using integrated servo drives from Schneider Electric.

In the freeze-drying process, moisture is extracted from a frozen product through a series of sublimation and desorption processes performed under vacuum conditions. Over the years, gradual improvements have been made to the freeze-drying process through more precise temperature management, improved isolation of the process against contaminants, and more efficient process designs. Currently, the best potential for further optimization lies in peripheral technology.

Automatic loading and unloading systems are highly innovative components of freeze-drying operations, designed to reduce the risk of contamination by personnel when loading and unloading the freeze dryers. GEA Lyophil was one of the first companies worldwide to identify the potential of automated loading and unloading processes, and made initial steps in this direction as early as 1989.



A new mobile ALUSTM unit in the assembly/test phase: On the left, the buffer table with conveyor belt; below, outside of the hygiene-critical area, the integrated Lexium ILM62 drives with cabling.



"The new ALUSTM units can be coupled and uncoupled from the stationary control cabinet, both electrically and in terms of control technology, by connecting and disconnecting a single plug."

Michael Groth, responsible for development of the ALUSTM at GEA Lyophil in Hürth.

Today, GEA Lyophil is the leading global supplier of the ALUSTM (Automatic Loading and Unloading System). Electrical engineer Michael Groth, technical manager for ALUSTM within GEA Lyophil, is the "man of the hour" for this product segment: He joined this product segment back in 1990, shortly after the company started moving in this direction, and helped to drive it forward, initially as a developer and later as a manager. As he explains it, "Essentially, ALUSTM is a transfer unit. It transports the vials or other containers with the substances for freeze-drying from the manufacturing process to the dryer, then redirects them back into the process after the freeze-drying is complete. To explain it in very simple terms, the system consists of a loading tray with a conveyor for loading and unloading the vials, an automatically unfolding bridge for docking to the freeze dryer's loading door (known informally as the "pizza oven door"), and a slider for transferring the entire batch into the dryer and out again".

An ALUSTM is either integrated permanently into a production line in the clean room or moves on tracks between various freeze dryers as a mobile unit outside of the clean room. In both cases, mobility is important. Integrating the unit into isolators calls for very tight space requirements. Clean room space is expensive and restricted to essential equipment only. Once the door to the freeze dryer is opened, the ALUSTM must be capable of moving to the side, even when it is permanently integrated into a production line. Even though the mechatronic processes involved are not particularly time-critical, GEA uses servo-technology in ALUSTM design because this is the only way to achieve sufficient security for the process. Despite rela-

tively high final speeds, the precise programming of motion profiles for smooth acceleration and deceleration prevents vials or bottles from falling over during transfer operations.



"Bridging the gap": The bridge, which is unfolded by a servo motor, reduces space requirements in the isolator.



The vials, shown here on optional tablets, approach the unit and are then pushed across the bridge by a slide into the freeze dryer. The process is reversed after the freeze drying process is complete.

Single-plug solution for greater mobility

GEA Lyophil is currently introducing a new generation of mobile ALUSTM units with even easier coupling and uncoupling. Groth points out the enormous benefit of this improvement: "The new ALUSTM units can be coupled and uncoupled from the stationary control cabinet, both

electrically and in terms of control technology, by connecting and disconnecting a single plug". Groth had already been on the lookout for some time, hoping to find technologically practical solutions that would allow mobile ALUSTM units to operate "on a long leash". Attempts were made using cable carriers, but these failed to meet expectations.

Then he found PacDrive technology by Schneider Electric. PacDrive offers Lexium 62 ILM integrated servo drives as an alternative to classic "servo technology" using cabinet-based drives. These are part of a complete solution, which includes servo drives with integrated drive electronics, a central shared power supply for all the machine's servo drives, and a flexible networking concept for connecting the drives to the shared power supply and the controller. This networking concept consists of distribution boxes and double-ended pluggable hybrid cables for connecting each drive to the power supply and to the Sercos® data communication.



The Lexium 62 ILM servo drives, connected with the distribution boxes and hybrid cables, are located in the base of the ALUS, outside of the hygiene-critical area.

The Sercos bus comes from the PacDrive-Controller, and is guided into the shared power supply together with the power supply for the drives and the motor feedback signal through a connection module with a single hybrid cable from the control cabinet to the machine's first distribution box. From that point, the hybrid cable is distributed in tree or line structures to all integrated servo drives. Serial daisy-chain topologies without distribution boxes are now also possible.

Hybrid cable conducts all signals and power supply

With the hybrid cable, the Sercos bus is available on site in every drive. It can also be made available as a separate connection on the motor's drive electronics by means of an additional module in order to integrate I/Os into Sercos communication using M8 standard connections. A single connecting cable between the stationary control cabinet and the machine can therefore provide everything needed for the controller and drive technology in the machine: drive and I/O communication via Sercos, motor feedback signal, and power supply for the servo drives!

The project originally began at GEA Lyophil as a topic for a master's thesis. Schneider Electric provided a free "starter kit" to GEA employee Anne Gerlach, then a graduate student, to create the project's solution using PacDrive technology. Gerlach quickly familiarized herself with the motion control technology. Looking back, she recalls that "commissioning the drives was especially easy". Her project won over the company, as Michael Groth is happy to confirm. "At the time we made the decision on

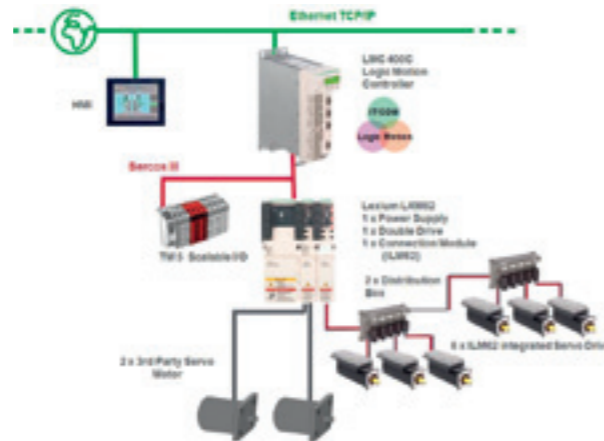
PacDrive, no other automation company offered us a way to reduce an entire machine unit's power and communication connections to a single cable in this way".



Anne Gerlach, ALUS Development/GEA Lyophil, explains the structure of the PacDrive automation solution with shared power supply.

Smooth integration of third-party drives

The automation architecture of the new ALUSTM consists of a PacDrive LMC400 logic motion controller, which communicates via Sercos with a total of six servo drives (in the standard configuration; up to eight in some cases). Groth uses Lexium 62 ILM integrated servo drives wherever possible. In addition to supplying power to the 62 ILM drives, the shared power supply also runs a Lexium 62 LXM double drive. This is a classic cabinet-based servo drive connected in series with a quick-connect mechanism, also powered by the universally compatible shared power supply.



Automation structure of the new ALUSTM: depending upon the version, two additional Lexium 62 ILM drives are connected to the available receptacles on the distribution boxes.

The double drive controls two specialized third-party hollow-shaft motors, which offer size advantages due to a combination of a servo motor and a gear box. Schneider Electric provided GEA Lyophil with parameter files for downloading into the motors. These files allow the drives to be integrated into the system communication using electronic name plates. This prevents any interface problems in system communication with the third-party drives. They can even be included in the extensive PacDrive diagnostics mechanisms and messaging functions.



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