

Mall + herlan

Complex tube production reliably controlled
New automation platform — safe, fast and easy to use

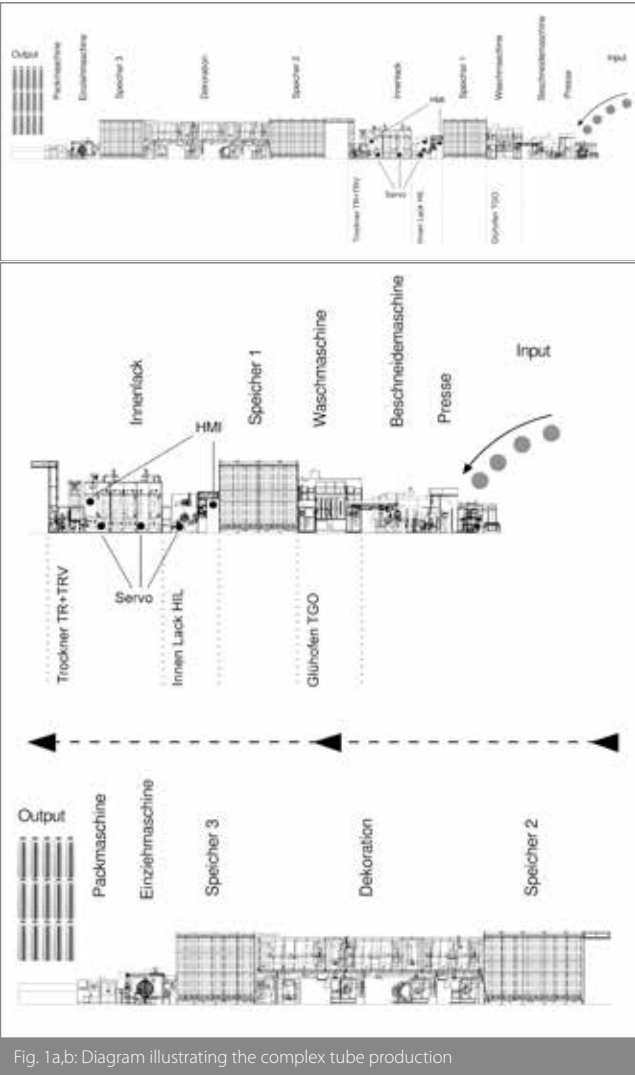


Fig. 1a,b: Diagram illustrating the complex tube production

In the field of modern automation technology, high computing capacity, fast response times, and straightforward control system programming and operation are of the utmost importance. This has all been achieved in a new machine control system. Based on the acknowledgment that every chain is only as strong as its weakest link, the developers ensured that they started out with a robust complete solution.

The new approach relies on the full integration of the controller, slaves, communication systems and associated software, allowing all of the requirements to be optimally served in the one system. In a complex system for metal tube production, the Sysmac platform shows its potential in practical use. From configuration and programming through to simulation and monitoring, all sub-areas are created within an integrated development environment (IDE).

Production lines for tubes are a good example of larger, very complex systems. Mall + Herlan from Pfinztal-Berghausen, Germany, a specialist in these systems, relied on the Sysmac all-in-one machine automation platform from Omron for the construction of its new system. The decisive factor in its decision was the fact that it allowed all the different sections of the system to be controlled optimally while at the same time ensuring that they could communicate with one another and also with the control level via the appropriate bus.

Tube production requires know-how

In theory, the production of tubes is simple: a metal blank sheet is deep-drawn, painted internally and externally, printed, inserted and packed. However, to run smoothly, these five steps require a great deal of experience and a complex system design. It is clear from the size of the production line alone, which is around 80 m long, that, in addition to controlling the individual production section, various coordination tasks are required throughout the entire system.



Image 2: Main drive with 15KW power trimming machine, which cuts the finished pressed tube to size.

A metal tube production line (image 1a,b) comprises the following sections: In the first section, the press creates a tube from the round blank. The trimming machine then trims the tubes to the desired length and rolls the thread.

After this step, the tube blanks pass into a buffer, which decouples the press station from the following internal coating (image 3). In an annealing furnace, the metallic tube body is soft-annealed and then given a non-porous, seamless, chemically inert coating to protect the contents later on. The tubes thus coated then go to a drying oven, and from there to a further intermediate buffer.

This is followed by the exterior coating (image 4). Here, the protective outer primer and individual, multicolor print decoration are applied by a painting and pressing machine, and dried in the ovens. The tubes run through a buffer into the cap screwing machine to apply the individual seals. These are then transferred to the packaging section where they are packed in protective cardboard boxes for transportation to the filler. All processes must be controlled seamlessly and precisely across the entire production line to ensure that the thin, sensitive tube body arrives at the customer with no dents, creases, etc.

High control potential

To ensure optimal interaction of all the components, several NJ-series controllers work together in the system (image 5). All system signals, the servo drives, and frequency inverter are connected to the Sysmac machine controller via EtherCAT, while the individual controllers communicate with one another via Ethernet/IP. On the drive side, only MX2 frequency inverter and Accurax G5 servo systems are used. Visual information and operation on site is ensured courtesy of eight HMI operator devices with 5" and 12" monitors (image 6a,b). The complex control system requires eight controllers: in the press module, one controller is responsible for operating 19 axes, while a further controller operates 32 axes for the internal coating. Five 4-axis controllers and one 16-axis controller control the remaining sections.

Because asynchronous and servo motors are used in the system, both frequency inverters and servo systems are required for motor control. Printing mechanism adjustment, for example, requires precise positioning and synchronous movement of multiple axes; 100 W servo motors that are controlled by G5 servo systems with EtherCAT bus are therefore used for this. Precise movement is also important for the spray jet used for the internal coating. The 15 kW drive is also regulated by servo system for this purpose. For the press, however, absolute exact positions are not crucial (force and price are the important factors). MX2 frequency inverters with integrated intelligence and also an integrated EtherCAT connection regulate these motors with outputs of 10 to 15 kW.

Comprehensive support

The conversion of a system to a new controller is not work "on the fly", especially when, as in this case, the dates for completion and commissioning allow little room for maneuver. This is where the all-in-one solution for control of the machine really comes into its own. The new Sysmac automation platform combines all the essential components under one roof. Fast real-time communication via EtherCAT, network monitoring for complex tasks or frequency inverters and servo systems — everything runs under a common interface, facilitating development, programming, and commissioning of the systems.

Omron offers customers extensive support for introducing new systems within a limited time frame. Jürgen Martin, Head of Electrical Design at Mall + Herlan, says that "to integrate the new control system quickly into the production system we took advantage of the support of the manufacturer for incorporation into the system. In parallel with 'learning by doing', experts seconded to us from Omron programmed essential modules for the system. This two-track approach meant that the normal time frame for conversion to the new system controller was drastically reduced." As Sysmac Studio IEC61131 is compliant



Image 3: Pressing module with Mäander intermediate buffer



Image 4: The print module applies the individual multicolor print design



Image 5: Multiple Sysmac NJ machine controllers work together in the system, ensuring optimal interaction of all components

and all motion functions are programmed in accordance with PLCopen, a transfer of existing know-how to the new platform is simple to implement. The user can draw on existing experience, work under a known programming interface, and also import existing structured texts or motion functionalities into the Sysmac controller programs—saving time and money.

Initial field tests on the individual system modules of the tube production system revealed that the new control solution was performing well and the individual components interacting successfully with one another. "The delivery service was excellent, especially in respect of the assembly of individual components and all subsequently identified component

additions and amendments. All of the required parts were always in stock and very quickly on site. There were no delays caused by waiting for components," added Martin. The high-performance computing in conjunction with the fast EtherCAT bus and the "distributed clock" slaves allows optimal alignment of even time-critical processes over the entire system topography.

The new Sysmac automation platform brings together for the first time all workflows—from programming through to virtual test runs and security functions—under a common software umbrella. High-performance computing and a fast bus connection to the slaves predestine the system for use in complex and time-critical applications. Extensive vendor support, not limited to just the induction phase, drastically reduces the usual "time to market" when moving to a new or more modern control system. Together with the fast delivery service for all components, the user saves valuable time in terms of development and commissioning.



Image 6a,b: Intuitive HMI control panels with 5" and 12" monitors provide clear, easy-to-understand information

Mall + Herlan

Mall + Herlan is the world leader in production systems for one-piece metal packaging such as cans, tubes, or bottles made from aluminum or steel, and is part of the Swiss company WIFAG-Polytype Holding AG. Mall Herlan MB GmbH, formerly Metzger & Becker GmbH, has been part of the Mall + Herlan group, which includes subsidiaries Mall + Herlan Schweiz AG and Mall + Herlan Italia SRL, since the end of last year.

Mall + Herlan also supplies highly-efficient turnkey lines for the production of this packaging. This "one-stop-shopping" concept affords customers of Mall + Herlan a great advantage. All of the machines needed for the production of aerosol cans, aluminum tubes, or aluminum bottles are provided by Mall + Herlan as a general contractor.

About Omron

Omron Industrial Automation is a leading manufacturer of high-tech products and solutions for industrial automation. The company is part of the Omron Corporation founded in 1933 in Kyoto, Japan, and employs more than 35,000 people worldwide. The wide product range includes control, drive and safety technology, image processing and sensor systems, as well as control and switching components. The aim is to provide mechanical engineers with demand-driven, integrated automation solutions from a single source. In addition, Omron offers its customers comprehensive application know-how, as well as region-wide on-site service. In Europe alone, Omron has 19 sales offices and operates its own production sites.