



## Flexible customisation work

Machine-specific control systems with options for additions and adjustments

**A price-optimised machine control system that fulfils the technical requirements of an application exactly and which is nevertheless open to future machine adaptations. Ergonomic operation and visualisation encompassing no less but also no more than operator needs and working conditions call for. In most cases, that cannot be achieved with a standard PLC!**

**Therefore, the choice of a suitable partner for the development of a machine-specific control system becomes a factor that crucially influences a machine manufacturer's competitive lead. With the modernisation of a strapping machine's control system, the packaging machine manufacturer Schwede Maschinenbau and the control system specialist Eckelmann AG have successfully completed their first joint project.**

### Schwede Maschinenbau

Situated in the German town of Goldkronach, Schwede Maschinenbau GmbH is a manufacturer of narrow-band strapping machines and innovative shipping room technology. Its end customers consist of printing shops and dispatch firms throughout the world that strap newspapers, magazines, cardboard boxes, shipping boxes, etc. with 5-12 wide plastic strips on their packing lines to secure them for transport. Schwede products are used worldwide and are placed in the highest quality ranges. Thus, in the USA, for example, nineteen out of the twenty largest newspaper publishing houses are equipped with SMB technology.



Fig.: The SMB ST1

For a model from the series of standard strapping machines that has been in use for many years now, in 2002 it became necessary to redesign the integrated control system. The electronic circuitry used up to then no longer fulfilled the demands on the response rate of the machine control, which had particularly grown along with rising demands on the cycle times of packing lines. The new control system to be developed was to be used both to equip the new machine generation SMB ST1 and also as a replacement for machines already in use.

### Customised development or control off the peg?

It goes without saying that the technical functions for operation of the strapping machine, e.g. closed-loop control and monitoring of electric magnets and single-phase motors of the transport belts, of the packing belt supply system and of the package height-dependent automatic strap tensioning system, and of the belt sealing system, could certainly be realised with a standard PLC. Initially, above all the strategically important price advantages for series production spoke in favour of a machine-specific development. On the one hand, the hardware costs contribute to the optimised price/performance ratio because these can be minimised by skilful component selection and an economical pc board design. On the other hand, however, low-cost adaptation of the control system including the cabling to the mechanical system and the machine structure is important because a considerable proportion of the production costs can be saved. However, not only the pure cost argument spoke in favour of a customised control system solution, but also the aspect of technology protection, i.e. the fact that it is more difficult to copy than a standard PLC.

Once the decision in favour of a machine-specific solution had been reached, in view of the increasingly tougher cost pressure in the face of international competition, support of the in-house standards of Schwede Maschinenbau GmbH played an important role in the quest for a development and production partner for the new SMB ST1 control system. To ensure compatibility with other products of the company, realisation using the CoDeSys programming tool was required. Schwede also preferred a solution that uses the CAN bus, warranting openness towards other components that have to be taken into account when integrating the strapping machine in an end customer's system periphery.

### Realisation of application-specific features

Thanks to numerous other projects, Eckelmann AG possesses experience with precisely the two required standards CoDeSys and CAN bus. As a control and automation technology system house with a great depth of performance, Eckelmann AG is capable of supporting the required control system development from the

concept, through the programming to hardware development, prototypes and series production.

Observing tight pricing specifications, it was now necessary to conceive a control system for the SMB ST1 that above all met the high demands on the cycle time and availability. Among other things, the following functions had to be realised:

- Continuously variable selection of transport belt speed (with automatic control of the strapping cycle)
- Continuously controlled automatic strapping tension system depending on parcel height
- Mechanical belt ejector, automatic belt ejection at the end of the belt and fully automatic belt threading

All options for different versions of the SMB ST1 strapping machine were combined in a compact arrangement on one pc board. This leads to higher volumes of one pc board version and to a lower production price despite higher component complexity.



Fig.: The pc board of the SMB ST1 control system

Depending on the retensioning force and the frame size, the machine now achieves an output of 50 strapping operations per minute with a cycle time of 2-3ms. An even higher processing speed would only be possible with a fundamental modification of the machine structure and higher precision of the mechanical elements. Availability is in excess of 99.96 %. This means that no more than three to four malfunctions are to be expected within the course of 10,000 strapping operations.



### Ergonomic operation

Just like the hardware and programming of the control system were fully adapted to the typical demands of the machine, operation of the SMB ST1 and its predecessor models were optimally adjusted to the working conditions on the end customer's premises. As frequently unskilled and changing personnel work on the packing lines, the development of an operator control that is as simple, clear and resistant to errors as possible was endeavoured. The operator control unit offers a convenient rotary button by means of which all functions and operating modes can be selected. By means of clearly arranged icons and LEDs, the chosen mode is recognisable at a glance. The current machine status is displayed in plain language on the LCD display, and diverse languages are pre-programmed or are programmable. Settings can be pre-programmed at the works, with access protection, and can also be selected by means of the rotary operating knob.



Fig.: The operator control unit of the SMB ST1

### Flexible adjustment to end customers' needs

Therefore, in comparison with a standard PLC, the advantages of the SMB ST1 developed in close cooperation between Schwede and Eckelmann lie in the conscientious application-specific choice of all hardware used, programming in the in-house CoDeSys standard and featuring a CAN bus, and also the resulting price optimisation of the overall solution.

Despite all its specific features, the SMB ST1 is distinguished by its great flexibility when it comes to adapting the machine to the user's individual ambient conditions. Thus, Schwede strapping machines are integrated into on-site packing or shipping lines and, when several machines are operated in parallel, are networked for visualisation and parameter definition purposes. The open communication interface based on the CANopen standard permits networking of the strapping machine with any conventional system PLC or with a control console via AnyBus modules.

But the developed control system solution also remains open for machine additions, although no-one is thinking of those at the moment, because the PLC can be expanded with field bus modules to suit requirements thanks to the fact that it is equipped with the CANopen interface. To do justice to increasingly new requirements in this respect, which will arise during the course of planned commissioning operations, Schwede and Eckelmann continue to discuss enhancements and additional equipment of the control system.