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High-end window profile machining through close co-operation between machine manufacturer and control system supplier

Designing state-of-the-art technology in a joint effort

→ The machining of window profiles leads to stringent requirements for machine and automation engineering if high flexibility, quality and cost-optimized production are called for. A mutual exchange of know-how between the machine manufacturer and the control supplier is vital for applications such as these. Optimum co-operation, as practiced between Schirmer and Beckhoff over many years, can lead to high-end solutions such as the profile machining systems from Schirmer, for which Beckhoff contributed more than just pure automation engineering.



High-performance cutting and processing center from Schirmer.



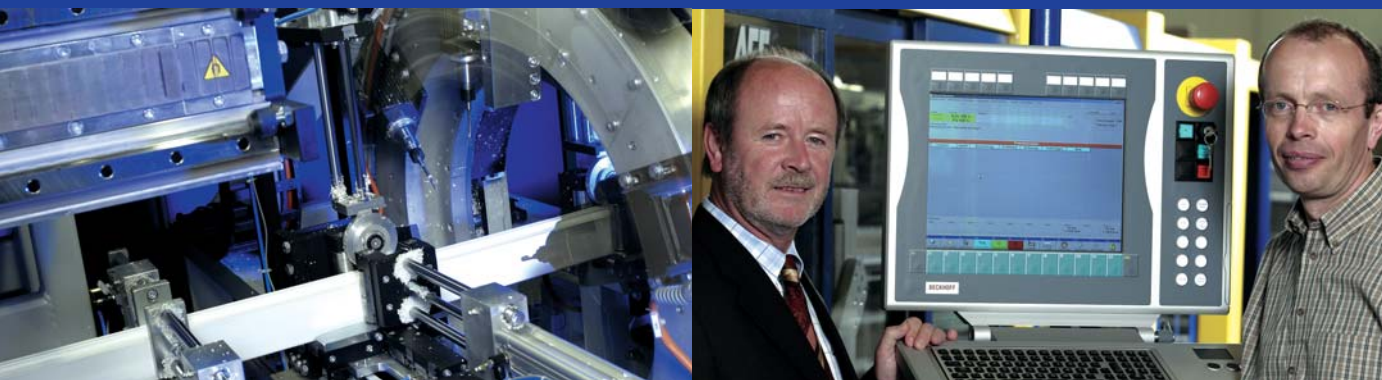
Complex tongs for conveying a wide range of profile types.



The whole system is controlled via a CP7012-1011 Control Panel from Beckhoff.

NC-controlled 4-axis module for freely programmable PVC machining.

Fritz J. Bentrup, managing director of Schirmer (left), and Beckhoff project manager Josef Frickenstein.



Schirmer Maschinen GmbH develops cutting and processing centers for bar-shaped aluminum, wood, plastic (PVC) and metal profiles, mainly for the window and door industry. BAZ 1000 is the name of a single-track machine series that, in contrast to the previously used twin-track version, offers adequate space for high-performance CNC technology with associated motors and positioning control systems. Fritz J. Bentrup, managing director of Schirmer, said: "We are a high-end machine manufacturer and our customers – mainly in Germany and Europe, but also increasingly elsewhere – have a high affinity for quality and flexibility – the higher the degree of automation, the better our prospects. Flexible positioning and innovative tool engineering enable different materials to be processed with the same tool. This can only be achieved with a powerful machine control system."

Close partnership inspires

For Fritz J. Bentrup it is important to have a competent control engineering partner such as Beckhoff, who is more than just a supplier of components. "World-

wide presence is an important factor, even though it does not often come into play," Bentrup said. "We will shortly be supplying our second system to Novosibirsk in Russia, where Beckhoff has a branch office. Our customer there is very satisfied because our first system has now been running for a year without problems or any service requirements."

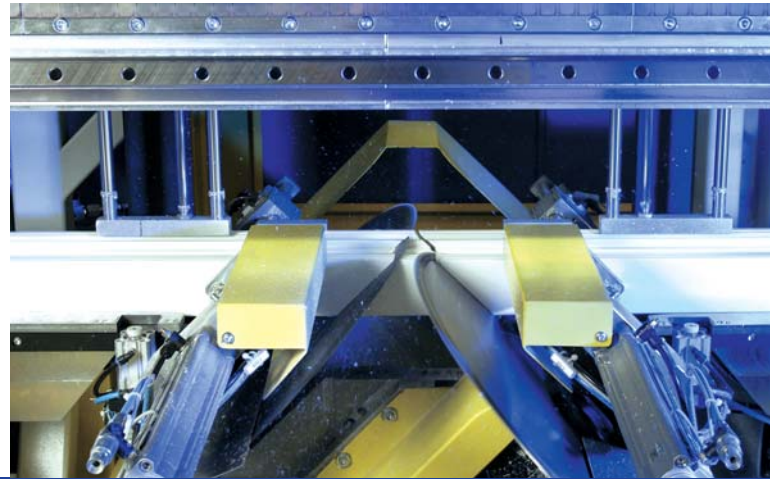
The partnership between Schirmer and Beckhoff already has a long tradition. The two companies started co-operating more than 20 years ago when they developed the first processing center for Schirmer. "Beckhoff is very familiar with our processes and the materials we process," said Bentrup. "We co-operate very closely and often meet customers together in order to discuss tasks and develop solutions." In this way, the automation of profile machining has reached very high complexity, combining the maximum number of value-adding processes in one machine.

Beckhoff project manager Josef Frickenstein said: "Not many companies can so precisely adapt their machines in such a modular way to user requirements as Schirmer. This is due to the powerful software-based PLC and Motion Control sys-

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One of 3 control cabinets with Beckhoff Bus Terminals, Servo Drives and C6140 PC Controller with 2.4 GHz Intel Pentium 4.



NC-controlled sawing unit for 45° and 135° cuts in a single duty cycle.

High dynamic linear drives for profile transport.

tem – but also due to the associated modular program blocks that can be used wherever they are required. These can be adapted to the respective machine layout with relatively little effort.”

“Another aspect is that during our long joint history, we have implemented a wide range of processes and archived them for reuse in other projects,” Bentrup added. “It is difficult to build such know-how from scratch. The close co-operation and direct contact with the specialists from Beckhoff and the modularity of our machines are important aspects of our success, as demonstrated by the fact that we have already implemented more than 40 systems during the current financial year.”

The co-operation between the two partners involves a wide range of Beckhoff products and services, starting with the TwinCAT NC I software for controlling up to 14 servo axes, which include:

- | Six transport axes with linear motors and AX2010 Servo Drives;
- | a 4-axis NC processing module for PVC machining;
- | an auxiliary axis (rotary linear motor) with AX2010 Servo Drive;
- | three machining axes with servo drives and servo motors from Beckhoff;
- | two saw axes for profile-dependent setting of the cutting speed and the profile height, and
- | a 2-axis NC processing module for steel machining.

Further components include a C6140 control cabinet PC, a Control Panel, a Bus Coupler with Lightbus interface, and various Bus Terminals. This application with approx. 850 I/O points also involved all projecting tasks, control cabinet construction, machine installation and modular programming of the individual machine components. These aspects generally apply to any application.



Buffer for cycle-independent conveying of workpieces.



Complex counter profile guide for a wide range of profile types.

Complex and modular machine operation

In principle, profile machining is a simple procedure that is easy to automate: A hollow PVC profile has to be cut with a miter saw, both sides have to be joined, and the ends have to be heated and stuck together. However, over the years more and more functionalities have been integrated into the machines, making them increasingly complex. "For example, holes and cuts for handles and striker plates, plus positioning and dowel holes have to be provided in window frames and casements," Bentrup explained. "We realized this using a swivelling twin miter saw and fully automatic length positioning, which we developed in collaboration with Beckhoff. Further components include a profile magazine and gripper for transporting the parts between the individual machine sections."

Schirmer pioneered a way of thinking that was completely opposite to the classic production process. Conventionally, the first process step is formatting (sawing) of raw material, followed by value-adding steps that are automated as far as possible. However, taking the cut workpiece to the next station and repeatedly picking it up and setting it down takes a lot of time and energy so Schirmer reversed the production process: "A dataset describes how and in what order the extruded bar is to be divided. This enables us to deal with all cutting steps first, which means we only have to grip the part once. After the machining process, the bar is cut according to the datasets."

In conjunction with increasingly specialized user requirements, this led to ever larger and more complex systems and ultimately to the idea to create different, reusable modules. Examples include a magazine, a transport module, a module for CNC-controlled machining on all sides or a cutting module. In this way, up to 30 stations can be linked in series and supplied with material handling systems so that in some cases a machine may hold up to 200 workpieces at any one time (including the intermediate buffer). According to Bentrup, parts tracking is ex-

tremely important. Beckhoff automation engineering enables Schirmer to control this aspect perfectly. Another special feature in this context is process optimization: "For us, it is not only important to be able to process the production data sequentially, the system also enables us to post-optimize. Since a machine cannot be designed for maximum throughput at all stations because some machining stations simply require more time, we distribute the processes that cause bottlenecks, without impairing cut optimization."

Development continues

"We are continuously working to safeguard the future of the automation concept," Josef Frickenstein from Beckhoff said. "We use our own drives, which are currently connected via Lightbus. Over the next few months we intend to convert the system to EtherCAT in order to achieve a reduction in connection costs and shorter cycle times."

Bentrup also sees benefits: "It is always better to have more automation power available since it enables us to develop our machines accordingly. The symbiosis between control system and mechanical components is a very important aspect. After all, co-operation based on partnership and continual consultation with Beckhoff has enabled us to realize even the most complex systems in any form required. EtherCAT offers large potential for innovation, since data transfer speed is important for simultaneous operation of many separate stations, – and with completely different materials that have to be processed according to different standards and in a certain order and dependency. Examples are welding, formatting and buffering of steel profiles, followed by fully automatic insertion into a section within a buffer."

→ Schirmer Maschinen GmbH www.schirmer-maschinen.com