



The company Thorwesten from the Westphalian Beckum produces innovative profile processing centers for manufacturing windows and house doors. A flexible system supplier was searched for which can meet all the demands of a new machine generation. The system solution made up of IPC, soft PLC, soft CNC and remote I/Os should come from one factory and be configured using a single software program. The complex task definition demands a competent partner, which was found in B&R.

automation spoke with owner and general manager Ralf Thorwesten about the project:

a **Mr. Thorwesten, what does it feel like to complete the development of a new machine generation?**

Thorwesten: Well, the machine still isn't completely ready to be delivered, but I am anticipating that the few things which remain to be completed, will be taken care of soon. But if you look at the overall development, everything has run extremely well. Of course in the beginning there were certain things which we couldn't get the controller to do, but its like that with all new developments.

a **What are the major requirements that you look for in a work relationship between automation companies and machine manufacturers?**

Thorwesten: First of all, everything must come from one company. Having too many contact people and systems is never good for development. It is definitely a big advantage when the entire control system comes out of one factory. When I mention the entire control system, I believe that encompasses the PC, servo drive with motors and the distributed I/O modules. In addition, we took two software packages from Automation Studio for soft PLC and soft CNC. This is a major advantage. I would never do that any other way.

So, we had everything coming from one factory. If it hadn't been that way, we definitely would have had a great deal of problems. You never know for sure if the problems are coming from the hardware,

the software or if it's because there are two software programs which are not working well together.

a **How is the creation of software handled; do you prefer solutions which have already been made or do you take part in the development?**

Thorwesten: Well, we do the CNC programming here of course. We also make the user interface here. Of course we got both software packages from B&R who also did all of the programming for the axes. When we used to have other suppliers, we had to do that all ourselves. We always use PC controllers because of all the advantages which a standard PC has to offer. Our machines are normally operated in a network by our customers. This means that data transfer, remote data transfer and error diagnostics is always part of the situation.

a **What was the actual reason for further development into the next generation?**

Thorwesten: The greatest advantage and the reason why we did all of this is due to the extremely good price/performance ratio of the CNC software. It wasn't necessary for us to handle interpolation or curves. The CNC controller allowed us to make significant improvements and to achieve time advantages of 30–50% when handling the profiles. Machines designed for normal window production have a time gain of about 50% and those designed for special production, such as door production for example, are a total of 30% faster. That significantly increases the machine's marketability.

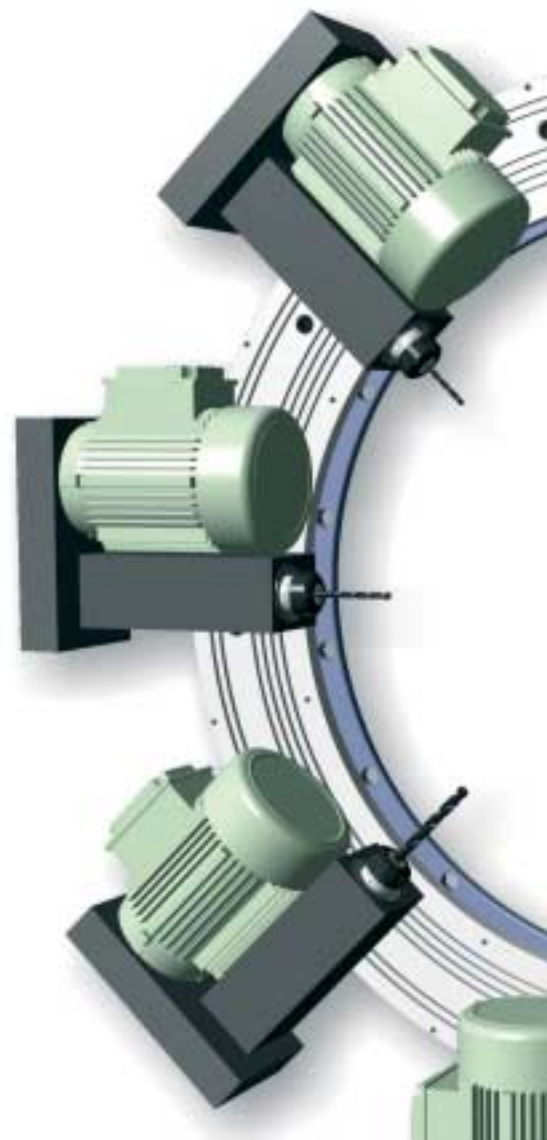
a **What are the specific demands in window production?**

Thorwesten: Here in Germany, all windows are different. In principal, each one is an individual part and is first measured, then manufactured. In England, on the other hand, there are only standard windows in a two inch frame.

They don't expect their bricklayers to work down to the exact centimeter. When

someone orders a window here at the window production, they say they're going to come down here and measure it. Like I was saying, the English do it differently. The window company delivers a frame which is as wide as the wall is thick. The bricklayers lay the brick around the frame and afterwards the window simply clicks into place. Therefore in Germany, not only does the window manufacturer have to be flexible, but those who make the machines which manufacture the windows must also be flexible. That's what our machines are made to do.

a **Thank you for the interview.**





View of the entire window profile processing system



The rotating ring mechanism with processing tools is the heart of the new machine generation



The operating and monitoring unit with Windows user interface is especially user-friendly

The Requirements

The rotating ring mechanism is a feature of the machine which all profile processing devices such as drills or cutters are attached to. The device needed for processing is selected by a positioning movement of the rotating ring mechanism. This can prevent time consuming tool changes. Before the actual operation, the profile to be worked on is automatically identified using a bar code. An optimized CNC program is generated from the resulting profile data (CAD drawing). The entire operating procedure can be tested in advance by the operator in a simulation mode. This reduces operating errors to a minimum and eliminates the need for further resources such as drilling templates. For drilling and shaping the very different profiles, the additional axes feed, XY table and rotating ring mechanism must proceed interpolated in addition to the rotating ring mechanism.

The Solution

Due to the complex task definition described earlier and high pricing pressure, the compact industrial PC Provit 5000 offered itself as integrated controller, visualization and CNC system. Windows 2000 is used as the operating system because of the profile data display from the CAD drawings and the required simulation mode. Behind the operating system, a real-time core with soft CNC takes care of the required deterministic timing. The real-time core communicates with Windows via a virtual TCP/IP connection. A fast and basic connection to a Visual Basic application is made using the ActiveX Controls provided. Communication to the four ACOPOS servo drives and the robust remote I/Os is made via two CAN bus lines. A remote 15" TFT touch display is used as display system in a massive IP65 aluminum housing. The large display provides a comfortable and simple operator interface for the machine. Of course all relevant operation tasks, alarms and the

manufacturing procedure are displayed. Highly dynamic servo drives run with a position controller cycle of 0.4 ms and are provided with integrated line filter and braking resistor. All drive and motor data such as position, torque, lag error, motor temperature, etc can be accessed via the CAN interface. The synchronous servo motors have a high resolution optical EnDat encoder system. In addition to the position data, all important motor characteristics are also stored in the encoder, so that the power transmission system is always optimally adjusted. Therefore, the servo or motor can be easily replaced when servicing without downloading a software program. When starting up the drive controller, movement tasks can be started by the user in the test and diagnostics window of Automation Studio. Data is written directly to the drive in real-time similar to a storage oscilloscope continually or event driven. The CNC data generated from the profile data is placed directly in the soft PLC. The soft PLC controls three remote nodes with a total of approximately 80 digital inputs and outputs via the second CAN line. The control program can be programmed in the standardized IEC 61131 program languages or directly in the high level language C. The multitasking controller operating system guarantees the execution of the various tasks in cycle times which can be freely defined. The standard Ethernet interface integrated on the industrial PC makes it possible to integrate the system into existing network structures and to connect machines to an automation network 