



→ In the making of textiles, fiber material is turned into yarn that is then woven into cloth. IRA Griffin Sons, Inc., Charlotte, North Carolina, makes sizing machines that combine fiber ends and apply chemicals to protect the fiber and yarn from stress damage during the weaving process. Since January 2003, IRA Griffin sizing machines have been supplied with PC-based control technology from Beckhoff to reduce costs, increase reliability and simplify the control systems.



All wound up

Beckhoff automation products were selected for the job because of their complete offering and compliance with the IEC 61131-3 programming standard. The controller of the sizing machine is based on the Beckhoff TwinCAT control software and Bus Terminals with Profibus interface. IRA Griffin chose Profibus because of its high speed and the range of suppliers that offer Profibus Variable Frequency Drives (VFDs). The sizing machines may have up to 25 coordinated drives.

Barry Shelton, Director of Electrical Engineering for IRA Griffin with responsibility for the conversion process of the sizing machines to PC-based control, said: "After many years of outsourcing control systems, in 1988 the company began producing its own DOS PC-based systems. The DOS-based system was very flexible and easy to program but did not allow for coordinated motion control. The drives were provided with a speed command in rpm or a torque command in percent load via a network. The DOS-based system did not provide a consistent timed update to the drives."

The next major change came in 1995 when IRA Griffin switched to a PLC-based system that offered the ability for highly regulated consistent torque or speed up-

dates to the drives. Usually these updates were provided during the normal PLC scan which ranged from 20ms to 50ms. Additional interrupts could be used in the PLC program if faster updates with a 5ms cycle were required. The PLC provided better regulated motion control but lacked the flexibility of the DOS-based system, and IRA Griffin still used a PC on the sizing machine. "Up to that point, we'd been using a separate computer to run the drive control system where we had coordinated drives," Shelton said. "Some machines have three to four drives, while others have 20 to 25 drives. They run in coordinated fashion – speed and torque regulated, with load cell feedback. When we tried to do that in the DOS software program, rather than utilizing built-in functions in the drives, the result was a highly regulated scan time," he explained.

The aim: Reducing costs and minimizing training effort

IRA Griffin used a PLC system until January 2003, when the company culminated a two-year re-engineering program and started shipping machines with Beckhoff controls. The program was geared to achieve the following objectives:

- | Reduce component costs,
- | Increase control reliability,
- | Lessen the amount of time it took to train customers, and
- | Reduce overhead costs attributable to programming each machine.

Having prior PC experience, and realizing the PC on the machine was not being utilized to its fullest, Shelton came to the conclusion that he could do everything



Top and right: Different views of sizing machines with Beckhoff control systems.

using one PC and reduce the number of controllers and networks used. "Early on, we determined the best way to accomplish our goals was to implement a PC-based control system. It integrates the controls, HMI and PC, plus the use of Profibus eliminates two of the three networks," Shelton said about the new, compact system. "We had three separate networks: a proprietary I/O network, a drive control network and an Ethernet network from the controller to the HMI. So we had a rack full of expensive components, plus high priced network cards." Shelton noted that almost all drive manufacturers have a Profibus option. "This dictated that we use a Profibus network, which meant we had to have I/Os and drives that talked Profibus," he said. "We've removed the complexity both for us and the customer. So now we've eliminated the PLC and special Ethernet cards that go in the PLC rack, and the special I/O cards that go in the I/O rack."

The solution: PC-based control

After settling on requirements for the new control system, a search ensued for a supplier. Shelton's sights were set on finding a single source manufacturer whose emphasis was on PC-based control and supplied as much of the components and software as possible. "We didn't want to have to buy the software from one company, I/O for the PC from another company and so forth," Shelton stated. "The more that one manufacturer could supply, the most likely it would be integrated and easier to implement."

Another factor was that full compliance with IEC 61131-3 was very important for IRA Griffin. IEC 61131-3 allows IRA Griffin to program with the preferred higher

level Structure Text language but also provides the flexibility to show the same programming in PLC Ladder Logic if required – however, the main goal was to reduce the complexity of the system so that the customer does not have to worry about programming. Other companies offering a total package either had acquired the makers of the components or purchased the components. "I've seen problems when there's too many people and departments inside an organization involved. Things don't always work as seamless as you expect them to," Shelton said.

He found that Beckhoff offered exactly what IRA Griffin wanted. In terms of cost optimization, Shelton's requirements were also met. The purchasing of components is directly handled with Beckhoff which resulted in IRA Griffin getting the best technology at the best price. IRA Griffin performed the entire code translation by themselves thanks in no small part to the Beckhoff compliance with the IEC 61131-3 standard. IRA Griffin was very familiar with the IEC 61131-3 Structured Text programming, which made for easier transition to the latest technology.