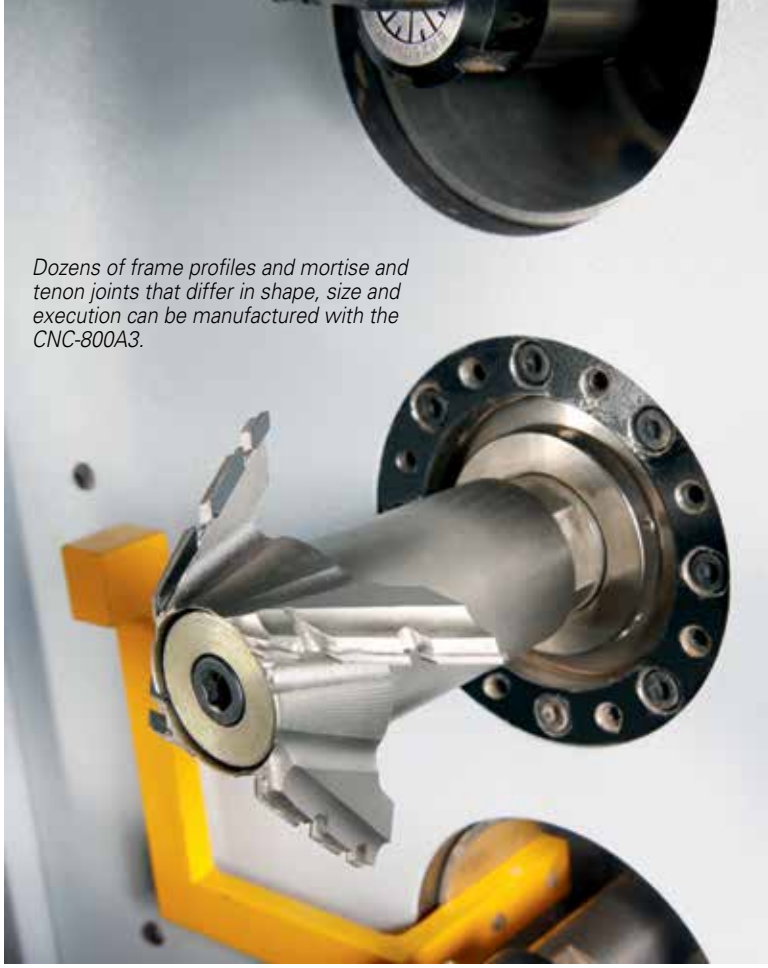


Dozens of frame profiles and mortise and tenon joints that differ in shape, size and execution can be manufactured with the CNC-800A3.

Automated Manufacturing of Mortise and Tenon Joints

Information provided by Beckhoff

Control platform solution in the automatic manufacturing of mortise and tenon joints.

The mortise and tenon joint represents a stable wood joining technique and forms the core of classic furniture manufacturing and a legacy of centuries-old Chinese craftsmanship. Although it is both extremely stable and aesthetically pleasing, this type of joint is complex to manufacture and cannot compete in terms of price with industrially manufactured furniture. Based in the city of Nantong, China, Nantong Guoquan Woodworking Machinery Manufacturing has found a solution in Beckhoff CNC: the PC- and EtherCAT-based control platform controls the automatic manufacturing of mortise and tenon joints and provides a bright future for the traditional wood joining technique.

Mortise and tenon joints can be used to manufacture stable framework constructions that serve as the basic 'skeleton' in traditional joinery, for example in the manufacture of solid-wood furniture, windows or doors. A mortise is milled in the frame piece, and the mating part is given a tenon, which fits precisely inside the mortise. The result is an extremely stable wood joint that is capable of bearing heavy loads and ideally accommodates the properties of the wood, for example, shrinkage in dry conditions. In modern mass-production of furniture, this craftsman's technique has for the most part been displaced by board construction methods and machine-manufactured connections such as dowels, screws or adhesives. However, more customers today value the durability and aesthetics of solid-wood furniture made using more traditional methods.

In order to serve this market niche, Nantong Guoquan Woodworking Machinery Manufacturing has developed the CNC-800A3 machines, fully-optimised for the automated manufacturing of mortise and tenon joints. The basis for the control platform is the TwinCAT NC I software. The geometries of the mortise and tenon joint to be processed are programmed via G-code, which is automatically generated by the CAD/CAM software. This makes the operation much simpler and more flexible. Dozens of frame profiles and mortise and tenon joints that differ in shape size and execution can be produced quickly and with high precision.

The frame pieces are fixed on the machine and machined through three-dimensional interpolation of the X and Y axes and the Z-motion of the machining spindle. The machining accuracy is within 0,1 mm. Li Jiawang, electrical engineer at Nantong Guoquan Woodworking Machinery, says: "We chose the TwinCAT NC I software from Beckhoff because it can execute various programs for non-standard tenons, which has greatly simplified our development. We can react quickly to individual customer needs. Such flexibility was impossible with our previous PLC."

> *'The software-based CNC controller from Beckhoff has taken us to the pole position in the woodworking industry'.*

Embedded PC as a compact and powerful control platform

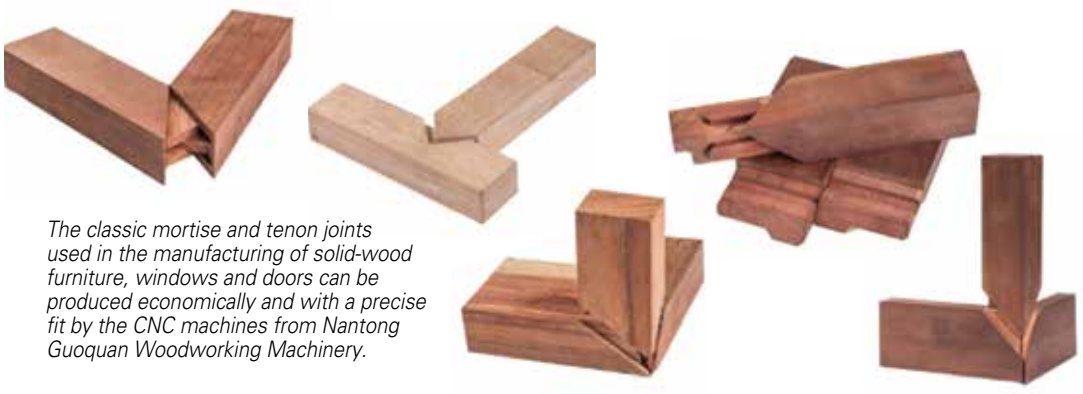
The CX5120 controller with TwinCAT NC I can not only execute interpolation movements, it can also control the positioning drives for the feeding or discharging of the materials. Apart from the execution of PLC and motion control, the performance of the 1,46 GHz IntelR Atom processor also enables the operation of the visualisation (HMI) and CAD/CAM software on one device. In addition, customer-specific applications such as viewing programs run on the same platform.

Optimised vertical communication

"Many Chinese furniture manufacturers see the advantages of the central management of production data. For example, CAD files can be downloaded directly from a central company platforms to the machine," Li Jiawang stresses and adds: "In view of the various interface standards of the MES or ERP systems and different requirements for

CAD	– Computer Aided Design
CAM	– Computer Aided Manufacturing
CNC	– Computer Numerical Control
ERP	– Enterprise Resource Planning
HMI	– Human Machine Interface
MES	– Manufacturing Execution Systems
PC	– Personal Computer
PLC	– Programmable Logic Controller

Abbreviations/Acronyms



The classic mortise and tenon joints used in the manufacturing of solid-wood furniture, windows and doors can be produced economically and with a precise fit by the CNC machines from Nantong Guoquan Woodworking Machinery.

View inside the control cabinet of the CNC-800A3 with the CX5120 Embedded PC as the central control platform.

data acquisition from individual companies, we have developed a database on the basis of Visual Basic .NET, in which all necessary machine states and production data are saved. Through the standardised connection of the customers' MES/ERP platforms to these databases, customers have the option to transfer any data across company hierarchies from and to the machine by means of simple reading or writing access. A further advantage of the PC-based machine control platform is the possibility of remote maintenance. With remote diagnostics and maintenance, service technicians no longer have to visit the customer on-site, which saves valuable time and labour costs."

Conclusion

Chen Guoquan, chairman of the board of directors at Nantong Guoquan Woodworking Machinery Manufacturing Co., Ltd. explains: "The software-based CNC controller from Beckhoff has taken us to the pole position in the woodworking industry. We are continually developing new machine models and are convinced that we will experience strong growth in the sales of CNC machines with Beckhoff platforms in 2016."

Enquiries: Beckhoff Automation.
Email kennethm@beckhoff.com