



Embedded PC controls double bending machine

Maximum precision and speed in production of profiles

Complex nine-axis CNC machines can be automated in the best possible manner with the compact Embedded PCs of the CX series from Beckhoff. This fact is proven by the bending machines made by the Swiss company Thalmann AG, which have been equipped with Beckhoff control technology since 2010. The open PC- and EtherCAT-based control platform provides greater flexibility when implementing customer enhancements, which also results in improved accuracy and increased production speed.



TD-150 double bender: Thalmann's control-shaft technology ensures highly accurate bending results. The double bender achieves accuracies of up to $\pm 0.5^\circ$ ($\pm 1^\circ$ with basic models) at a maximum bending angle of up to 143° and, thanks to high-performance hydraulics, amazingly needs just three seconds for the combined outward- and return stroke.

Based in Frauenfeld, Switzerland, Thalmann Maschinenbau AG specializes in sheet metal bending. Introduced to the market in 1960, the first hand-operated machines were followed by hydraulically driven and combined machines for cutting and bending sheet metal. Today, the company offers a comprehensive range of standard and special machines for forming sheet metal up to 18.2 m long and with a bending capacity for sheet steel up to 3 mm in thickness (400 N/mm²).

Among its clientele, Thalmann serves small craft businesses as well as large industrial operations. "For example, an industrial sheet-metal processor uses our double bending machine to produce generator cladding panels, and sound-insulation panels for ICE train routes. But a small sheet-metal-working company buys the same machine, because they make custom facade panels and need the functionality of the double bender," explains Marco Cappello, Global Sales, Thalmann Maschinenbau.

Higher complexity than meets the eye: the double bending process for sheet-metal forming

The swing-folding process is used to produce edge bends on flat sheet metal and to produce profiles. It is a gentle processing technique in which the bending beam rolls upwards about its pivot point and on the material, without damaging the surface of the sheet. A bending machine usually consists of a bottom beam on which the sheet lies, a top beam that clamps the sheet on the bending edge against the lower beam, and a bending beam that is moved upwards and ultimately bends the sheet metal to the required angle.

Thalmann's type TC and TD double benders are equipped with two bending beams; the sheets can be bent upwards and downwards without needing to be turned or swiveled during the bending process. This speeds up the bending process and increases the machine's throughput considerably. A total of nine axes must be controlled in the double bender.

CX Embedded PC implements complex CNC functions

The automation of the Thalmann machines was managed by Regatron AG from Rorschach, Switzerland, with whom Thalmann has worked successfully for 25 years. "The first control systems that we built, which are still in operation, were based on a hardware PLC," reports Felix Lanter, Head of Development - Control and Drive Technology, Regatron AG. However, Regatron employed the first PC-based control systems with MS DOS computers as early as 1991, and the first Industrial PC (IPC) with Windows and Ethernet followed in 2003. "We moved over to the Beckhoff technology in 2010," says Felix Lanter. "The increased

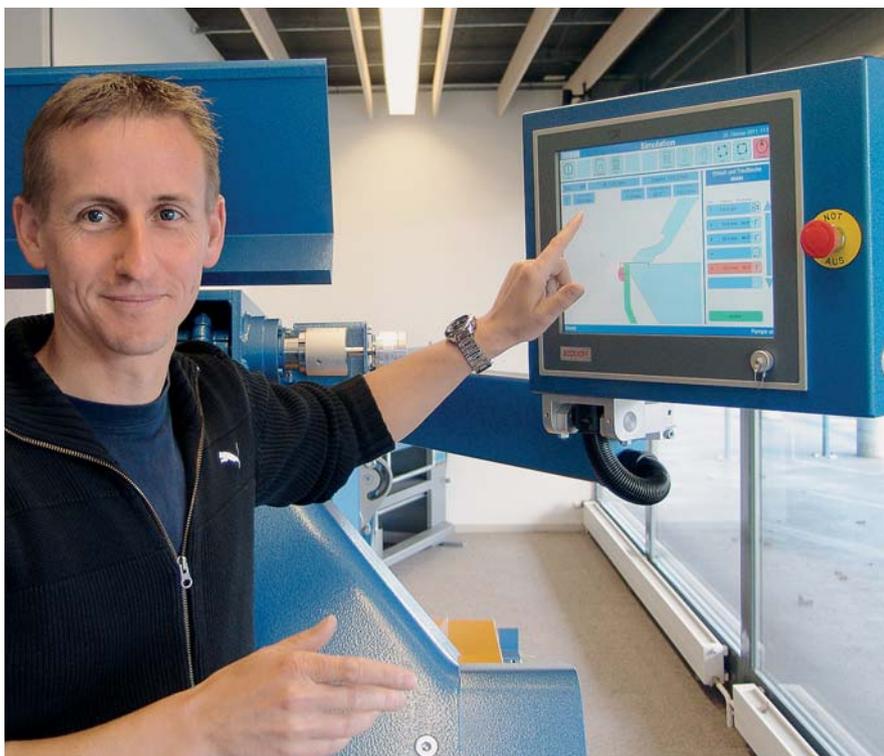
complexity of modern machines necessitated a generational change in the control system. Our choice to utilize the Beckhoff solution was based on the fact, among others, that Beckhoff could offer a hydraulic-software library. When you have to drive three servomotor axes and then up to six additional hydraulic axes, that is a big advantage."

Patrick Ruf, software programmer at Regatron, cites further arguments for the Beckhoff technology. "The CX1020 Embedded PCs make it possible to build an affordable, scalable, and technically high-quality control system. Suitable Servo Drives and analog Bus Terminals are available to drive the axes. In addition, we can be very flexible with regard to the building of the control solution and can choose from a large variety of signals. The control solution is also extendable when customer-specific requirements must be implemented, for example. The software also offers the corresponding flexibility; we use the Beckhoff automation software TwinCAT NC PTP. We can continue to use our existing Windows-based user interface without any problems. We were able to adapt it to the control system without any big changes by using TwinCAT ADS."

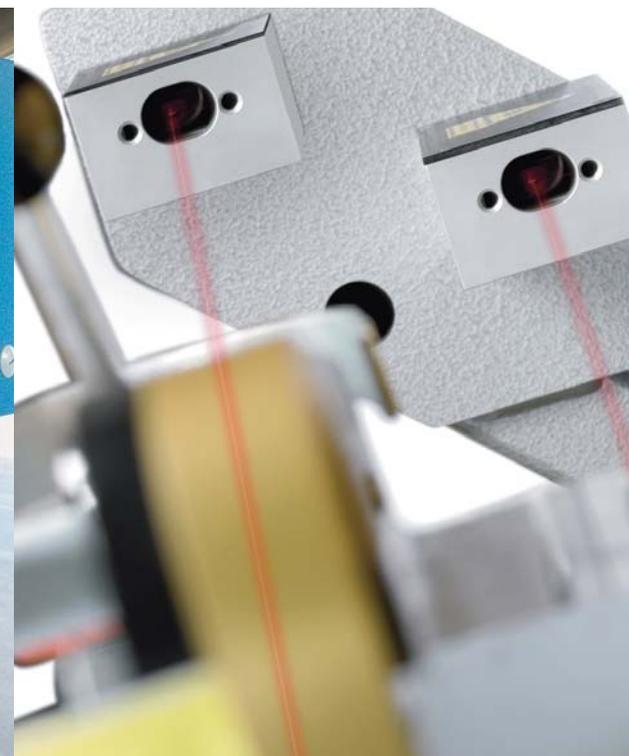
Integrated safety technology

"Of course, an important aspect of the control solution for bending machines is operator safety," says Stefan Kern. In order to meet the requirements of the machinery safety standard, Thalmann uses the Beckhoff EL6900 Safety PLC terminal, which is seamlessly integrated into the EtherCAT Terminal system. This TwinSAFE solution is certified for applications up to SIL 3 according to IEC 61508 and DIN EN ISO 13849 PLc. Safety functions such as emergency stop, safety

Patrick Ruf, Software Programmer from Regatron,
at the operating panel of the Thako bending machine



On all Thalmann machines, a laser barrier system ensures
maximum safety in the working area.



door monitoring, two-hand control, etc. are simple to select and combine. They are conveniently configured in the standard TwinCAT System Manager and run on the same PC platform as the machine program. The safety functions can be linked to the machine program, but are independent of it.

Scaling with a sense of proportion

For machine manufacturer Thalmann, the focus is always on the customer. There is therefore no traditional standard machine, but mainly custom machines that take the customer's requirements into account and vary with regard to size, length, functionality, etc. "The range of customer requirements make it necessary for us to use suitably adaptable components, systems and control systems," explains Marco Cappello. Chief designer Stefan Kern also shares this view. "The complexity of the machine and the control system must be exactly matched to each other. At the moment we are working on a project where, because of costs, we have to dispense with certain features. This has resulted in our basic version with a smaller, more targeted range of functions."

This concept also has implications for the control solution, i.e. the range of requirements for the machine must be reflected in the programming. "On the other hand, we intend to maintain uniform design as much as possible," explains software specialist Patrick Ruf. "We have taken some care to design the structure of the control solution in such a way that we can easily expand the area of any individual function. We also try to make all machines compatible with one another, so that even the oldest machine can be supplied with an update."

EtherCAT Servo Drives: dynamics under control

The servomotor-driven axes of the bending machines are controlled by AX5000 EtherCAT drives from Beckhoff. For the servomotors, Thalmann uses the AM3000 series of pole-wound motors from Beckhoff. The hydraulic valves are controlled via EL4001 EtherCAT analog output terminals. The positions of axes are determined, and the angular positions are measured, using EL5001 digital absolute rotary encoder terminals.

Numerous monitoring functions are also incorporated in the machine programming, and these ensure trouble-free operation. In the case of the hydraulic oil, for example, its temperature is monitored, the flow rate is measured and the oil filters are checked. "A great advantage of the Beckhoff Bus Terminals is that we can use them to control almost everything," says Felix Lanter.

Remote maintenance and diagnostics, a new possibility

Thalmann AG sells its bending machines worldwide. In this context, the potential service options for PC-controlled machines are interesting. "While Thalmann practiced traditional service in the past, a web-based remote service, in particular for the double bending machines, could be an interesting alternative," notes Marco Cappello.

Further Information:

www.thalmann-ag.ch

www.beckhoff.ch

Interchangeable gripper fingers individually adapted to customer needs or to the bending programs: this shows a stop finger for a very small contact area on the sheet.

