



Wood machine manufacturer counts on software-based control software with TwinCAT

“Knocking on wood using the industrial PC”

The Hymmen company implemented the control of a chained up machine installation including conveyor equipment in an open PC architecture. Thus, the machine manufacturer can optimally combine a complex drive controller with his specific user interface along with the major software parts that are based on his know-how on a PC.

Software-based PLC and 7 axes controller

Real-time expansion for Windows NT enables the implementation of a real-time capable PLC and NC structure on a PC platform together with the operating system on one CPU.

With TwinCAT, Beckhoff has designed a software-based PLC and NC system. TwinCAT offers an open solution – from the small scale PLC up to the high performance solution with integrated PTP and CNC positioning and visualizing. Only by using software every compatible industrial PC converts into a real-time capable machine controller – without additional hardware.

In this way, the Hymmen company – a German manufacturer of wood processing machines, laminate presses and laminate equipment – is able to optimize machine functions and to increase the machine performance using the most up-to-date control technology.

A very flexible adaptation to special problems is possible since the machine control and axis coupling is only performed via software. This happened in one installation of the Hymmen company in Egger, Austria. Here, Hymmen started up a machine line with presses for the laminate processing in sheet or roll form. In Egger, differently operating machines are chained up with each other in the line.

In the installation, a single single-sheet feeder is combined with pallet magazines to feed laminates; it is then connected to a conveyor in order to feed the material to the following machine line. Alternatively, roll material can be used. The following machine elements perform: positioning of upper and lower laminates with the laminate body, edge processing, glue application, pressing by means of heat/pressure profile, cutting and palletizing in a continuous process without further manual intervention. In practice,

seven axes are used to control several overlapping movements at the same time.

The continuous operation mode present various advantages for the melamin processing: increase of the productivity, constant high quality due to the relatively low warmth burden and short staying time before and during the machine process, savings in the case of personnel, material, energy and maintenance.

Chained axis functions optimize the material flow

The PC based controller chains up machines with different processing speeds. In the first machine section, the laminate sheets are processed in intervals of approximately 20 cm but they should be processed in the rear press part with an interval of 2 cm. The task sounds very simple, comparable to a car ride: during a continuous movement, a driver – and also the following – must close



Several machines are chained up with each other in the wood processing installation of Hymmen. The various installation parts are controlled by the TwinCAT software that is based on Windows NT.

a gap by accelerating and braking until the distance is reduced. Every driver masters this procedure – this absolutely is not valid in case of standard CNCs. For a few parts, here a complex super position of continuous movement, acceleration and braking must take place in a series of moving parts.

In the case of Hymmen, this task was ideally implemented on an open PC structure as a special positioning solution:

- the open standard programming environment of the PC facilitates this,
- a PC can easily carry out complex calculations with his computational power
- in a central controller, the dependences of the axise movements can be processed very well in software.

Open Multi-PLC according to IEC1131-3

The PLC task is carried out in the open manufacturer-independent languages that are defined in IEC1131-3. The system permits multi-tasking in order to structure the different machine tasks. Furthermore, up to 4 PLC systems can be processed on a PC at the same time, e.g. in order to control different machines by one PC. In Egger, the

TwinCAT PLC processes the machine and positioning sequences and cooperates with an available PLC. Data exchange takes place via the Profibus and the drive functions via the fast Beckhoff Lightbus. The Beckhoff Bus Terminal system is used as flexible field bus-independent I/O hardware.

Programming is performed using an efficient development environment according to IEC1131-3. The major advantage of these systems is the creation of program modules (program organization units POUs) that have their own local data during the execution and at every call (instance): thus, every call of the modules can be analyzed during machine maintenance without any side effects. The increasing PLC memory demands of modern applications can be easily satisfied by the used PC. Not only textual but also graphic languages are offered that considerably facilitate the maintainability of programs:

- Instruction list (IL)
- Function block diagram (FBD)
- Ladder diagram (LD)
- Sequential funtion chart (SFC)
- Structured text ST

The debugging offers the remote selection of the target systems from the number of connected TwinCAT systems; at any time, program mod-

ifications in data and code are possible (on-line changes) to an optional extent with the PLC in RUN mode; forcing of variables, display of the processing of programs (Powerflow), break points and tracing of variables make the debugging easy.

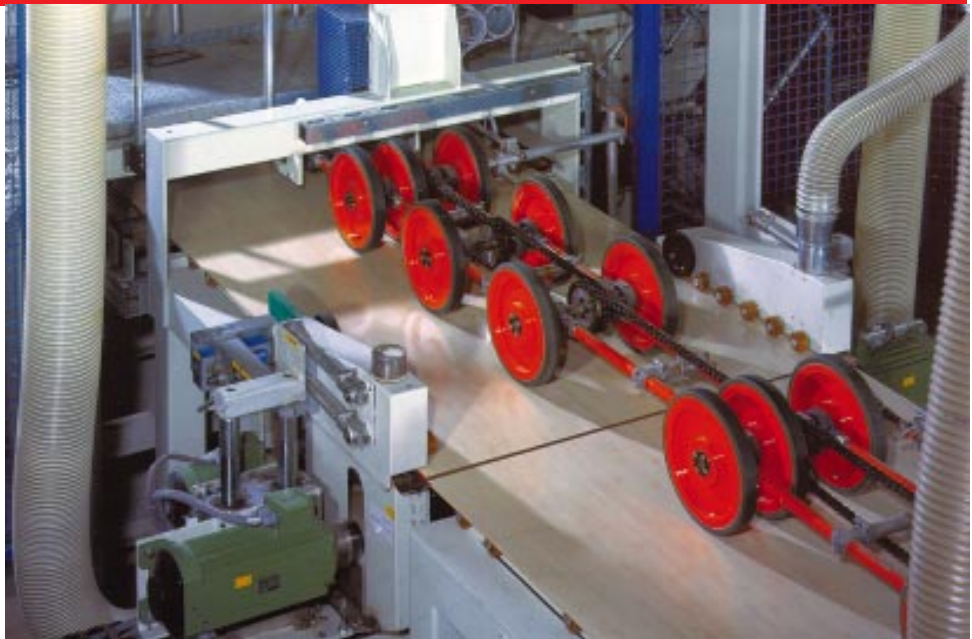
NC in new garment:

Multi-axes PTP on the PC

Also on the NC axis controller side, the software solution of the positioning control of the axes offers advantages if performed on the PC: Depending on the processing power, TwinCAT processes up to 256 axes in 256 groups on the CPU of the PC. The user can activate the desired number of axes: This way, the axis structures (motor, drive, encoder, positioning controller) can be easily changed on-line, for example to use different encoders: the assignment of the feedback loop and the drive only exists in software:

- optional assignment of feedback loops and drives,
- dynamic arrangement of linked or interpolated axes,
- optional coupling of PTP and continuous path axes, gear functions and cam controls.

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Currently, the positioning software supports point-to-point positioning or continuous path control with interpreters according to G-Code DIN 66025 for 3 axis interpolation. The configuration permits the utilization of:

- servo drives,
- frequency converter drives,
- stepping motors,
- two-level motors with pol-switching.

The position of the axes is monitored via off-the-shelf absolute or incremental encoder systems. Digital interfaces exist to drives of selected manufacturers. The positioning controller itself is configured as a P, PI, PID or On-Off controller. An optional Look ahead algorithm performs the pre-control, the positioning controller minimizes the lag distance. The form of the positioning travel is set via the speed, acceleration and jerk parameters. These parameters can be reassigned on-line for every movement. A series of optional functions supports the realization of projects:

- override functions for speed,
- electronic gearing with real variables as a factor and offset of the factor,
- compensation travel between linked axes,

- multi-dimensional master/slave axis coupling in 1 to N to M structure,
- dynamic coupling/decoupling of master/slave axes
- electronic pattern control with a high number of support points,
- electronic cam controller with a high number of cams.

The positioning controller is integrated into the PLC using a function block interface that allows the parameterizing and execution of movements and outputs status information (present position, lag distance): in this way, the positioning is integrated into the PLC.

Applications in the most diverse industries

TwinCAT is a software solution with a series of demanding applications. Based on an open Windows NT platform, the PC controller offers flexible programming, fast commissioning, and efficient axis functions where application programs present a man-machine interface to the user.

The linking of Windows characteristics and automation permits the realization of application-specific controllers with extremely efficient characteristics. This will facili-

tate a series of tasks: remote maintenance, video conference, remote programming – all of this is becoming more simple and more economical. The merger of the data-processing and automation technologies will change this field of work heavily – it will be more exciting again.