

SAB Plastmach: PC-based EtherCAT application for blow molding

# EtherCAT improves hydraulic Motion Control systems

SAB Plastmach Co. Ltd, Thailand, developed a new range of high-performance extrusion blow molding machines based on TwinCAT PLC and Motion Control from Beckhoff. Particularly the material handling system was improved thanks to EtherCAT.

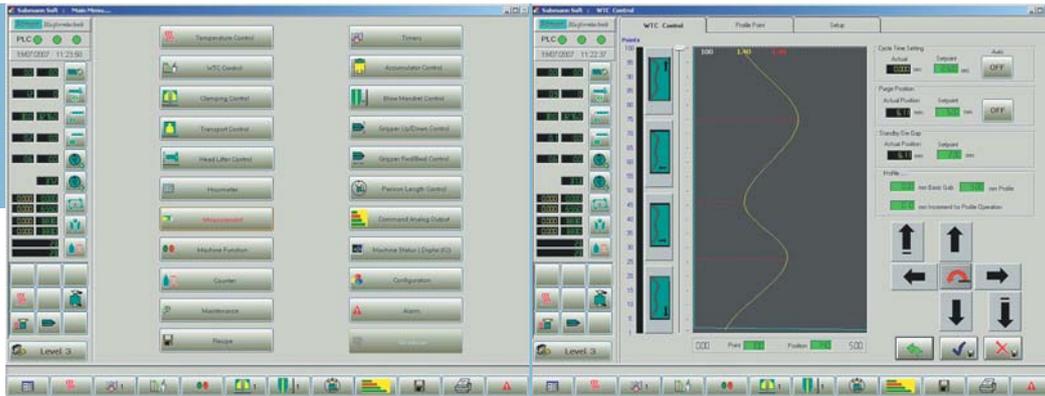
TwinCAT enabled SAB to replace all existing hardware components for sequential programming, hydraulic and temperature control with a single C6140 Industrial PC based on Pentium® 4.



SAB is a leading manufacturer and supplier of extrusion and injection blow molding machines for the plastics industry worldwide. Previously, the machines had a special control system: Three CPUs were used for sequence programming, motion and temperature control; a different fieldbus technology was used for the controller and the I/Os. The hydraulic control system was a black box that SAB was unable to adapt or develop further.

## EtherCAT for blow molding

Boonlue Rungsawang, leader of the electrical systems and control technology section at SAB, initially decided to use a central PLC controller and a single fieldbus for the whole machine. Initial trials with a standard PLC were unsatisfactory due to long cycle times and slow fieldbus communication. Particularly control of the hydraulic axis could not be realized with the required precision.



HMI interfaces of the SAB extrusion blow molding machine

Thus, SAB came to the conclusion that a PC-based system with fast, real-time Ethernet was the optimum solution. The technology offers adequate performance reserves and has the advantage that the complete control system know-how, including hydraulic control, can be mapped in a software PLC according to IEC standard.

TwinCAT handles HMI, sequence programming and Motion Control in a single system. Data exchange between the system components is quick and easy to implement. PC-based technology and fast EtherCAT I/Os shorten the sampling time of the digital controllers substantially.

#### Industrial PC as all-rounder

SAB replaced all existing hardware components for sequence programming, hydraulics and temperature with a single Pentium® 4 Industrial PC running TwinCAT NC and the TwinCAT PLC Hydraulic Positioning und TwinCAT PLC Temperature Control libraries. The control unit is a customized Beckhoff Control Panel with 15" TFT touch screen, PLC keys, membrane keyboard, and floppy drive.

The fully integrated software platform is based on the languages defined in the IEC 61131-3 standard. TwinCAT function blocks for hydraulic axes are used for controlling ten machine axes based on the standard. The Beckhoff system solution does away with black box programming, which means that SAB can modify or extend all program components in the common IEC-61131-3 languages.

Motion control for a hydraulically operated positioning axis is not a trivial task, because the controlled system is non-linear and must

meet specific process engineering requirements. For example, the system must enable highly dynamic movements of the transport axis weighing several tons and hold the axis in the target position with high precision. The computing power of an Industrial PC enables cycle times of 1 to 2 ms with simultaneous handling of ten or more axes as well as HMI, temperature control, and sequential control. Direct communication between the individual program components largely eliminates non-productive times caused by conventional control systems.

#### TwinCAT as the backbone

Replacing special control hardware with a software-based open control concept using EtherCAT reduces system costs considerably. The Industrial PC offers the system performance required for handling all control functions plus adequate reserves for future expansion.

With support from Beckhoff, SAB was able to handle all machine programming tasks in-house, thereby gaining comprehensive machine and process know-how. TwinCAT provides a constantly available programming and diagnostics environment for service engineers that can be used on site – or remotely via modem – directly at the machine.

In future SAB will develop modular machines and "zero engineering" tools for simple programming. TwinCAT is the backbone of this new concept that enables flexible responses to customer and market requirements.