



Complete solutions for blow molding applications ...

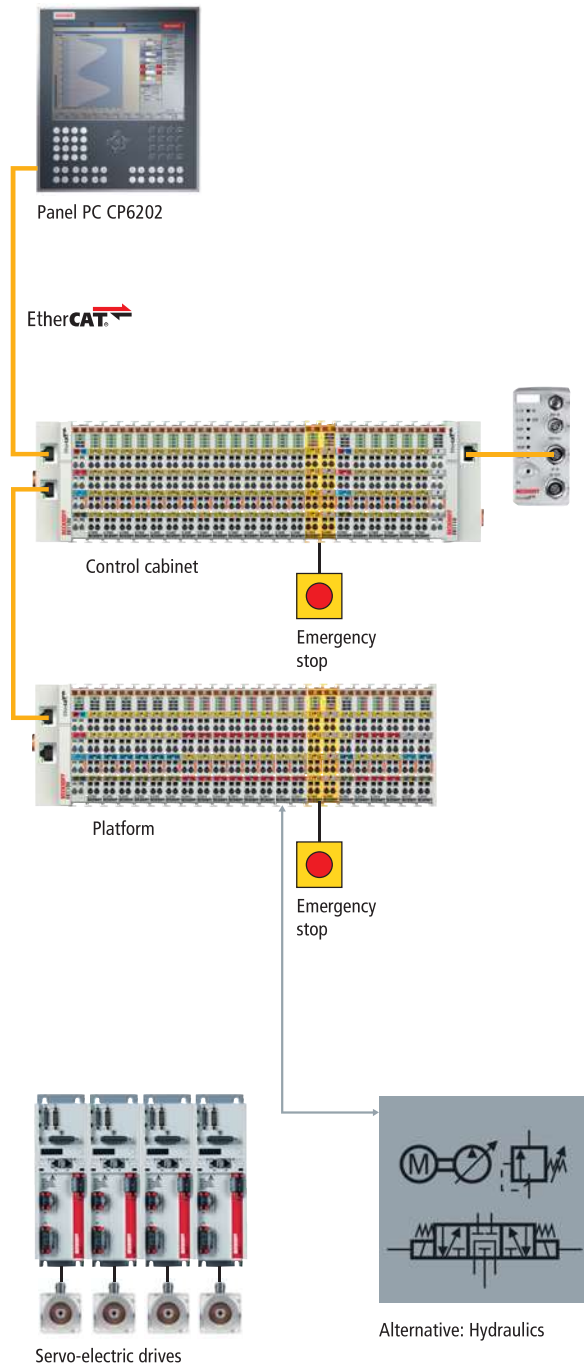
Beckhoff offers turnkey system solutions for the blow molding industry that integrate industry expertise acquired over many years. The full-scale platform is suitable for simple to complex applications. The compact solution also represents a cost-optimised alternative for controlling blow molding processes with reduced functionality. Fast and precise wall thickness control and fast control of the transport movement and clamping units are key factors for ensuring product quality in the blow molding process. EtherCAT, high-performance Industrial PCs and industry-specific Beckhoff software for blow molding applications strike the optimum balance between fast motion and exact positioning. Blow molding machines benefit particularly from the decentralised distribution of I/Os, which enable different machine components such as extruders, clamping units and blow heads to be equipped with individual I/O stations for communication via EtherCAT.



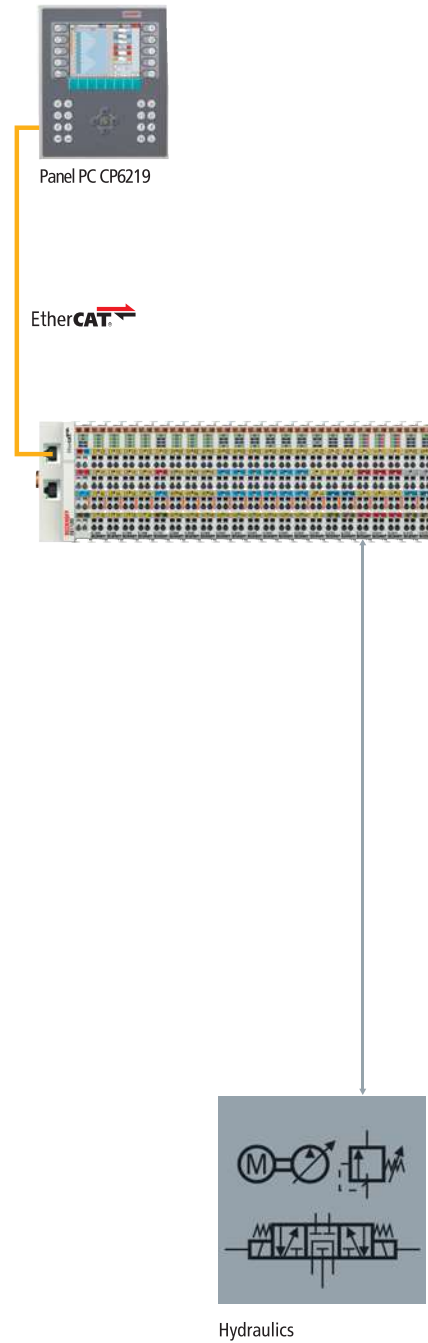
... simplify operation and optimise the production process.

The blow molding controller, designed by Beckhoff specifically for blow molding machines, has 40 manual keys. In addition, it features functions such as user administration with different access rights and language selection. With the user-friendly feature "undo" memory, the operator can easily cancel the last changes he/she made. The user interface was designed with particular emphasis on a clearly structured design, to ensure that the machine operator has a good overview of all key data and is able to quickly intervene in the running process, if necessary. Softkey functions support intuitive operation. The main operating screen of the blow molding controller is the wall thickness editor. Colour grading makes interpolation points and curved segments of the wall thickness curve easily identifiable.

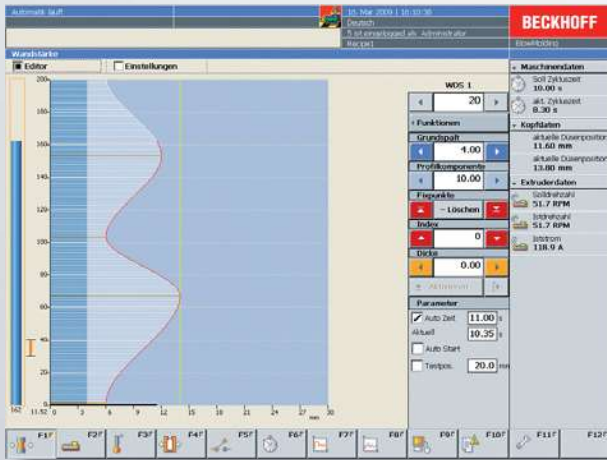
System overview full-scale solution



System overview compact solution

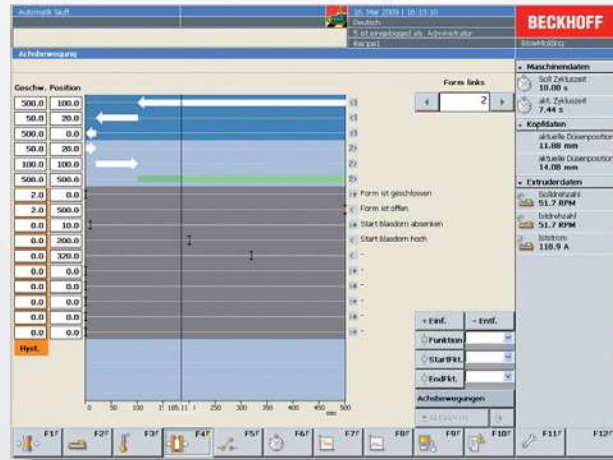


User interface of the full-scale solution for blow molding machines



Wall thickness control

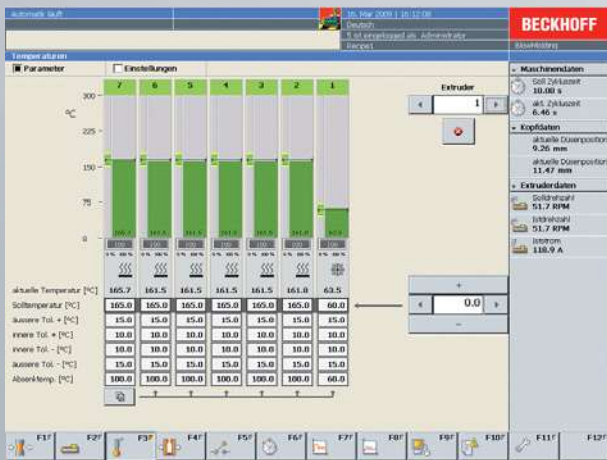
- wall thickness curve with up to 400 interpolation points
- display of the accumulator level
- display of the current parison length
- display of the current curve (in red)
- undo memory for up to 10 curves and up to 5 wall thickness markers



Clamping unit

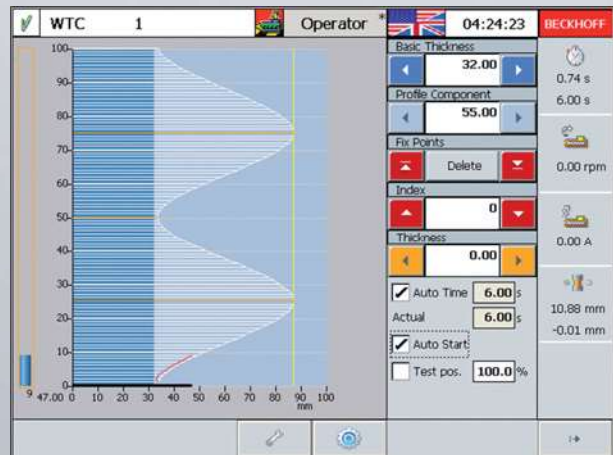
- up to 25 motion channels for clamping unit, carriage, blow pin, etc.
- up to 5 motion segments for each direction
- up to 10 switching cams with hysteresis and direction of movement for the control of auxiliary functions
- Specific start/stop functions can be called up at the start or end of the movement, axis labelling for motion and cams via XML file.

User interface of the compact solution for blow molding machines



Temperature controller

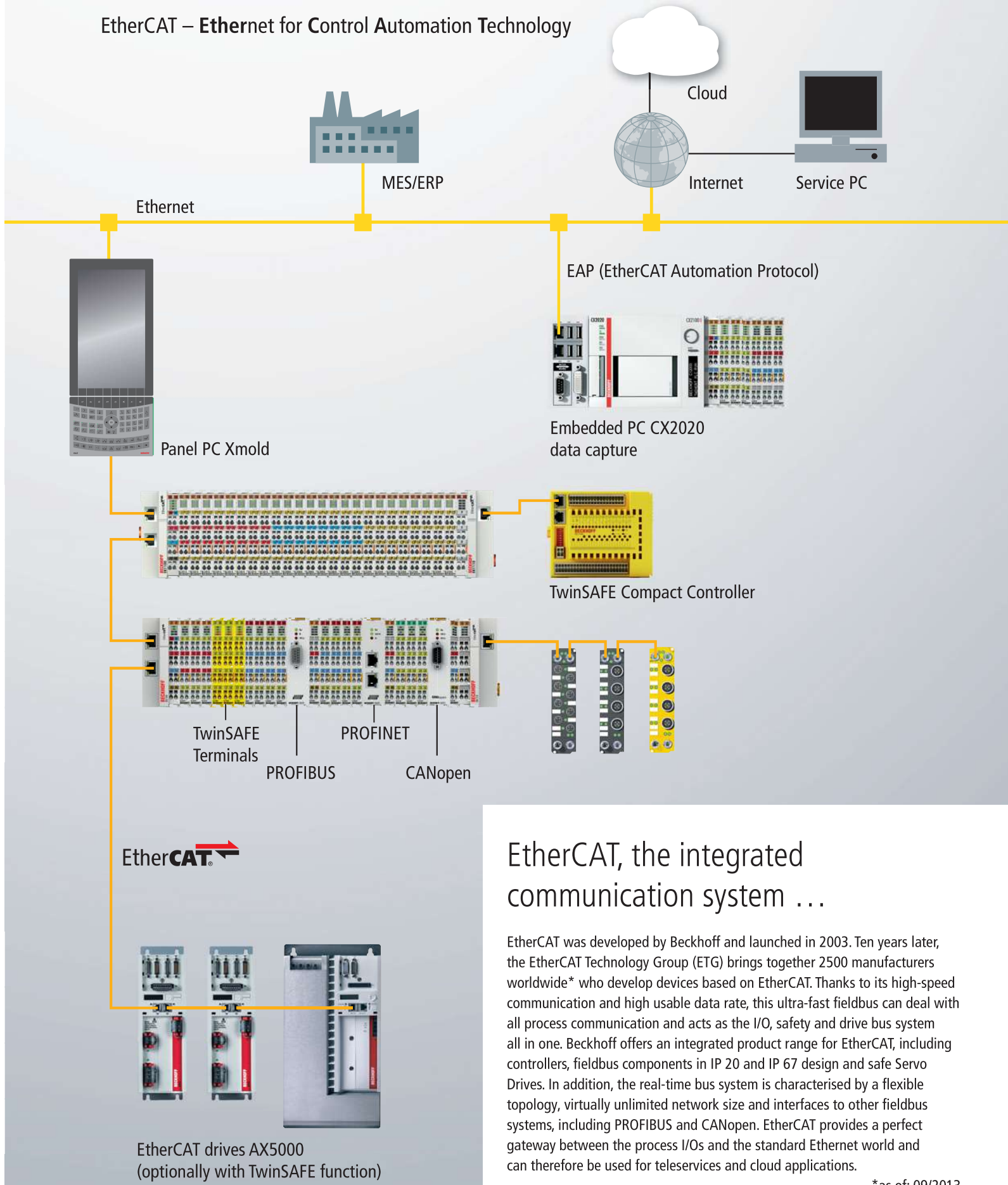
- bar chart display of set value/actual value and tolerances
- colour change
- display of heating/cooling
- two tolerance bands
- input of all set values with one button
- switching functions



Wall thickness control

- maximum 200 interpolation points
- continuous or discontinuous machines
- multiple heads are supported
- real-time display of the wall thickness curve


EtherCAT – Ethernet for Control Automation Technology



EtherCAT, the integrated communication system ...

EtherCAT was developed by Beckhoff and launched in 2003. Ten years later, the EtherCAT Technology Group (ETG) brings together 2500 manufacturers worldwide* who develop devices based on EtherCAT. Thanks to its high-speed communication and high usable data rate, this ultra-fast fieldbus can deal with all process communication and acts as the I/O, safety and drive bus system all in one. Beckhoff offers an integrated product range for EtherCAT, including controllers, fieldbus components in IP 20 and IP 67 design and safe Servo Drives. In addition, the real-time bus system is characterised by a flexible topology, virtually unlimited network size and interfaces to other fieldbus systems, including PROFIBUS and CANopen. EtherCAT provides a perfect gateway between the process I/Os and the standard Ethernet world and can therefore be used for teleservices and cloud applications.

*as of: 09/2013



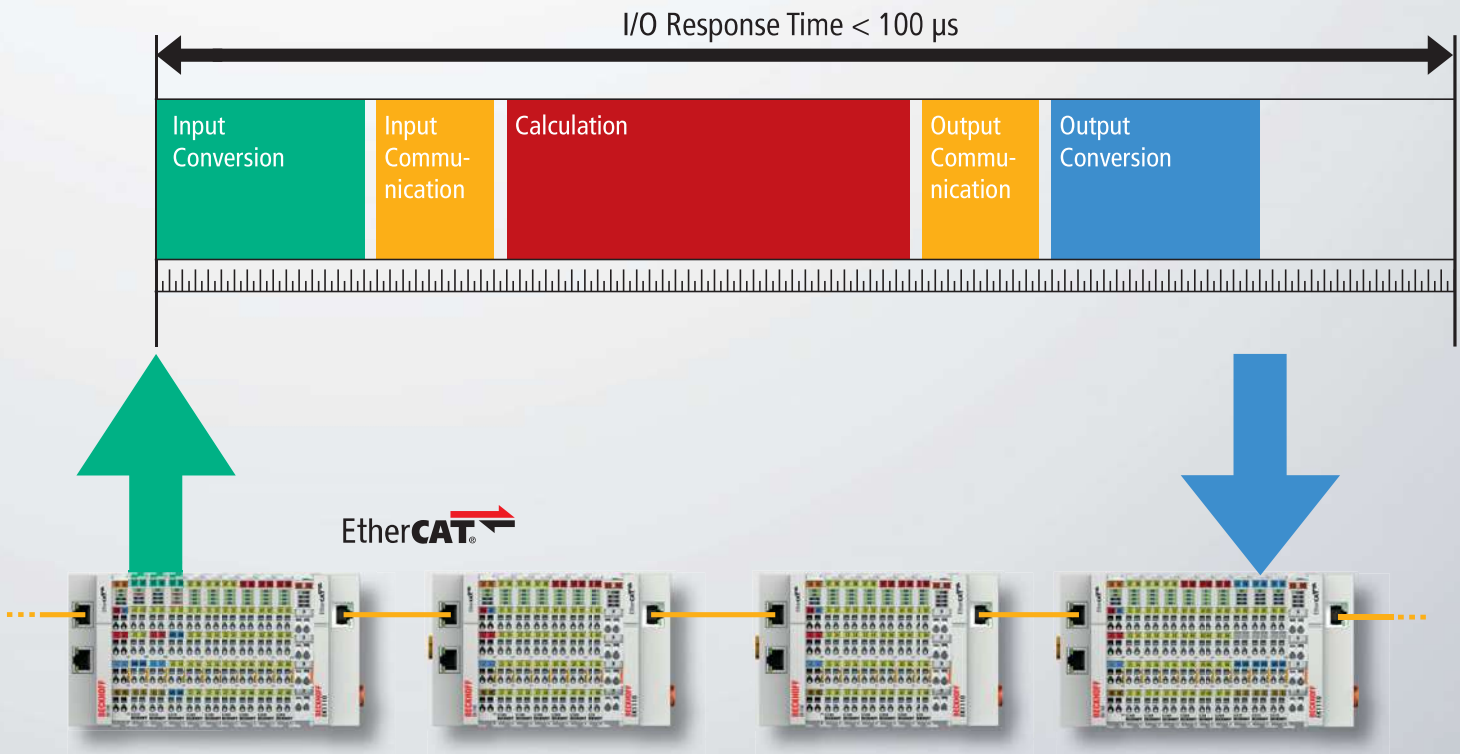
Safety integrated

Occupational health and safety plays an increasingly important role in machine design. With TwinSAFE, Beckhoff offers an advanced safety solution that is integrated into the primary control system. It is based on safety Bus Terminals and the TwinCAT Safety Editor and enables safe operation of axes and integration of machine safety devices without the need for additional wiring. In extrusion systems, for example, downstream equipment such as take-offs and saws can be connected with an EtherCAT fieldbus cable without separate emergency-stop cabling. Due to the modularity of the Beckhoff safety solution, system retrofits are quite straightforward, and subsequent modifications or extensions can be implemented with ease through software adaptations.



... enables perfect integration of plastic machines in the production environment.

Due to its excellent real-time characteristics and high bandwidth, EtherCAT is ideally suited for controlling the complex processes encountered in plastic machines and serves as a backbone for linking production equipment. The openness of EtherCAT in terms of connecting to other fieldbus interfaces facilitates integration of peripheral systems such as cooling devices, hot runner controllers or handling systems. The CANopen-based Euromap standard, which is used in the plastics industry worldwide, can be implemented simply via gateways. In this way EtherCAT enables exceptional integration of plastic machines into the production environment – be it towards the master computer or towards the peripheral equipment. Because EtherCAT is a worldwide standard today, machine manufacturers can choose from a wide range of drive solutions available on the market and are able to integrate components into their control architecture that are best suited for their respective applications. Compatibility with other EtherCAT-based devices is guaranteed.



Very precise and fast: eXtreme Fast Control ...

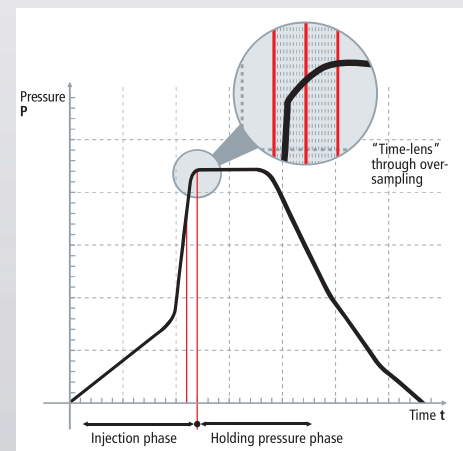
eXtreme Fast Control (XFC), the fast, high-precision control solution is based on: high-performance Industrial PCs; EtherCAT, the high-speed communication network; optimised I/O components (which can sample signals and trigger actions with high precision); and TwinCAT, the integrated software platform. This unified system enables I/O response times of less than $100 \mu\text{s}$, so that very fast and highly deterministic responses become possible. Accordingly, XFC opens up new opportunities for process optimisations. Oversampling technology enables exact determination of the signal characteristics. In combination with the time stamp function of EtherCAT, which links each event with a precise point in time, the reproducibility of procedures is significantly increased compared with conventional solutions. Drives can be perfectly synchronised based on the distributed clocks function of EtherCAT.



... reduces raw material consumption and increases parts quality.

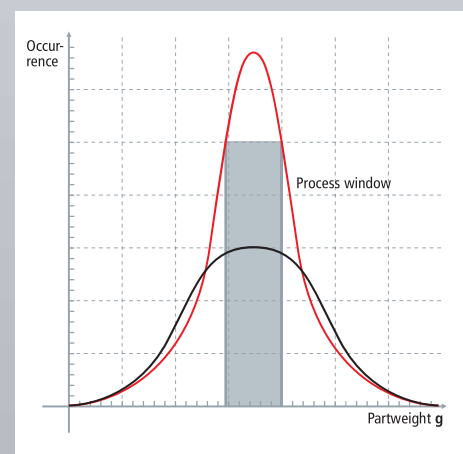
Logging of highly variable input signals with high temporal resolution enables precise control of the injection molding process. Fast algorithms enable the magnitude and trend of the control value to be precisely calculated as a function of the switching event time. The working window becomes narrower, while part weight fluctuations and raw material consumption are reduced. High-precision servo drive technology, in conjunction with XFC, increases the reproducibility of the injection molding process even further. XFC also enables the integration of measurement technology into the machine control system, eliminating the need for special hardware. In this way it is possible to implement a cost-effective solution for Condition Monitoring, for example, which can extend the service life of machines and minimise downtime through preventive maintenance.

Oversampling



XFC enables high-resolution analysis of the corresponding pressure curve. Oversampling enables resolutions even below the minimum I/O response time. The distributed synchronised clocks, combined with the time stamp functionality of EtherCAT, facilitate sampling at precisely defined times.

Reduction of material consumption



Logging of highly variable input signals with high temporal resolution enables precise control of the injection molding process. As a result, the working window becomes narrower, and part weight fluctuations and material consumption are reduced.



Electrical servo technology replaces hydraulic systems ...

The TwinCAT technology modules for plastic machines support hydraulic drive technology and servo-electric drives, therefore offering a wide selection of drive technology components. The integrated, fast control technology of the AX5000 EtherCAT Servo Drive series enables the realisation of fast and highly dynamic motion processes. The flexible drive design, with 1- and 2-channel units as well as the variable distribution of motor output allocation, allows cost-optimised solutions, in particular for handling systems. The comprehensive range of Beckhoff Servomotors is optimised for the AX5000 Servo Drives. One Cable Technology, which combines the power and feedback cables into one standard motor cable, reduces cable runs, mounting space and commissioning costs. Thanks to the integrated TwinSAFE technology the Servo Drives meet the stringent safety requirements for plastic machines and simplify the configuration of production cells.



... and increases the energy efficiency of plastic machines.

PC-based control technology in combination with EtherCAT Servo Drives is ideally suited for replacing hydraulic axes with electrical drive solutions, which helps reduce the energy consumption of machines. When it comes to energy-efficient machines, a distinction is made between all-electric machines, where each axis is equipped with an electric motor and a spindle, and so-called servo hydraulics, where the hydraulic pump is operated with a servomotor. For both drive concepts solutions exist that include the AX5000 and TwinCAT technology software modules. In this way it is possible to effectively trigger crucial mold protection procedures that quickly stop the machine movement if a plastic part is detected in the mold. For the development of new machines Beckhoff can offer support for the configuration of motors and gear units.