

Bemaco Engineering uses automation technology from Beckhoff for controlling plastic blow molding machines



→ Bemaco Engineering based in Langenberg, Germany, produces plastic blow molding machines and offers upgrades for existing systems. The plastic blow molding industry is a very competitive market. Only cost-effective and highly productive machines for fast and reproducible production of high quality plastic components can succeed in this competitive environment. Bemaco therefore uses innovative control technology from Beckhoff.

Modular safety technology saves engineering costs

Plastic blow molding machines such as those made by Bemaco are used to produce hollow plastic bodies such as drums and canisters for the packaging industry, fuel tanks for cars and technical components for the automotive industry, or – using smaller machines – vials and small bottles for cosmetics.

Blow molding machines operate according to the following principle: Plastic granulate is melted in an extruder and is transported into an accumulator where the hot, viscous melt is collected and, once a specified quantity has been reached, ejected from the extrusion head in the form of a plastic tube. During the ejection process, the required wall thickness in vertical and/or horizontal direction is generated through servo-hydraulically operated cylinders. The plastic tube is subsequently formed in a water-cooled blow mold through injection of air.

The main control criteria for the plastic molding process are:

- | observance of the melting temperature for preventing qualitative impairment and creating a visually uniform surface of the plastic part,

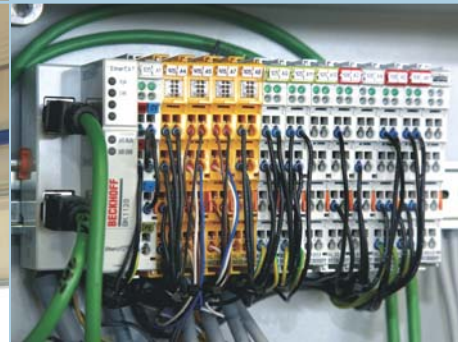
- | control of the wall thickness of the extruded tube to ensure the required wall thickness for geometrically complex parts,
- | fast and precise control of the clamping unit to ensure high productivity and low wear of the expensive blow mold.

All axes of the blow molding machine are hydraulically operated. Modular safety technology serves as protection of operators and the machine.

"We met these requirements with modular automation technology from Beckhoff," said Jörg Johannpaschedag, Electrical, Electronics and Software Manager at Bemaco Engineering. "Computing power, data interfacing, safety technology and the controllers are scaled and modularly configured according to the requirements of the system. This means we only use what we actually need, which minimizes costs. This kind of modularity also gives us flexibility for subsequent extensions or modifications."



Plastic blow molding machine for producing drums, fuel tanks, and technical components



Bus Terminal stations at the extruder, clamping unit, blow station and hydraulic system link the data points locally. The Beckhoff safety terminals offer safety I/O directly in the Bus Terminal station of the system.

Tailored computing power

At the core of the control system is the CP6622 built-in Control Panel with Windows CE and TwinCAT as the control platform. The Control Panel has two RJ 45 Ethernet ports for connection to the corporate network and for an EtherCAT connection. The EtherCAT connection does not require a fieldbus card. In addition, two USB interfaces and a serial RS232 interface are available.

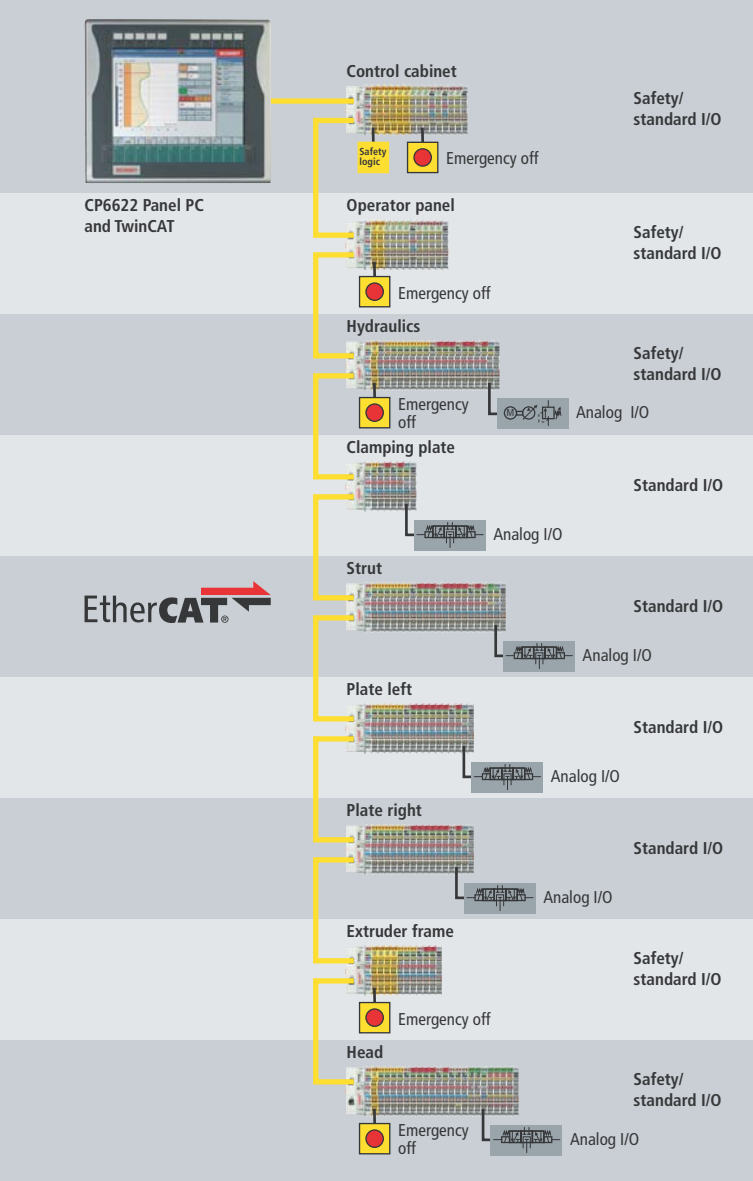
The Control Panel offers access to all system components such as the heater, clamping unit, blow station, and hydraulic drive. Jörg Johannpaschedag explained: "The data points of the system components are directly and locally integrated via Bus Terminal stations. For each data point we selected the ideal Bus Terminal from the large and modular I/O terminal system and configured an individual I/O station for each system component. We installed the Bus Terminal stations locally in terminal boxes at the system components. This shortens the wiring routes for the actuators and sensors and makes the wiring configuration more transparent."

EtherCAT offers higher precision for wall thickness cylinders

Bemaco uses fast Ethernet-based EtherCAT as the fieldbus system. "With EtherCAT we achieve sampling rates of less than one millisecond," said Ralf Gösmann, Mechanical, Hydraulic and Pneumatic System Manager at Bemaco. "This increases the precision of the production processes and, as a result, the parts quality. One example is the setting of the wall thickness via the wall thickness cylinder. Due to its mass, precise and smooth process control can only be achieved with fast control."

TwinSAFE - modular safety technology

In the past, safety components such as emergency stop switches were wired conventionally. With the TwinSAFE terminals from Beckhoff the safety functions are integrated directly in the bus system. Ralf Gösmann is delighted: "Safety terminals save wiring effort and associated costs. We chose the safety terminals



according to the safety functions required at the system components and directly integrated them into the Bus Terminal system locally. For example, we connected the emergency stop switch directly in the heater terminal box."

The strategies for safety-critical situations are implemented in software. A library provides pre-assembled function blocks that can be configured and adapted according to each unique application. "Implementation is straightforward," said Jörg Johannpaschedag. "Our developers quickly mastered the function blocks and were able to configure the required safety strategies very efficiently."

The right control for any application

"We achieve precision and reproducibility through optimized control technology based on TwinCAT automation software," said Jörg Johannpaschedag. TwinCAT makes implementation of the complex control system for the plastic blow molding machine very easy. Controller libraries are available for this purpose. The TwinCAT PLC hydraulic positioning library is used for controlling the hydraulic axes. Temperature control is implemented via the TwinCAT PLC temperature controller library.

"The production of high-quality plastic components requires consistent observation of the melting temperature in order to avoid damage to the material through excessive temperature fluctuations. The TwinCAT PLC temperature controller fully meets our process control requirements. Automatic determination of controller parameters results in good transformation of the control path properties," said Jörg Johannpaschedag.

Michael Gottschalk, Commercial Director at Bemaco Engineering, added: "Convincing factors for us were the high-performance PC-based automation technology without special hardware and the comprehensive range of Bus Terminals – including safety terminals. This technology enables us to provide customer-oriented solutions with lower engineering costs."

→ Bemaco Engineering, Germany, www.bemaco-engineering.de