



Energy efficiency and an optimal performance ratio

For plastic injection molding machines, electric drives are increasingly in demand. With the e-max series, Engel succeeded in developing an all-electric injection molding machine with fully integrated control and drive technology from B&R which stands up well to the competition from other suppliers on the hotly contested European and Japanese markets by providing a compact, energy-efficient, precise and secure system.

Precision injection molding - this refers to the technique of producing finely detailed parts with extremely small manufacturing tolerances, and often small wall thicknesses, but with defined and often high load capacities. The parts can be toothed gears wheels or rocker arms, but they can also be guide rings or housing parts. For the automobile industry, for electronic devices, for cameras or printers and for hundreds of other applications where precision parts "from a mold" are in demand.

During injection molding, enormous forces occur: The melted plastic granulate is injected into a mold with high pressure. The mold must be closed and remain closed with sufficient force



in order to withstand this pressure. Until just a few years ago, manufacturers of injection molding machines only used hydraulics for these procedures, as did Engel Austria GmbH, one of the leading manufacturers in the world for these types of machines. The fact that this technique functioned very well is proven by over 70,000 injection molding machines that were made in this way and that worked with a great deal of precision and reliability during the more than 50-year history of Engel.

However, the hydraulic drive technology has its disadvantages, and therefore the desire for an electrical alternative, which was mainly based on developments on the American market, began to surface in the middle of the 90s. This caused Engel to make a decision in 1999 to develop an all-electric series called e-motion, which was introduced in 2001 at the K Trade Fair (International Trade Fair for Plastics and Rubber) and was mainly sold overseas. However, efficient electric drives were only available in the lower

power classes, so they were limited to use on machines with low closing force.

With increasing acceptance on the European market, a decision was soon made to give the faster and quieter electric drive technology priority and to develop a complete line of all-electric machines based on this concept that would include power classes with closing forces up to 500 tons, which was previously only handled using hydraulic drives. Reasons for this decision were the lower energy consumption and maintenance requirements as well as cleanliness, because electric machines do not require oil.

All-electric machines for the price of hydraulic machines

With this goal in mind, a further product series followed - the e-max was introduced in 2007 and has been available since April 2008. The name says it all: The price/performance ratio was improved on several levels to the advantage of users. The advantages start with the significantly reduced footprint as compared to conventional machines and continue with the high total performance and excellent energy efficiency. This also includes the high precision and reliability of the electric drives, which prevent waste and reduce the costs required to ensure quality.

Keeping the total price at the same level as comparable hydraulic machines was a challenge for the development engineers. For this reason, Engel started searching for a partner that, in addition to supplying the control and drive components, would also present a total concept for all electrical and electronic aspects of the new machine generation and would later also share the responsibility for implementation. "With an innovative and completely comprehensive concept that included the control electronics and drives, B&R provided us with the possibility to fully meet our performance requirements," says Engel Product Manager Wolfgang Steinkellner. "And this



The combination of touch screen technology and discrete keys provides optimal operating comfort.

was done with the cost-effectiveness necessary to meet the lofty goals for an exceptional price/performance ratio.

Energy efficiency reduces the amortization time

This starts with the reduced space requirements of the decentralized electrical equipment, which - for the first time at Engel - is not installed in the switching cabinet and is instead integrated in the machine. The high performance motors are controlled using the modular ACOPOSmulti drive system. Because of the integrated power factor correction, reactive power is not applied and only effective power is taken from the mains. This greatly reduces the power consumption of the machine. >>



A small footprint and maximum energy efficiency thanks to B&R's state-of-the-art technology: The ACOPOSmulti drive system for high-powered motors can be installed directly on the machine and return the brake energy back to the power source.

mal price/



The injection performance is also very high, with injection speeds up to 450 mm/sec. Because of parallel operation of all drives, the dry operation times and therefore the cycle times are considerably shorter as compared to hydraulic machines, and process constancy is increased through the precision of the electrical movements and independence from environmental influences.

The intelligent power supply modules are equipped with a network connection and linked directly with the CPU via high-speed POWERLINK. This saves space, cabling and expensive electronics between them and ensures a nearly identical set of curves for the process data, and also provides completely new possibilities for machine and system diagnostics because many status messages from the individual

ACOPOSmulti



The use of highly dynamic servo drives from the ACOPOS series, which can be combined with synchronous, induction, linear, servo or stepper motors or hydraulics, creates the basis for innovative drive technology. Standardized software components guarantee a completely integrated drive concept from 20W to 120kW.

Highly concentrated intelligence, specialized cooling concepts, simple installation and optional energy regeneration give machines and systems maximum efficiency.

drives can be sent between the control commands via the fast system bus. This allows the CPU to react flexibly. With the global Engel network, remote diagnostics and remote maintenance are possible around the clock from any location, as is integration in the Engel e-factory system for higher-level process monitoring and optimization.

Increased operating comfort

This specific controller was developed during more than a year of cooperation between Engel and B&R. Much emphasis was placed on operating ergonomics. In spite of the many specific functions provided, the user interface was designed to be similar to the familiar standards from hydraulic machines. Machine operators that have experience with Engel equipment can operate the e-max machines right away, with virtually no training. An extensive function library with easily selectable programming modules for plastic processing tasks is available in order to simplify operation.

That is also true for the main controller hardware. The control and visualization applications run on a B&R Power Panel 400 that was customized especially for Engel and has a swing-arm for easier operation. The Power Panel, which provides maximum ergonomics using a combination of touch screen technology and discrete keys, elegantly controls the five positioning axes and has ample processing power for future extensions or the connection of handling equipment.

Successfully on the market through technological advancement and international cooperation

In general, the machine manufacturing industry is considered to be very conservative. It is therefore remarkable that Engel didn't shy away from using brand-new B&R products when developing the e-max machine. "Our goal was to use the absolute latest technology for the e-max and ensure our customer's security for the future," explains Wolfgang Steinkellner, and continues: "The level of maturity of the B&R technology used is proven by how few problems occurred, which allowed the all-electric machines to be introduced onto the market. In addition, it was important



The all-electric injection molding machines from Engel's e-max series impress with high performance, precision and reliability.

for us to cooperate with a partner that also does business worldwide so that our customers on all continents can expect local support directly from the supplier of the components. We also cooperate closely with B&R in the USA and in Korea."

The success of this strategy is proven by the fact that the expectations of everyone involved were exceeded by far. Engel supplies e-max machines with identical technology from Schwertberg and Pyungtaek, Korean to anywhere in the world. In the meantime, the e-max machines constitute a significant part of the total output of approximately 3000 machines from all classes. ■

ENGEL:

ENGEL

Founded: 1945

Employees: 3,777 worldwide

Revenue: 622 million euros (2007/2008)

Locations: Headquarters in Schwertberg (AT), nine production plants in Europe, North America and Asia

Products and services: The ENGEL group offers all technology modules for plastics processing from a single source: Injection molding machines for thermoplastics, elastomers and automation.

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