



XMold, the turnkey solution for injection molding machines from Beckhoff, in use with the 2-plate injection molding machine from Shuangma



User interface of the XMold CP6212 Panel PC

# Open automation technology answers challenging market requirements and shortens engineering time

Quality requirements for plastic components used in the automotive industry are continually increasing. Therefore, plastics processors demand machines with lowest possible variations in product quality, short cycle times and minimal energy consumption. This trend can also be observed in other sectors, such as high-quality household articles and consumer electronics. For these reasons, manufacturers of injection molding machines focus almost exclusively on 2-plate systems in this market segment. The turnkey solution for injection molding machines from Beckhoff, XMold, is ideally suited to automate such machines, delivering high performance in a wide range of applications.

Ningbo Shuangma Machinery Industry Co., Ltd, headquartered in Chinese Ningbo, manufactures injection molding machines under the brand name Bole. Shuangma has utilized PC-based automation technology from Beckhoff in its standard toggle machines for several years with great success. Now, this technology will be integrated into their 2-plate injection molding machines.

## Injection molding processes place high demands on control technology

Short cycle times and high positioning accuracy are fundamental parameters that are influenced not only by the design of sensors and actuators, but also, to a large extent, by the control system. Therefore, short sampling times with fast program processing are required on the control system side to minimize non-productive times in step sequence processing. The production of complex plastic parts for the automotive industry often requires advanced core-puller programs and a large number of control options that extend as far as special applications. Another industry requirement is integration into production cells

with robot-assisted automatic parts removal. At the same time, programming and commissioning times must be as short as possible. In addition, simple solutions are required to transfer process and machine data into cloud databases.

## XMold and eMold: control solutions with precisely scalable performance

Beckhoff offers solutions for injection molding machines in three performance classes: the eMold solution, a powerful controller with 9-inch display and closed-loop control, is available for standard toggle machines; the XMold controller, with 12-inch display in portrait mode, is designed for the medium performance class. It can be used for injection molding machines that are equipped with hydraulic, electric or hybrid drives. For large machines, an XMold version with a 15-inch screen is available. All controller variants use the EM8908-1001 EtherCAT I/O board especially developed for injection molding machines. Depending on the design of the machine, these solutions can additionally include EtherCAT Terminals from the extensive Beckhoff I/O portfolio.

### **EtherCAT for fast, reliable machine communication**

EtherCAT has become the standard real-time bus system for injection molding machines. Outstanding speed makes the protocol ideally suited for demanding control processes such as fast switchover to holding pressure or high-precision mold protection. EtherCAT provides fast and secure communication, not only for data exchange between Beckhoff components, but also with connected sensors. Precise and reliable data communication is critical for accurate detection of the moving plate position, as the required high pressure build-up should be controlled with the shortest possible delay. Neither analog potentiometers nor magnetostrictive position sensors connected via CAN bus or SSI provide such reliable measurement values with short sampling times. Only EtherCAT sensors meet all the requirements for best-in-class motion control.

The Shuangma engineers also selected drives with EtherCAT interfaces for communication with the servo pumps. Based on the wide market acceptance of EtherCAT, a wide variety of hardware from third-party vendors is also available to the machine manufacturer, allowing Shuangma to offer its customers cost-efficient EtherCAT solutions.

### **TwinCAT Injection Molding Application Framework for all applications in injection molding technology**

The injection molding process places high demands on the flexibility of motion and sequence control. The motion controller must be able to operate both cost-optimized hydraulic actuators and fast servo-electric axes, which means conventional CNC solutions are unsuitable for these applications. Beckhoff has developed the Injection Molding Application Framework especially for the unique requirements of injection molding machines. It is ideal for both hydraulic and servo-electric drive technology.

The open, flexible architecture of the framework was crucial for Shuangma in choosing the Beckhoff control platform. With the flexible axis concept and the configurable sequential control by means of interpreter language, the company was able to accelerate commissioning times for its large and special machines. The mature control algorithm – in combination with the powerful XMold CPU – led to a 10 % improvement in positioning accuracy with shorter dry-cycle times when compared to the previous controller.

### **XMold: the automation system for specialized, high-tech applications**

The architecture of the Injection Molding Application Framework is so broadly based that all injection molding applications are supported. One example of this is the application of the Injection Molding Compounder in a machine developed by Shuangma that combines extrusion and injection molding processes in order to manufacture plastic materials with glass fiber reinforcement. The extruder provides a homogeneous, material-friendly plasticizing process. The extruded plastic mass is then transported into a bulk storage vessel and pressed into the mold by an injection plunger. With XMold, Shuangma is able to control both the extruder and the injection molding machine with one centralized PC-based control platform.

“In this special application, Beckhoff was also able to utilize its extensive expertise in the temperature control of liquid-cooled extruders,” points out Thomas Kosthorst, Business Management, Plastic Processing Machines, at Beckhoff. “The temperature control of an extruder is more demanding than that of an injector cylinder. Injection molding compounder applications often require

hotrunner molds with specialized temperature controllers. As opposed to external hardware solutions, the integrated hotrunner controller can run any number of hot runners only by adding thermocouple inputs. The performance class of the PC needs to be selected to match the application requirements.”

The XMold solution provides special algorithms for servo-electric machines: for instance, the set curve calculation for servo-electric machines takes into account the special requirements of electric injection molding machines, such as fast switchover to holding pressure and jerk-optimized motion control.

In plastics processing, demand for energy consumption documentation continues to increase. Beckhoff offers capable hardware to meet this need, and the Plastic Application Framework delivers the necessary software modules. The XMold user interface is optimally designed for the requirements of injection molding processes; this means that the key parameters for each shot are saved in a freely-configurable table for quality data. Up to 12 (measured) values can be saved per shot and long-term archiving is possible via the local network or using a USB flash drive.

### **Open communication standards and TwinCAT IoT as the foundation for Industrie 4.0**

In today's processing facilities, injection molding machines communicate with central production planning systems. For this purpose, the Euromap 77 interface was defined in the Euromap Organization on the basis of the OPC UA standard, and this interface is available for XMold and eMold. However, concepts for cloud-based communication and analysis are now undergoing initial tests. The TwinCAT IoT software family for Industrie 4.0 communication is well-suited to injection molding processes, enabling cloud-based analysis of machine properties.

However, XMold also offers a wide range of functions for communication from the injection molding machine to peripheral equipment and robots (M2M): the Euromap 67 interface is available for conventional robot interfaces with digital I/Os, and fast Ethernet-based fieldbus connections according to Euromap 75 are supported with EtherCAT. Via EtherCAT, injection molding machines can also be seamlessly integrated into complex production cells, for example in medical technology applications.

### **A sustainable solution with Beckhoff IoT technology**

“For many years, embedded systems of a low technological grade have dominated the Chinese domestic market for injection molding machine control,” concludes Shuangma's Technical Manager Rocky Liu, “Now we need innovative concepts for the reliable production of high-quality parts. The cooperation with Beckhoff offers us a solid basis for technological development. With the open, PC-based control technology, we can completely fulfil our customers' wishes for higher availability, quality and productivity, while also implementing production concepts in accordance with Industrie 4.0 methods and standards.”

Further information:

[www.shuangma-machinery.com/en](http://www.shuangma-machinery.com/en)

[www.beckhoff.com.cn](http://www.beckhoff.com.cn)