

Real-Time Process Monitoring in Cleanroom Environments

Electrical Drives in Injection Molds

In the production of plastic parts for the medical and pharmaceutical industry, the requirements for cleanroom environments are becoming increasingly stringent. In this area, not only the demand for all-electric injection molding machines is increasing. There is also an increasing use of electric drives for the implementation of mold movements, which meet the high requirements for cleanliness and reliability.

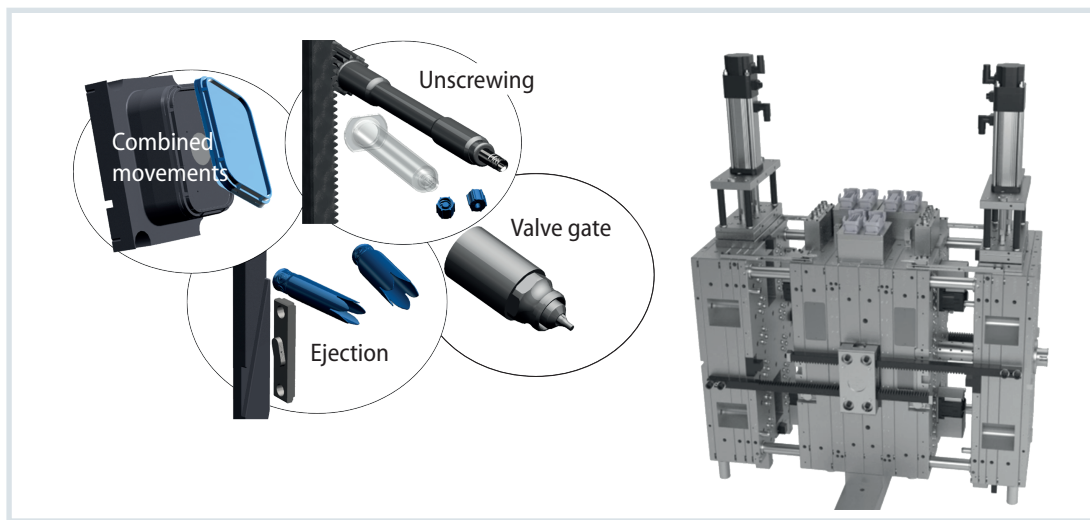


Fig. 1. Solutions for electrical mold movements, for example a 72+72 cavity stack mold for the closing cone production © Schöttli/Husky

Compared to hydraulic or pneumatic systems, electric drives offer high cleanliness and virtually maintenance-free operation over millions of cycles. In cooperation with Husky Injection Molding Systems, Schöttli AG, Diessenhofen, Switzerland, a Husky Company, offers fully integrated complete solutions for electric mold movements and valve gate actuation in high-cavity injection molds.

Electrical Actuators

The performance of electric drives is constantly evolving and opening up new areas of applications and uses. In combination with efficient control technology, the actuators offer great advantages over alternative systems from the hydraulic sector in terms of cleanliness and energy efficiency. In addition, individually programmable motion profiles, for example when actuating valve gate systems, can

increase the quality of the molded part and the durability of the injection mold.

The vast experience of Schöttli AG, a Husky Company, in the design of electric actuators ensures that the ideal actuator is selected for every injection mold and every application. In addition to the maximum force, the acceleration of the movement is also taken into account in order to achieve the shortest possible cycle times. The applications are varied and include not only unscrewing and ejection movements but also combined movements, which are realized for example in compression molds and electric valve gate systems.

For example, Schöttli has designed and manufactured a 72+72 cavity stack mold for a medical locking cone, which ensures the unscrewing movement of the thread cores and demolding through ejection sleeves via four individually controlled electric drives (Fig. 1).

Challenging Control Technology

Dynamic mold movements impose high demands on the regulation and control technology of the actuators. The acceleration of the mold components in combination with the demolding of the plastic part requires a high moving force, which the actuator must apply. This force is generated by a servo motor and is transmitted over a gearbox into the core puller.

At this point, high torque means extensive power consumption, which the controller must provide via the power and control electronics. The high current consumption of the servo actuator within short time intervals represents a demanding task in the dimensioning of the electronic components.

Schöttli already includes the control manufacturer during the development period of the injection mold and defines the expected requirements on the ac- »

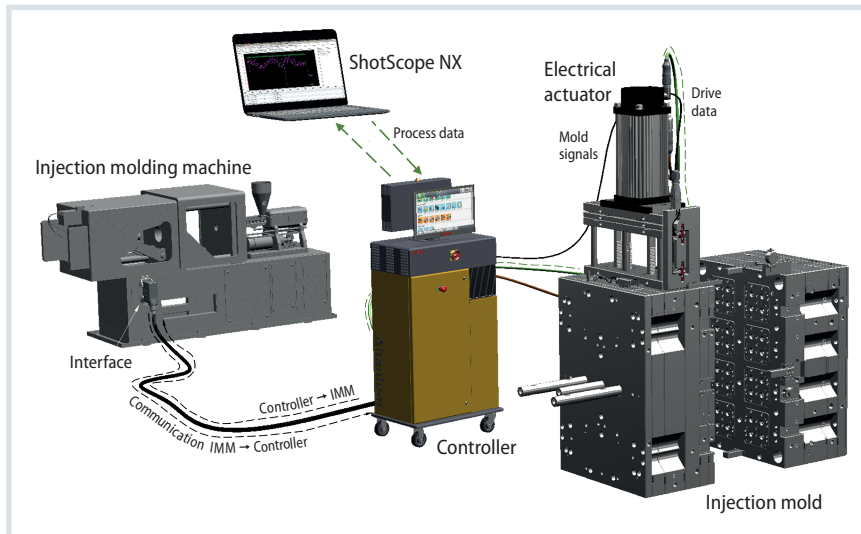


Fig. 2. The Husky-ASC system offers the possibility for a realtime process monitoring © Schöttli/Husky

tuator, which allows a perfect adjustment of the power electronic components. This close coordination between mold- and control supplier guarantees, that the complete system works reliable in operation and a competent assistance in case of incidents.

Commissioning and Securing Production

After the development and production

phase of the injection mold, the injection molding machine, controller and injection mold must harmonize perfectly for a stable process. Communication between the devices takes place via predefined interfaces. Schöttli provides preconfigured interface cables which can be used for commissioning according to the plug-and-play principle. Furthermore, the operation with Husky ASC-controllers offers the customer the possibility of a continuous process monitoring and process in-

terruption, when significant process parameters are out of tolerance.

The efficient Husky ASC controller in combination with a highly dynamic servo motor offers a large variety of advantages. The exact control of up to seven drives (six Servo-axes and one axis for the valve gate UltraSyncE) in combination with the path and force detection by the controller offers extensive possibilities to optimize the process.

The Husky system also offers the possibility of continuous process monitoring and can be integrated into the safety system of the injection molding machine (**Fig. 2**).

Real-Time Monitoring of Process Data

The new generation of Husky controllers allows users to evaluate process data in real time to optimize the process. This is particularly necessary for sensitive processes where the individual mold and machine movements must be coordinated (**Fig. 3**).

In cooperation with Husky, an injection compression mold with UltraSync-E valve gate system was realized, in which the interaction of

- injecting the melt,
- closing the gate by needle movement and

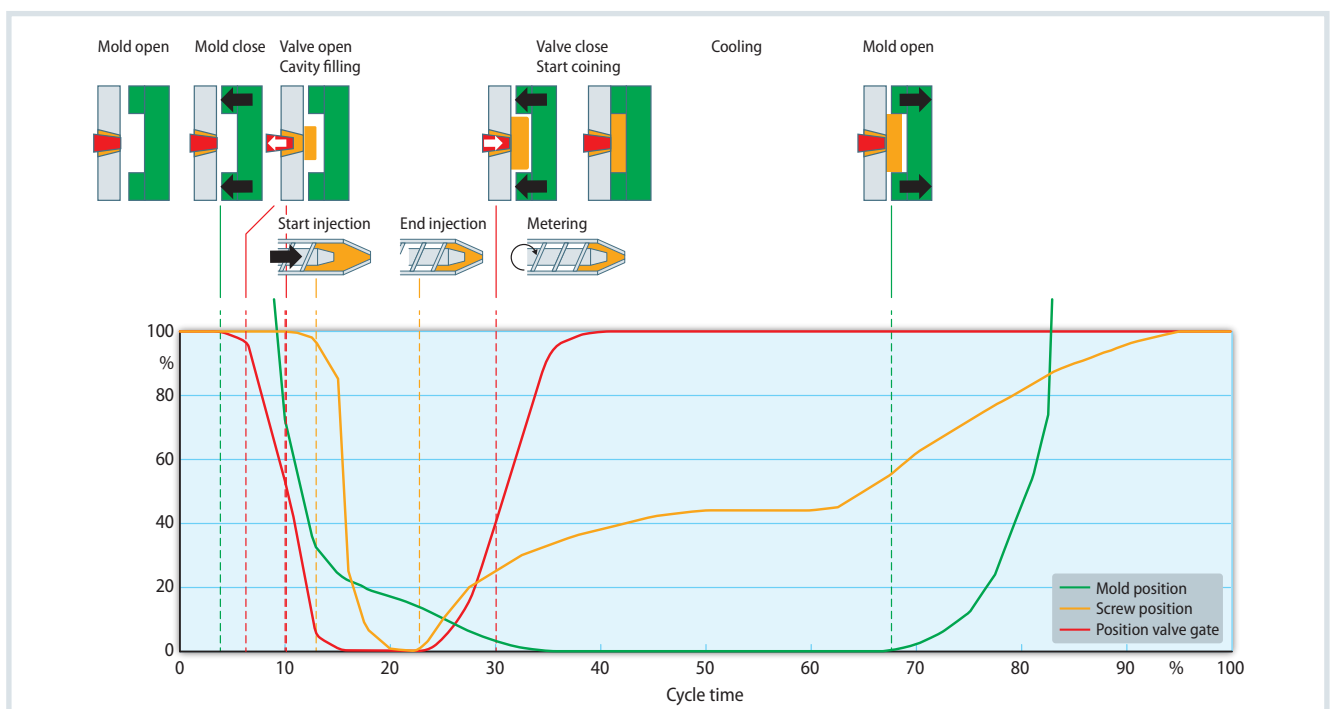


Fig. 3. Signal sequence of a combined mold movement consisting of screw position, valve gate and compression position Source: Schöttli/Husky;

graphic © Hanser



Fig. 4. With the program ShotScope NX, process data like current energy consumption are recorded over the production cycle © Schöttli/Husky

■ compression via the mold movement can be perfectly coordinated. The precise positioning of the mold components by the electric drives ensures that production is continuously within a stable process window and a maximum output with minimum cycle time.

In addition to local data acquisition, the Husky controller allows customers to analyze this data in a central location and get an overview of the current production status of multiple manufactur-

ing cells. The ShotScope NX program is used to capture process data, such as current energy consumption, and record it over the production cycle. In this way, deviations in the system are quickly recorded and production losses are minimized. The evaluation of the data can also be used to localize and optimize processes with high energy consumption in the system to increase the energy efficiency of production (Fig. 4).

Direct Replacement for Existing Molds with Hydraulic Cylinders

A cost-saving solution is guaranteed by the Schöttli E-Drive system. The simple operation combined with a reliable actuator makes this system attractive for prototype molds and unscrewing molds up to 64 cavities. As the controller is already integrated in the actuator housing, this system can also be used as a direct replacement for a hydraulic solution. Existing production molds with hydraulic cylinders can be converted to an electric drive without additional investments in complex control technology (Fig. 5). Especially in the field of unscrewing molds, Schöttli can draw on a wealth of experience gained over more than ten years. This helps to define a tailored solution for the customer and ensure reliable operation. In this context, the company offers safe and efficient solutions for complex applications in the medical and pharmaceutical industries with combined movements, including the conversion of existing molds to electric drives. ■

Company Profile

The Schöttli AG, Diessenhofen, Switzerland, is a globally acting injection mold manufacturer focused on medical and pharmaceutical applications. Established in 1952 and "a Husky Company" since 2013, Schöttli-molds stand for precision and high performance in the production of medical and pharmaceutical applications. With ten production sites and 30 aftermarket locations, Husky offers a globally organization for the injection mold market.

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The Author

Stefan Schneidmadel is Development Engineer of Schöttli AG, Diessenhofen, Switzerland.

Service

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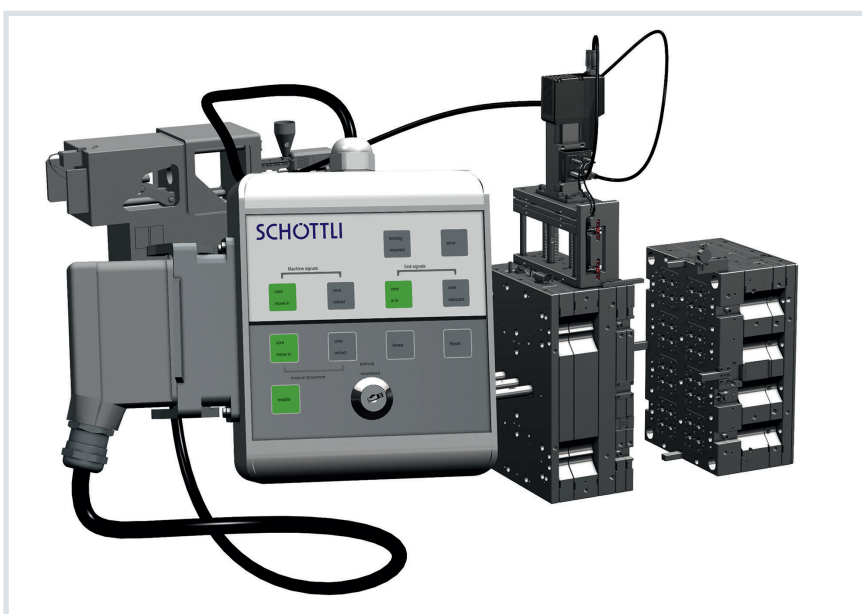


Fig. 5. The E-Drive system is suitable for prototype molds and unscrewing molds up to 64 cavities © Schöttli/Husky