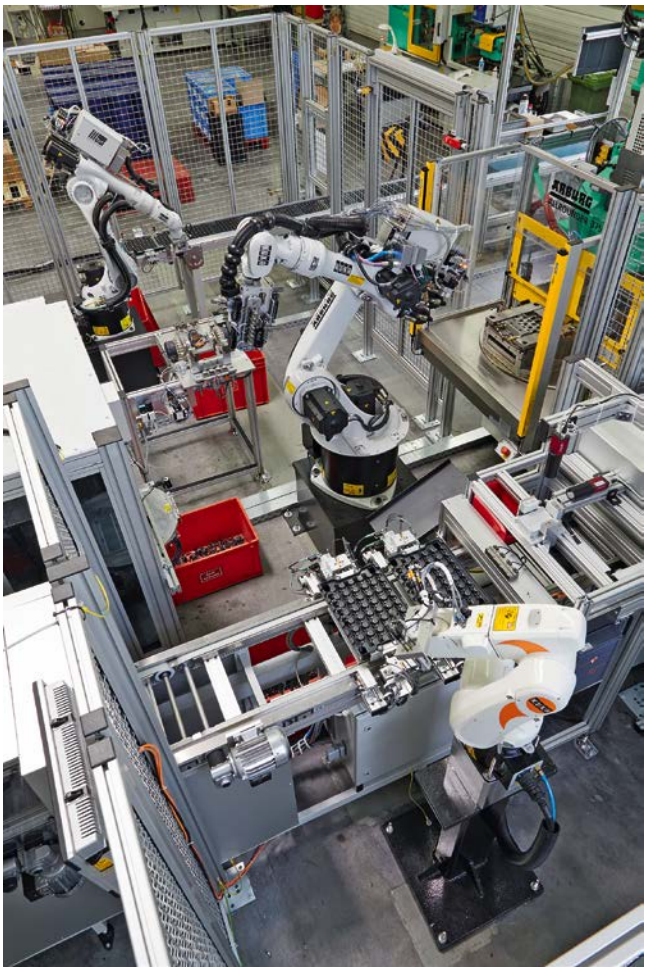
A Trio Working in Synchronization

Injection Molding Machine and Three Six-Axis Robots Work Together in Perfect Synchronization to Save Cycle Time

A production cell which produces automatically around the clock. Three six-axis robots which are fully integrated in the control system and operate in a synchronized manner. An injection molding solution in which machine, robotic systems and peripherals are supplied from a single source. All this is not a pipe dream of an efficient injection molding solution, but every day, well-proven reality at a plastics processor in Upper Franconia, Germany.

Rudi Göbel GmbH & Co. KG, by its own claim a top-flight manufacturer in the field of plastics and metal working and processing, provides its customers with precision injection moldings and complex stamped-bent parts. Among other products, the company manufactures components for an innovative stop/start system for vehicles. "We produce the part, a so-called "connector carrier" for the stop/start system, for the international automotive industry. The requirements with regard to efficient high-volume production are therefore extremely high," explains Peter Baumann, purchasing manager at Göbel. The connector carrier comprises a metal insert and pin contacts, which are provided with positional accuracy at two stations and then overmolded with fiber-glass reinforced PBT.



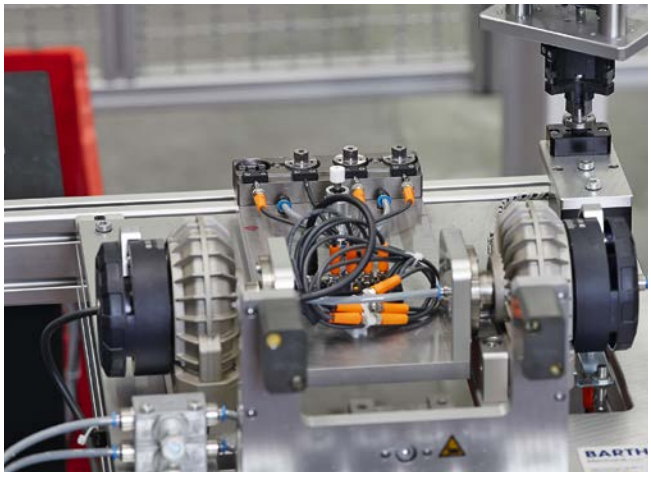
Complete solution: all three synchronously operating six-axis robots are integrated into the machine control of the vertical Allrounder (figures: Arburg)

"We wanted to produce the complete part without secondary operations, in three-shift operation round the clock on an automated system, at our German site in Helmbrechts," is how Baumann describes the situation. The production solution, which has operated reliably and almost continuously since the end of 2012, was supplied by the injection molding machine manufacturer Arburg, as a turnkey "one-stop" solution. The fact that, according to Baumann, this also includes reliable supply of spare parts and good service in general is particularly important for complex manufacturing cells operating round the clock.

Synchronized Movements and Correctly Positioned Inserts Ready for Feeding

At the heart of the system designed for Göbel is a vertical injection molding machine (type: Allrounder 375 V, manufacturer: Arburg) and three six-axis robots. The inserts are provided via a tray feed and a feeder cell featuring a Scara robot. The system also includes a control station and a conveyor belt for removing the finished parts. »

The connector carrier for the stop/start system consists of a metal insert and plug contacts, which are fed correctly positioned at two stations and then overmolded with glass-fiber-reinforced PBT



The first six-axis robot feeds the four metal inserts correctly position by "event-controlled rotation"

The second robot receives the four inserts and eight contacts from the feed cell (left) and also places them in the injection mold (right)

The six-axis robots are fully integrated in the Selogica control system. They therefore move in synchrony with the machine. The two robots for handling the inserts are connected serially via a bus interface. Bus communication enables centralized start-up scenarios and facilitates restarting following malfunctions, for example.

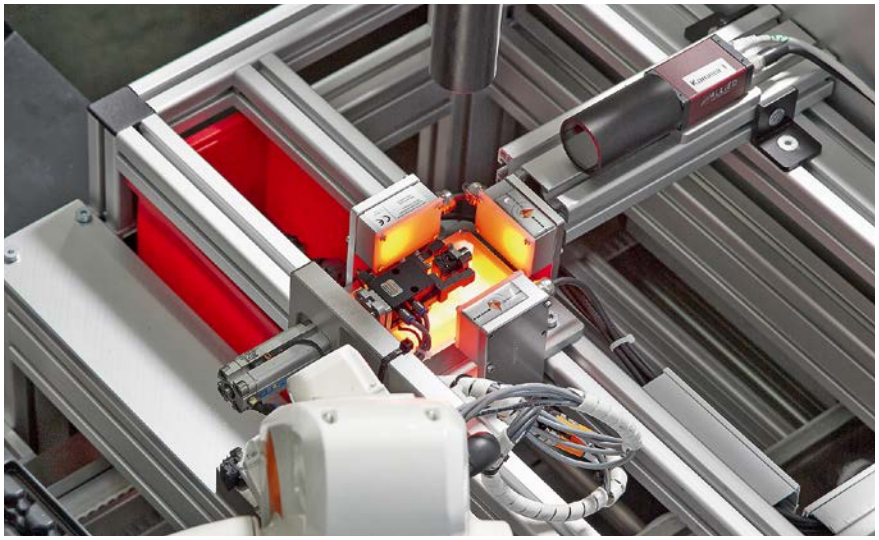
The complex 3-D movements of the three six-axis robots were programmed by the Arburg experts from the Project Department in person during commissioning of the system. Thanks to implementation of the Selogica user interface in the control system of the Kuka robots, this is comparatively straight-forward, meaning that further optimization can be carried out by the operating personnel at any time.

The tasks are clearly delineated during the production process. The first six-axis robot is responsible for providing the sintered metal inserts. It removes the parts, which are provided randomly positioned in trays and precisely aligns each one via three sensors using its sixth robotic axis. This task is performed via so-called "event-controlled rotation", whereby three sensors detect the position of the inserts. This special function can be programmed via the Selogica controlsystem and replaces an expensive rotary unit that would otherwise be required. The robot consecutively places four inserts, positionally accurately, onto a transfer station. The station turns and the parts are then ready for insertion into the injection mold.

Complex Gripper Performs Multiple Tasks

At the same time, further inserts are provided via the feeder cell – two contacts per component. This task is performed by a Scara robot, which is connected via a peripheral interface. Its camera system recognizes the geometry of the inserts. The robotic system picks up four sets of two contacts and places them in four positions in an alignment station. This station then rotates through 180°, providing a total of eight inserts in pairs.

Next, the second six-axis robot, which is equipped with a complex gripper, comes into play. This first removes the four metal inserts from the transfer station and fetches the four pairs of contacts from the alignment station of the feeder cell. The robotic arm then moves to the rotary table of the vertical Allrounder 375 V injection molding machine. Here, it first removes the finished parts from the lower part of the 4-cavity mold before consecutively inserting the four sintered parts and pairs of contacts. The mold, with the inserts in place, is



The third robot transfers the finished parts for quality testing by camera

then brought into the injection position via a rotary table. The inserts are then overmolded with just under 10 g of glass-fiber reinforced PBT. In the meantime, the six-axis robot ejects the sprues, transfers the finished parts to the control station and moves back to the transfer station.

100 % Camera Inspection Integrated in Process

Simultaneously with the injection molding process, the third six-axis robot consecutively passes the parts on to the control station for camera inspection before placing the good parts onto a tray, which is automatically removed via a conveyor belt. Thanks to the simultaneous and coordinated interaction of the robotic systems, the complete production process runs in about 35 s. "We currently produce around 3,000 parts per shift," says Peter Baumann. "At the moment, we're working on further optimizing the overall process in order to reduce the cycle time by a further 15 percent." ■

The Authoress

Dr. Bettina Keck works in corporate communications at Arburg GmbH + Co KG, Lossburg, Germany.

Company Profile

Rudi Göbel GmbH & Co. KG produces injection moldings and punched and hybrid parts for the power electronics industry, automotive industry, medical technology and instrumentation and control technology. The company, founded in 1957 by Rudi Göbel, is now managed by Franz and Frank Pichler, and operates 62 injection molding machines at its headquarters in Helmbrechts, Germany. The group includes three subsidiaries in Germany and Austria. In total, Göbel most recently achieved sales of about EUR 60 million.

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