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5.3 Case study 2: Robotic automation of a counter-spindle lathe Standard solution with productivity guarantee

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At Framo Morat, a gear and drive specialist based in the Black Forest, the decision was taken to automate a counter-spindle lathe. What was needed was a cost-effective solution that would ensure productivity, flexibility and process reliability. A pioneering infeed system, including a Motoman robot, meets the requirements perfectly.

Framo Morat GmbH & Co. KG is one of the world's leading manufacturers of high-quality drive solutions. The core competency of this company, which employs around 400 people, is gear technology. Founded in 1912, the traditional Black Forest-based company has three business units – Gear Technology, Worm Gear Sets and Drive Technology – and relies on its great depth of production capabilities. Customers from around the world appreciate the high quality of the precision parts and the development expertise acquired over generations, meaning that Framo Morat has no cause to fear any let-up in demand.

On the contrary, business is booming and in most departments the machining centers operate around the clock in three-shift operation. In order to meet the high demand, all machine tools are optimized for maximum performance. In the case of one counter-spindle lathe, there was still scope to increase productivity: "We were looking for an automatic loading solution for this machine. What was required was a robust standard solution that had to be highly flexible and easy to operate, and that had to function reliably and take up as little space as possible," says Murat Okan, Head of Central Process Planning at Framo Morat.

The challenge in this project was to meet, with a single cost-effective solution, all of the customer's requirements that could normally only be achieved in practice with far more expensive special systems. EGS Automatisierungstechnik, based in Donaueschingen, has a wealth of experience in tasks of this nature. The company sees its core competency in the automation of machine tools and can look back on numerous successful projects.



Figure 5.5: The automation of the lathe perfectly meets all user's requirements

EGS had already carried out successful automation projects for Framo Morat in the past, and was able to offer the perfect solution for this task, as well. Heiko Röhrig, EGS Sales Manager, recalls: "After closely examining the requirements specification, it quickly became apparent that our standard feed system – the Flexiplex from the SUMO range – in combination with a tried-and-tested Motoman MH6 robot from the Japanese manufacturer Yaskawa could be the ideal solution. And we did, in fact, manage to meet all the customer's requirements using this standard configuration with slight modifications."

Highly flexible loading/unloading system

In practice, opting for the SUMO Flexiplex proved to be exactly the right decision. The system works without work piece carriers, thereby ensuring maximum flexibility and enabling conversion to other parts from the customer's range of products with a minimum of effort. The EGS solution in the implemented version has absolutely no difficulty handling the disk-shaped work pieces with diameters ranging from 42 to 125 mm and lengths of 8 to 70 mm.

The loading and unloading of the feeder system is the responsibility of the operator, who takes the unmachined parts from a pallet cage and distributes them evenly between the four infeed conveyors located at the top of the Flexiplex. Following machining, the operator removes the parts from the four offloading conveyors in the lower buffer zone.

All work steps between the manual loading and unloading of the feeder system are carried out automatically. The task of the Motoman robot is to automate the lathe. The MH6 takes unmachined parts from the infeed conveyor and loads them with great precision into the main spindle of the lathe. It then removes the finished parts from the counter-spindle and sets them down on one of the four lanes of the output conveyor.

Robot handles difficult operating conditions with ease

The Motoman MH6 has to extend far into the working area of the lathe during loading and unloading. Thanks to its impressive working range of 1,422 millimeters, the robot can effortlessly reach every position. What make the handling processes inside the machine tool particularly challenging are the cramped working conditions. This is where the compact design of the six-axis robot comes into its own. The MH6 acquits itself with exemplary agility when working inside the machine and performs its tasks precisely, quickly and, with the corresponding programming and servo-float function, with the required degree of care.

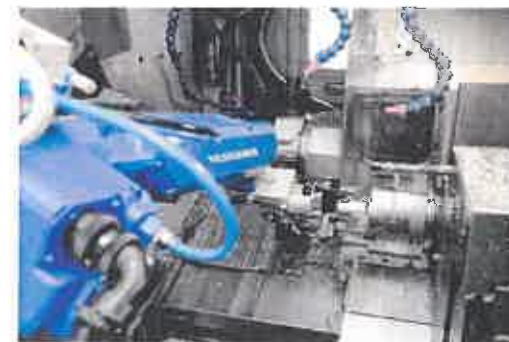


Figure 5.6: For loading and unloading, the Motoman MH6 has to reach far into the working area of the machining center (Photograph: Ralf Högel)

In view of the problems presented to the robot by the inevitable contact with swarf, cooling lubricants and other aggressive fluids, automation of the machine is no easy task for the MH6. Nevertheless, despite these harsh conditions, the six-axis robot performs with great reliability. In practice, the robot's workload is rather more relaxed, as it spends most of its time in the waiting position during the main work cycle of the lathe. This situation could soon be changing, however, as Framo Morat and EGS are already working on integrating downstream work steps into the cell and thus optimizing utilization of the robot.

As well as the exemplary performance of the robot, another aspect is equally important for Framo Morat, as Okan explains: “The machining of parts in this machine is an integral part of a machining process that extends across a number of different machines. In other words, in the event of a failure in this machine, our entire process chain would be disrupted or break down completely. The EGS solution with the SUMO Flexiplex feeder system and the Motoman MH6 robot has proven to offer maximum reliability. Unplanned downtime is virtually unheard-of.”

The fact that the system has proved to be a master of endurance is due in no small part to the systematic avoidance of potential causes of faults in the design. As Röhrig says: “We have dispensed with everything that could cause faults. For the safeguarding of zones, for example, we have used a conventional safety fence rather than expensive sensor-based safety solutions. Another example is the positioning of the robot next to the machine on an inclined base – practical, unbeatable in terms of price, and highly dependable. This solution offers optimal accessibility to the lathe by simply swiveling the robot away from the machine.”



Figure 5.7: Simple and ingenious: the positioning of the robot on an inclined base next to the machine allows perfect accessibility to the machine (Photograph: Ralf Högel)

Figure 5.8: The six-axis robot fetches unmachined parts from the four infeed conveyors at the top. It sets finished parts down on the offloading conveyors (Photograph: Ralf Högel)

With the EGS automation solution, and the Motoman robot that works reliably in all conditions, Framo Morat has been able to leverage a whole range of advantages in a particularly cost-effective way, as Okan stresses: “The fully automatic loading and unloading in an area of just six square meters made it possible to make significant reductions in the amount of costly non-productive periods. Furthermore, the autonomous system operation has enabled us to minimize machine downtimes and, not least, to make the work considerably more pleasant and interesting for our employees.”