





## RV 10 Flexmaster increases productivity with customized automation by Rexroth

**In addition to short cycle times, the productivity of machine tools is increasingly determined by the effort required for their changeover. In recognition of this trend, WINEMA Maschinenbau GmbH has introduced CNC-controlled rotary indexing machines to a market segment that was previously dominated by cam-controlled machines. For its newly developed RV 10 Flexmaster for small workpieces with a diameter of at least 2 mm, WINEMA is employing the CNC system solution IndraMotion MTX by Rexroth with decentralized intelligent electric and hydraulic drives. The sercos automation bus provides the high-performance profiles for the smooth integration of both drive technologies. This increases productivity by 20% compared to previously available solutions.**

The large-scale production of small parts is also increasingly subjected to ever shorter product life cycles. While manufacturers of standard parts previously could use the same machine for decades, the emphasis now is on varied manufacturing with frequent changeovers. "Our customers expect maximum output with minimum changeover times," confirms Eckhard Neth, Managing Director of WINEMA Maschinenbau GmbH in Grosselfingen, Germany. The manager of the medium-sized company speaks to manufacturers of price-sensitive mass products such as plug pins, cam disks or cable connectors made of various metallic materials. "Previously, cam-controlled machines were unbeatably fast for large-scale series production," he adds. "However, we top this speed and combine it with the advantages of CNC

technology for increased flexibility." The sercos automation bus offers excellent freedom for such innovative and flexible machine concepts.

Introduced at the EMO 2011 trade fair, the RV 10 Flexmaster was designed for the complete processing of rotationally symmetrical workpieces from 2 to 23 mm in diameter, with a focus on machining operations. "The machine also handles assembly tasks," Neth emphasizes. The core of the machine consists of a vertical indexing table with 10 clamping stations. In each cycle, the table, which is powered by a torque motor, rotates the workpieces to the next station. A CNC bar feed pushes the semi-finished product into the hydraulic two-jaw chuck. The insertion process can also include a plunge-cut oper-

ation parallel to the cutting of the blank. The Flexmaster then guides the workpieces through the process with a single clamping operation.

The rotary indexing principle allows the machine to process nine workpieces in parallel in each cycle, achieving a very high throughput. This, combined with the very high transfer rates provided by the sercos automation bus, ensures maximum productivity. One advantage of the vertical principle is that processing takes place at all stations at once and from both sides with nine axial axes each. In addition, the Flexmaster has two radial axes on both sides for other operations such as drilling and thread or contour milling. The machine also handles thread cutting or upsetting and offers flexibility for special processes such as wobbling or cross-sliding. For a fixed workpiece, this gives the same results as rotating the workpiece during processing.

### **54 electric and hydraulic CNC axes**

In the development of the new machine, WINEMA for the first time employed the CNC system solution IndraMotion MTX by Rexroth in combination with sercos. The MTX performance version controls the 54 CNC axes of the RV 10 Flexmaster, of which 27 are IndraDrive spindle drives. Up to 12 NC channels are available. The consolidation of CNC and PLC in a single hardware unit simplifies the entire automation process. The slender architecture allows the CNC core to execute even the complex processes of the Flexmaster in minimum time. The typical NC set formatting time is less than 1 ms and the CNC interpolation time is 0.25 to 1 ms. The IEC 61131-3 compliant PLC, which handles ancillary movements of the machine and visualization tasks, processes 1,000 instructions in only 0.06 ms, thus reducing unproductive idle time.

### **Compact hydraulics reduce heat penetration**

To keep the machine compact, WINEMA applied an intelligent mix of hydraulic and electric drives. The spindle sleeves for the circularly arranged processing axes are hydraulically powered. "This requires only two hose couplings, and we significantly reduce the heat transfer

into the machine," Neth points out. The external oil cooling dissipates the heat of the hydraulic axes outside of the machine. The stable temperature improves precision – vibration-cushioned spindle sleeves with direct positioning transducers allow a repeat accuracy of less than  $\pm 1 \mu\text{m}$  for the hydraulic servo axes. This results in an accuracy of less than  $5 \mu\text{m}$  on the workpiece, which is adequate for this application. At high speed, the spindle sleeves can reach 30 m/min.

The micrometer-precise control of the hydraulic feed axes is handled by the Rexroth HNC 100-3x assembly in a controller format. Its software takes the special requirements of fluid technology into account and thus separates the drive and control levels. "For the electrical setup of the hydraulic axes, Rexroth IndraWorks provides the same software tools as for the other drives, and this substantially facilitates our work," Neth emphasizes.

### **Real-time communication via sercos cuts cycle time**

The electric and hydraulic drives communicate with the control via sercos. The Ethernet-based automation bus employs strictly deterministic real-time mechanisms. „Combining the HNC with sercos and IndraMotion MTX allowed us to improve our output by 20% compared to the previously available solutions," Neth calculates.

The highly dynamic torque motor for the indexing table also contributes to the improved output. It positions the table so precisely that the hydraulically clamped spur teeth can engage immediately. "This allowed us to lower the unproductive idle time to under 0.3 seconds," he adds proudly.

In the RV 10 Flexmaster, WINEMA also observed energy efficiency requirements. The hydraulic delivery stream is generated by an axial-piston variable displacement pump. In contrast to fixed displacement pumps, it operates on an as-needed basis, considerably lowering energy consumption. What's more, it lowers the level of cooling required.

### Many processes – simple handling

The control simultaneously coordinates several processes. Predefined functions simplified WINEMA's engineering efforts. "Rexroth supported us intensively in all technologies throughout the entire development phase, significantly lowering our time to market," Neth says, emphasizing: "Of course, it is an advantage that Rexroth supplies the entire automation system, which significantly reduces the interface problems."

Manufacturers of large-scale series parts often employ numerous machines by the same vendor, which is why a uniform user interface across all series is important. "Our customers demand uniform and simple handling and programming during operation," says Neth in describing a key requirement. The new RV 10 Flexmaster is therefore based on a proven basic concept, which WINEMA has already implemented in several series. User-friendly software tools from the Rexroth solution helped WINEMA quickly transfer the in-house interfaces to the new RV 10.

Users want to employ several of the machines unattended as the standard mode of operation. The operator then focuses on quick changeover for producing variants. This is where the RV 10 Flexmaster offers a decisive advantage: A complete changeover takes less than 90 minutes. Cam-controlled machines, on the other hand, are down for at least half a shift. "The higher output and faster changeover quickly offset the higher purchase price through lower unit costs, and the users see it the same way," Neth says in summarizing the meetings with interested buyers at the EMO. He is already planning to expand the production facilities in Grosselfingen.

### Motion controls for hydraulic drives

The hydraulics produce wear-free linear movements and, thanks to an open design, can fit compactly even in confined areas. Motion controls that are especially matched to the specific requirements of hydraulic systems combine these advantages with the latest in digital control technology. Decentralized intelligent drives respond like electric drives to the control unit. Rexroth offers an exten-



sive range of motion controls for hydraulic drives. The cabinet-based HNC 100-3x controls up to four axes and supports various control communication protocols such as sercos, PROFIBUS DP, CANopen, or PROFINET RT.

For the motion controls of the IAC series, Rexroth has completely integrated the electronics into the valve. The single-axis control units support open-loop as well as closed-loop operations and feature a Multi-Ethernet interface. Decentralized control units lower the cabling expense.

Both versions offer CNC functions and, similar to the electric drives and controls by Rexroth, are initially set up using the consistent IndraWorks engineering framework. This does not require a profound knowledge of hydraulics. In a highly dynamic environment, the precision of the movements is limited only by the position measurement systems used. ■

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