Highly compact and flexible tool handling solution

The tool terminal developed by Wassermann Technologie in collaboration with system integrator Becker Engineering is characterized by an exceptionally compact design and high flexibility. This is largely due to the open and modular control technology from Beckhoff, with which machine tools can be seamlessly connected to the most diverse control systems available.
The increasing demands placed on cutting technology and the associated requirements for higher flexibility and productivity are leading to an increase in the need for more advanced machine tools. Eberhard Hahl, managing director of Wassermann Technologie GmbH in Eichenzell near Fulda in Germany, explains: "The innovative tool terminal was designed in accordance with these current customer needs. Only the diameters of the tools and tool drums are predefined, while all parameters such as tool lengths, length divisions, number of tools, tool cleaning, tool holders and RFID tool data acquisition are freely configurable. The salient feature is an extremely compact design. It is achieved by having the tool drums run inside one another around one axis instead of side-by-side."

This tool terminal from Wassermann integrates up to three concentric drums and is therefore extremely compact.
Christoph Neuhaus, application software developer at Becker Engineering GmbH in Leichlingen, Germany, adds, “Higher flexibility also means the option to integrate the widest variety of machine tools with the most diverse control platforms. The openness of PC-based control is crucial for this capability. For instance, third-party software can also run on the Beckhoff control hardware, which among other things facilitates access to the tool tables for the individual machine.”

Flexible in structure and use
The concentrically structured tool terminal consists of one, or the addition of up to two more drums running inside one another, depending on application requirements. The tools are handled by a linear unit with an integrated tool changer. The latter places the tools in the drums and also takes them to a tool buffer or directly to a tool changer on the machine. “The tool terminal offers tool management for up to 9,000 tools and is suitable for use as a direct magazine and tool store for tool management, and alternatively as an extension of existing tool magazines or as a central supply magazine for several machine tools,” Eberhard Hahl points out. Julian Becker, application software developer at Becker Engineering, describes the key benefits of the terminal as an intelligent auxiliary magazine. “The tool terminal can operate completely autonomously. For that purpose it has its own tool management, database and sequential control system as well as its own interface to the machine tool. In addition, there is software in the tool magazine itself for external auxiliary handling, interfaces to peripheral devices and integrated data acquisition for the tooling,” Becker says.

The high flexibility of the tool terminal means that the end customer benefits from significant cost savings, as Hahl explains. “In the tool terminal we have designed a standard magazine with a wide range of uses, and that is reflected in its excellent price-to-performance ratio. However, an individual connection to a machine tool, for example, can be realized entirely according to customer specifications if desired. The tool terminal is available as standard in two model variants: S-Curve for up to 280 tools and D-Curve for a maximum of 570 tools,” he says.

Open, scalable and efficient control technology
Becker Engineering has been gaining experience with PC-based control since 2014. According to Christoph Neuhaus, numerous benefits have been achieved: “We benefit from the fact that PLC and additional high-level language applications can be realized on one universal multitasking platform. Another
Convenient and efficient motion control

In a recently implemented tool terminal with two drums, a total of five servo axes are used for fast and precise tool handling. The associated AX5000 Servo Drives and AM8000 servomotors are controlled by a CX2030 Embedded PC with TwinCAT NC PTP. In addition, one rotational axis is provided for each of the two tool drums as well as a vertical axis for reaching the desired drum level, a horizontal axis for reaching into the level and a rotational axis for a double gripper. The pneumatic control for the double gripper is an additional automation task.

Eberhard Hahl adds: "The tools are transferred from the drum to the outside via the gripper rotation axis. This can also be implemented as a telescopic axis in order to transfer the tool directly to a magazine on the machine without intermediate handling."

The motion control application was implemented in TwinCAT software with the aid of PLCopen motion blocks, which Christoph Neuhaus says has proven itself in practice: "The programming of the motion functions with the associated function blocks was very simple and extremely time-saving. Another advantage of the Beckhoff Drive Technology is the One Cable Technology (OCT). It dramatically reduces assembly and material costs and allows the use of smaller cable carrier chains, facilitating more compact designs. Apart from that, the electronic name plate considerably accelerates startup procedures."

For Christoph Neuhaus, other important aspects of PC-based control are the availability of the current Windows operating systems, the user-friendly software update policy, and the simulation options available without additional license or hardware requirements. "The complete system can be simulated on your own development PC. This means, for example, that you can convert the motion axes to simulation axes or map the I/O behavior similar to that with hardware using software simulation blocks," he concludes.