Precision Mechatronics

Fully automatic ink filling at intervals of seconds



Precision Mechatronics Pty. Ltd., Australia, supplies applicationand customer-specific machine solutions for various industries and areas of application. With the development of an ink cartridge filling machine, the company is positioning itself in a niche market; nevertheless, the demands on the machine are anything but small. The fully automatic filling, checking and sealing of the ink cartridges with the highest process speed and ink purity as well as precise dosage requires a powerful controller and a fast communication system.

Side view of the ink cartridge filling machine with leak test station and ink processing drive platform

The ink cartridge filling machine developed by Precision Mechatronics, based in North Ryde (Australia), fills 5 x 50 ml ink every 20 seconds. "A complex and, from the point of view of control, very demanding task, which requires a large number of I/Os and servo axes as well as some interesting subprocesses", says Jason Thelander, CEO at Precision Mechatronics.

Integrated control solution regulates complex operational sequences

When it came to choosing the control system, Precision Mechatronics decided on the PC- and EtherCAT-based Beckhoff control platform with integrated Motion Control functionality: "This is not the first project in which we have cooperated with Beckhoff. The good





Discharge conveyor and ink processing drive platform

experiences gained in the past meant that we could expect the Beckhoff control solution with its high memory capacity and computing speed, integrated Motion Control and local I/Os to suit our machine design well", reports Craig Strudwicke, Engineering Manager of Precision Mechatronics. A total of four Beckhoff AX5203 EtherCAT Servo Drives and eight servomotors of the type AM3024 are installed in the ink cartridge filling machine. A rotary table design enables a large number of processes to be executed simultaneously in the machine. The prerequisites for this are the large storage capacity and the high processing speed of the EtherCAT-based control components.

The filling plant is fed with the ink cartridges by a connected conveyor, whereby each cartridge is checked by a sight-assisted sensor for alignment and correct type of container. Subsequently, the containers are handed over to the back magazine and submitted to a sealing and pressure test. Only then are the ink cartridges filled. The machine can fill five containers simultaneously with differently coloured inks. This purpose is served by a mechanism that rotates step-by-step, driven by a Beckhoff servomotor. The processes are executed in parallel, in order to maintain the required cycle time of approximately four seconds per container. The ink is provided by an ultra-clean supply, which filters the ink, deaerates it and doses it into the individual containers. The filling of the containers is controlled by precision displacement pumps with Beckhoff servomotors. Seven fluid circuits allow an immediate change to a different colour. After filling, the containers are sealed and their QA data are stored, before they are set down on the discharge conveyor.

The heart of the controller is formed by a compact Beckhoff C6920 control cabinet Industrial PC with TwinCAT PLC NC I automation software. "We use TwinCAT PLC NC I, even if no interpolating movements are needed, since all movements take place independently of other axes", explains engineering manager Craig Strudwicke. All safety functions are integrated seamlessly into the I/O level with the Beckhoff TwinSAFE terminals.

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