PC-based control and integrated servo drives in modern digital presses

Highly flexible digital printing leverages precise synchronization and distributed servo drive technology

Shorter product life cycles and increasing customization are changing many areas of life, and the packaging market is no exception. Accordingly, manufacturers must adapt the shape as well as the look of their products to their customers' requirements even as quantities decline to levels as low as one unit. Israel-based printing specialist HP Indigo accommodates these changes with its new V12 digital printing press, in which roughly 100 axes are synchronized and controlled with PC-based control technology, EtherCAT and compact, integrated AMI812x servo drives from Beckhoff.

The fast-growing trend toward individualized products is spurring increased use of digital printing technology in the labels and packaging industry. Since HP Indigo recognized this trend years ago, it has become one of the pioneers and market leaders in the digital printing press field. A prime example is the new V12 printing press. It employs the company's new LEPx technology, which is based on the well-known LEP technology but uses a circulating blanket instead of a conventional impression cylinder. Using the ink developed by HP Indigo, which contains electrically conductive particles, the machine can print almost any color combination (up to 97% of the Pantone palette).

PC- and EtherCAT-based precision
At the core of the PC-based control platform, the V12 press uses a CX2062 Embedded PC. In combination with numerous other Beckhoff components and the powerful EtherCAT communication system, the machine is able to achieve printing speeds of up to 120 m/min with up to six colors. At half the speed, up to 12 colors are possible. The many-core CX2062 coordinates a wide range of tasks. Running TwinCAT automation software, its eight processor cores handle simultaneous closed-loop control of roughly 100 axes while using OPC UA to seamlessly integrate the machine into the plant environment.

As a global communication standard, EtherCAT reliably connects all of the machine's automation components and delivers maximum performance with minimal cycle times. The precise synchronization of all components with the distributed-clocks function of EtherCAT enables HP Indigo to deliver the best printing results possible. All servo axes operate with a time accuracy of 100 ns and a real cycle time of up to 250 µs. Besides the axes – for example, to guide the paper web – many other EtherCAT devices such as the optical inspection systems use the same system time to synchronize their operations.
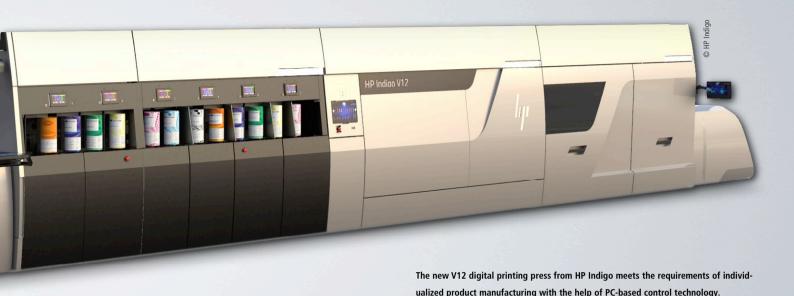
Distributed drive technology
The new LEPx printing technology is supported by maximum machine modularity. Whether the user wants to print with four, six or even 12 colors – everything can be accomplished with a single printing press. Here, the compact, integrated AMI812x servo drives from Beckhoff were ideal to implement a decentralized drive concept. As a result, HP Indigo benefits from the technology's significantly reduced wiring effort and its standardized cabling concept, which delivers immense improvements compared to conventional drive systems. In addition, the integrated cogging torque compensation delivers the best possible printing images.

The AMI812x series, including TwinSAFE STO/SS1 safety functions and an additional I/O interface, allows for highly dynamic positioning in a compact design. Since the integrated servo drives combine power and control electronics as well as the motor in a single space-saving housing, they require only one power supply line and an EtherCAT connection to the PLC. The compact drives with an output of up to 400 watts and an integrated EtherCAT interface (in/out) can even be daisy-chained, which eliminates the need for additional infrastructure components.

Versatile EtherCAT I/Os
Using many EtherCAT I/Os, the new V12 machine generation processes more than 50 signal types from roughly 1,000 data points. HP Indigo employs IP20 terminals as well as EtherCAT I/O box modules with IP67 rating that can be mounted directly on the machine base. For example, several EP3356-0022 box modules for load cell analysis measure the web tension of the print medium via strain gauges.

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The new V12 digital printing press from HP Indigo meets the requirements of individualized product manufacturing with the help of PC-based control technology.

The machine also uses EJ-series EtherCAT plug-in modules, which are mounted directly on the custom-tailored signal distribution board. Their electrical connections are not routed the traditional way via point-to-point wiring to the control cabinet but via the kind of circuitry that is common with printed circuit boards. Compared to conventional control cabinet building, this minimizes potential errors. In addition, the signal distribution board can easily accommodate other components such as circuit breakers, connectors and with appropriate plug-in modules even TwinSAFE functions. This allows HP Indigo to combine application-specific components with standard Beckhoff components, resulting in more standardization.

Efficient automation software
With TwinCAT, HP Indigo relies on a tried-and-tested central runtime and programming environment. With its seamless integration into Visual Studio® and in combination with modern source-code management systems, TwinCAT allows even large teams of developers to collaborate on a single project, which minimizes the overall development time.

The version management integrated in TwinCAT supports the concept of a consistent PLC code basis for different machine series because it makes it easy to generate different configuration versions – also referred to as machine variants. Based on a basic configuration, components can be parameterized or fully activated/deactivated for individual variants. This applies to I/O components such as individual input terminals as well as to complete servo axes and PLC contents. Based on the variant selected, certain portions of the code generation can be included or excluded. If this feature is also used in the declaration section within the engineering environment, it results in a much clearer mapping of the input or output data linkages.

Outstanding system openness
HP Indigo decided to make its supplier strategy as flexible as possible, which is optimally supported by EtherCAT as a global standard that is supported by many vendors. In addition, third-party components can be seamlessly integrated into TwinCAT with EtherCAT. Nevertheless, the company decided to employ mostly Beckhoff components, as confirmed by Alon Gazit, Head of R&D, and Haim Tziosho, Control and Software Section Manager: "We see in TwinCAT and the complete Beckhoff product portfolio a great opportunity for HP Indigo to move the automation technology to a uniform standard and to reduce future development times and costs considerably."

Golan Landsberg, Manager R&D Future Platform, sees the close and open cooperation between HP Indigo and Beckhoff as a cornerstone for success: "The reliable and competent advice on site in Israel plus the global coordination by Beckhoff Germany ensure an optimal exchange of knowledge and information across all international borders. In addition, Beckhoff's global sales and support infrastructure offers customers the security of finding a contact person anywhere in the world."

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