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Cover picture: Siemens AG
Digitalization: All industries, including printing, are facing increased demand for personalized products at the lowest possible price. In the printing industry, software tools are used for all processes in the value chain, allowing printing machines to be flexibly retooled and quickly commissioned.

In 1908, Ford Motor Company brought the Model T onto the market. It was the first car produced on a conveyor belt, and around 15 million units were sold in the years that followed – a record that was not broken for another 45 years. Mass production meant that almost any American could afford a Model T, although individual requests could not be accommodated. Henry Ford supposedly said, “Any customer can have a car painted any color he wants as long as it is black.” Fortunately, it is now possible to order a car in red, blue, or green – entirely according to personal taste.

Trend toward personalization in the printing sector
The trend toward product personalization is gathering momentum, including in the printing industry. A clear example is photo book production – probably one of the most personalized products of all. The
customer is able to decide not only the content of every page but also the number of pages, the format, the print quality, the paper used, and the type of cover. The machines for processing such elaborate products must therefore theoretically be adaptable to each individual product. Retooling times and set-up procedures, whose effect would be negligible in traditional mass production, become significant for the machine productivity.

Even in print media and package printing, where print runs are large compared to those for photo books, there has for years been a noticeable trend toward “short runs.” Minimizing the time required for job changes is therefore an important requirement for modern production plants, and set-up for the new job should also ideally be automated. In addition to a reduction in the number of units produced per job, the form and nature of the products are becoming ever more varied. In many cases, it is now the packaging that decides whether a product will become a sales hit or it will gather dust on the shop shelves. The packaging production plant must therefore be able to handle a highly diverse product spectrum. In addition to printing of basic and special colors, finishing processes must be cost and time optimized and part of the same operation.

This means that modern production plants must have three key characteristics: flexibility, modularity, and availability. These are supplemented by other requirements, such as maximum compactness, a competitive price, and a rapid development process with ever-shorter innovation cycles. A look at the field level confirms this trend: the number of servo-axes involved in the process is constantly increasing. First, they are a cost-effective and flexible replacement for functions that could previously only be carried out with complex mechanics. Second, format presets that were previously simply automated or implemented manually are increasingly being replaced with dynamic servo-axes. Because of the increasingly varied formats involved, servo-axes play a significantly greater and more dynamic role in the process. The consequences of this development and the generally fast-growing rate of automation (control systems, sensors, actuators, etc.) include an increasing number of communication participants in the machine network and, of course, greater demands on software for communication, control systems, and technology.

An integrated engineering solution

The growing complexity is reflected throughout the design and engineering process. It is increasingly difficult to maintain plant data and information consistently because although conventional approaches to the engineering process are for the most part optimized, they are often prone to errors because of a lack of defined interfaces. The solution for greater
Data consistency lies in an integrated engineering process, where all software tools used for design, simulation, dimensioning, and software creation access a common data repository and are always kept up to date and where development processes can be carried out in parallel. To achieve a consistent development process, Siemens provides the Digital Enterprise Software Suite, which includes solutions for machine manufacturing throughout the entire value chain – from the design of the machine and its integration into the production process; to engineering, commissioning, and operational optimization; to service and maintenance during the production process.

In real terms, this means that the integrated engineering process is based on the design tools for mechanical and electrical engineering, in combination with a unified and comprehensive data foundation that is always kept up to date, ideally throughout the machine’s entire lifecycle. When the first draft of the mechanics and the necessary automation and drive components has been created, a workable software project can be produced for the PLC based on stored software modules – without manual intervention. The sequence program can be written and tested via simulation at the same time the machine is being physically manufactured. If a behavior model is stored, process issues such as tension changes for web-guiding machines can also be simulated.

Standardized engineering tools, such as TIA Portal, provide additional benefits during commissioning. This engineering framework optimizes all operation, machine, and process sequences and offers a uniform and consistent control concept. It seamlessly integrates controllers, distributed I/O devices, HMI, drives, motion control, and motor management into a single engineering environment.

Effective machine servicing as a business model

Where the engineering process ends, servicing begins. Today, machine manufacturers can almost always access machines located in the field from wherever they may be – meaning that effective machine servicing has become a business model. Whether the task involves monitoring machines, recording and analyzing long-term data, or implementing targeted servicing measures before plant downtime even occurs, MindSphere – Siemens Cloud for Industry, based on SAP HANA, offers companies the perfect platform for managing their data in order to optimize plants, machines, and energy and resource consumption.

siemens.com/printing
joern.guetzlag@siemens.com

1995

Shaftless drives in the printing sector

2016

Digitalization

The development in the printing industry
Innovative machine designs with integrated engineering

**Digitalization:** The Mechatronics Concept Designer brings teams together and facilitates collaboration between engineering departments at every stage of a project, from sales requirements, conceptual design, and construction to mechanics, electrical systems, and software and automation technology.

The design process for machines incorporates various disciplines and departments. A number of challenges involving sales, mechanics, electrical engineering, and automation can arise during this collaboration. Even closely synchronized and well-established teams frequently encounter coordination problems that, in many cases, become apparent only at a much later stage in the project. With integrated engineering, the individual disciplines can work together more closely and reduce the amount of downtime between the various development stages.

**The virtual prototype – reality's twin**

The Mechatronics Concept Designer facilitates mechatronic 3D modeling and simulation of concepts with multibody physics, including simulation of automation-related behavior. A virtual prototype enables almost complete advance simulation of the machine, allowing problems to be detected at an early stage of the conceptualization process. This eliminates the need to produce a potentially costly mechanical validation prototype and allows for a significantly faster concept design process.

A functional model establishes a common basis for parallel collaboration between the mechanical, electrical, and automation disciplines right at the very beginning of product development. The model can be used to roughly predefine design ideas and then gradually refine them or replace them with detailed drafts. It also allows processes and timing to be tested and logical links to be established. This virtual model can be used by any team member and can always be updated via a central data repository. MCAD and ECAD changes are recognized immediately during simulation and can be compared as required. The machine’s interaction with the PLC program and all sensors and actuators can subsequently be tested during virtual commissioning.

The bottom line: The Mechatronics Concept Designer enables users to accelerate the development process and shorten innovation cycles so they can get their products to market sooner.
Efficient software engineering for complex machine functions

Digitalization: The mechanical functions that must be implemented in increasingly compact machines are growing in complexity. The integration of the Print Standard software package into the Simotion easyProject Generator paves the way for a reliable and automated engineering process for modern printing machines.

Simotion Print Standard – the established software solution for motion control systems used in printing and print finishing machines – provides all the necessary basic functions for the axes in printing machines and uses sample projects to suggest approaches that can be used for all types of machines. The creation of extensive multiaxis designs and the implementation of motion control requirements via several motion controllers are major features here.

Standardized yet individual and flexible
The application provides a standardized interface for each axis, controlled by the higher-level process controller. Flexible synchronous systems consisting of real and virtual axes can be created and synchronized. A modular combination of any number of printing units can, for example, be combined with additional embossing, coating, stamping, or cutting equipment. Different cost/benefit ratios and synchronization strategies can be selected and parameterized with ease via the interface.

In addition to the basic functions, a wide variety of control and technology functions are available – for winders, tension regulators, and register controllers, to name just a few. The open technology also makes it easy for users to integrate their own solutions; plus it offers numerous intervention capabilities.

Reproducible project engineering
In combination with the Simotion easyProject Generator, the Print Standard application offers a unique solution for reproducible and modular software engineering. In addition to standard modules such as report handling, energy data collection, and topology detection, the easyProject Generator contains all Print Standard modules and offers a variety of options for project creation. Users also have the option of storing their own additional modules or adapting existing modules to suit the specific application.

In the basic model, the executable easyProject (PLC, motion controller, drives, and software modules) can be generated with the Simotion engineering system via a wizard extension. Automated operation of the generator is also an option for series machine manufacturing.
Digitalization: Ink streaks are a frequent problem in flexographic printing, and position control errors are one of the possible causes. The intelligent control algorithms of the motion controller can learn a recurring error pattern independently and then take preventive action to minimize the faults.

In flexographic printing, only the raised surface of the printing plate comes into contact with the substrate and the ink. The form cylinder rotates continuously between the anilox roller and the impression cylinder. For the ink to be applied as desired, the operator must ensure that the correct surface pressure between the cylinders is achieved and that rotation is continuous. The arrangement of the cylinders and the unevenness of the plate mean that the load torque is constantly changing, depending on the print motif, speed, pressing force, and so on. The load torque acts as a disturbance variable to the drive of the plate cylinder and causes position control errors that result in the print motifs being depicted incorrectly – errors that recur periodically with the print format. The fundamental control principle is based on measuring the effects of disturbances as control errors and subsequently minimizing these errors with the controller. The delayed reaction, however, prevents changing control errors from being fully suppressed, and the achievable control accuracy is limited by the dynamics in the drivetrain.

Error prevention through learning and compensation

If the control errors are known and periodic, the motion controller can counteract the disturbance at the root of the error by preventing it before it happens. Although the typical position control errors in flexographic printing are periodic for a cylinder revolution, the disturbance profile is unknown. But with a self-learning algorithm such as Simotion Learning Error Compensation (LECo), they can be corrected in advance in the motion controller.

High-performance motion control – even better with self-learning compensation

The open controller structure of Simotion and Sinamics combined with the standardized PROFIdrive profile provides optimum conditions for the development of a self-learning algorithm. The position control of the Sinamics drive controller works to suppress the disturbance in the current control cycle, the shortest possible cycle. Set-point values and control errors refer to the cylinder in Simotion and are thus directly related to load. If LECo is on, the motion control error is learned after just one cylinder rotation, at which point it is immediately used for compensation purposes. The learning algorithm then continuously monitors the result of this compensation. Only the proportion of the motion control error that is attributed to the cycle causing the disturbance (plate cylinder) is compensated. Nonperiodic or otherwise periodic influences are minimized by continued active control.

As is clearly demonstrated in the illustration, the motion control error in the flexo printing machine is compensated when LECo is switched on.
Sophisticated service programs are becoming increasingly important for printing machine manufacturers that are seeking to gain and secure a competitive edge – because, ultimately, customers should continue to receive the best possible support after the machine has been delivered and throughout its entire lifecycle. But machines are often distributed worldwide, so manufacturers usually have access to only a limited amount of information about the current condition of their machines. Most manufacturers also lack a general overview of their fleet of machines, so helpful comparative data are nonexistent as well. But thanks to Plant Data Services and MindSphere – Siemens Cloud for Industry, these limitations are now a thing of the past. Insightful data from machines in locations around the world can now be evaluated and converted into added value in the open IT ecosystem.

Digitalization: The cumulative knowledge of Plant Data Services allows machine manufacturers in the printing industry to provide customer support for printing machine maintenance and enhance the performance of customers’ machines.

Making sound decisions
Printing International – a Belgian specialist in pad printing machinery for a diverse range of materials and industries, with more than 30 years of experience – is taking full advantage of two key services: Plant Data Services and MindSphere – Siemens Cloud for Industry. Plant Data Services collects and analyzes the data that are continuously produced by the individual printing machines. This helps the company make sound decisions regarding preventive maintenance and measures to increase energy efficiency and even machine performance.

The new MindConnect Nano, a Simatic IPC-based cloud gateway, records the data agreed upon between the partners locally on the machine (data collected via sensors, e.g.) and securely transmits this information to MindSphere – Siemens Cloud for Industry. The data provided and displayed on this open cloud-based platform, which uses technology from the SAP HANA Cloud Platform, allow printing machines all over the world to be monitored continuously and their current status to be assessed. The printing head and the servo-axes, for example, are checked for wear and tear in this way. Comparisons can also be made between the printing machines. “Perhaps, for instance, a different kind of ink needs to be used in the tropics in order to ensure that the capacity of the printing machines is fully exploited,” explains Marc Joris, who is responsible for Plant Data Services at Siemens Belgium.

Anticipating problems
Long-term trends can also be identified thanks to the secure storage of data – which remain the customer’s property – so problems are detected and rectified before anything can go wrong. Printing International is among those benefiting: the company has proactively improved its own digital service models for customers thanks to the extensive analyses and has significantly improved the efficiency of its maintenance processes as a result.

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pds.industry@siemens.com
Perfecting the art of inline converting

Packaging: Heidelberg Web Carton Converting GmbH achieves optimum quality and profitability in the printing and inline finishing of high-quality folded boxes from the reel with an integrated Simotion register control.

In the world of printing, it is the functionality of the register control that determines how quickly the desired quality can be achieved and maintained. But other factors that contribute to system performance are the communication and connection of the control system, sensor technology, and drive system. The fewer the interfaces, the simpler and more efficient the processes – from engineering to service. This is what motivated Siemens to develop an integrated register control in the Simotion D motion control system, as well as evaluation units and register cameras designed specifically for this purpose.

Dot detection in the interpolation cycle
Among the most demanding applications of this solution are the modular and thus extremely flexible ICS 670/850 printing and inline converting systems from Heidelberg Web Carton Converting GmbH in Weiden, Germany. As a development partner, the machine manufacturer has contributed considerably to the functionality of the Simotion register control. The register control, based on the Print Standard software package, is embedded in Simotion. The Simotion TRC7000 register control uses an intelligent camera that captures all the dot marks on a printed page at the same specific point in time. Real-time communication means optimum control dynamics, delivering a measurement resolution of under 5 µm and outstanding repeat accuracy, which results in consistently high process and print quality at speeds of up to 1,000 m/min (up to 350 m/min for this particular system). The camera detects dot marks anywhere on the printed image, even on low-contrast backgrounds. So in most cases, there is no need for a separate edge strip for this task – a bonus that significantly reduces the material costs of the system. An optional varnish strobe optimizes recognition on varnishes. Live images on each printing unit facilitate the positioning of the camera and monitoring of register accuracy.
Completely modular machines and motion control
The fully modular design makes the 670- or 850-mm-wide machines stand out. Different process modules on standardized Easy Value Add (EVA) platforms on the main body of the machine can be combined in any sequence based on the particular job. These include HiDef flexographic, coating, and screen-printing modules, as well as laminating and cold foil units. Then there are gravure printing units, various stamping units, dryers, punches, and other additional units. The new design supports reverse-side printing and holographic foil insetting, plus it is able to adapt to the procedures of the future. The system is thus ideal for use in highly flexible continuous production of high-quality packaging products – from the reel to the finished blank. With changeover times of just five minutes from a flexographic printing unit to a screen-printing unit, production of even small to medium batch sizes with frequent changes in precisely the required quantities is extremely cost-effective. “The motion control system from Siemens was the only solution that met our requirement of being able to change, for example, from flexographic to screen printing or to switch functions from synchronous axes to winding axes and vice versa on the fly – capabilities that are essential for quick product and module change-over,” says product manager Werner Schwab.

The modular design of the systems is based on an automation solution with a centralized failsafe Simatic S7-400F system control unit and subordinate Simotion D435-2 motion controllers on every printing unit. The latter use modular Sinamics S120 drives to coordinate the printing cylinders and adjustments for the Simotics servomotors pertaining to each respective module. The distributed D435-2 motion controllers can easily be integrated into the Profinet architecture at various points on the EVA platform, and the drives can be connected on the fly. This also makes the automation cost-effectively scalable for a specific range of applications. All the machine and register control functions can be accessed both on the central control panel and on every printing unit. Set-up and changeover are thus extremely easy, and there is no longer a need for a second person at the central control panel.

Everything for efficient register control
The register control function library extends the functionality of Simotion Print Standard with the addition of modules for process-specific tasks. The centerpiece is the actual register control module, which evaluates the instantaneous values delivered by the measurement system (sensor or camera) and calculates the register correction speeds based on the parameterized printing technology and the geometric machine data. If register movements influence the material – as the clamping fixture does in rotogravure printing, for example – the underlying controller model takes additional downtime into account in the control loop. The module covers the web-web and web-cylinder control modes. There are additional function blocks designed to ensure efficient processes, such as register decoupling and insetting. This means that optimum adjustment of the control system is always possible for the given type of machine.

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joerg.reh@siemens.com
Advertising space on corrugated cardboard

Packaging printing: Corrugated cardboard packaging has evolved into a marketing instrument, so the print quality must be correspondingly high. The Bavarian company Göpfert uses flexible motion control technology to ensure highly accurate direct printing onto corrugated cardboard.

The image of corrugated cardboard printing used to be defined by banana crates, pizza boxes, and moving cartons, all featuring relatively simple motifs. But it is now possible to print directly onto corrugated cardboard in preprint quality, meaning it has become an attractive option for the packaging of high-quality electrical devices and other large consumer goods and for use in retail sales displays. The print-quality demands are correspondingly high. At the same time, ever-shorter product innovation cycles and a high diversity of variants lead to smaller batch sizes, which in turn lead to frequent production changes and machine adjustments. This means print machine manufacturers must continuously improve not only their systems’ quality but also their flexibility and productivity. One of the market and technology leaders in the production of printing machines for corrugated cardboard is Göpfert Maschinen GmbH from Wiesentheid near Würzburg. The family business supplies prestigious companies in more than 50 countries, showing a constant commitment to quality “Made in Germany.” The same also applies to Göpfert’s drive technology and motion control, which for many years have been supplied exclusively by Siemens.

More efficient and flexible with direct drive technology

The Bavarian machine manufacturer was one of the first to abandon the drive wheel train in favor of individual electronic drives synchronized using high-performance motion controllers. State-of-the-art Simotion D motion controllers on the feeder, on each of up to 10 printing units, and on the rotating stamp are cross-linked via Profinet IRT. These controllers are driven by servomotors from the Simotics portfolio and are powered by the similarly modular and therefore precisely scalable Sinamics S120 converter system. For higher-level
sequence control, Göpfert uses a Simatic S7 with a robust Simatic IPC427D industrial PC and failsafe, real-time-capable Simatic WinAC RTX-F PLC software.

This distributed drive design provides a range of benefits for machine operators: shorter changeover and retooling times thanks to the machines’ simpler mechanical construction, greater serviceability thanks to anilox rollers driven directly via the machines’ own servomotors, printing and counter-pressing cylinders on each printing unit, and noticeably improved synchronization and significantly higher control accuracy. Even greater freedom is achieved thanks to the direct drive technology of high board lines, such as Göpfert’s Ovation Line, which differ from conventional approaches in that the board moves above head height. This means, for example, that free stations on machines with eight or more printing units can be retooled and completely prepared for the next task while production is in progress. This keeps downtime short and productivity high. Another advantage of the modular design with Simotion: the drive configuration of every printing unit can be prepared and optimized in the office and then exported to the machine by simply inserting the memory card into the motion control unit. Because the memory cards can be easily duplicated, engineering, commissioning, and device exchange times are significantly shorter.

Using seamless automation technology
Göpfert takes full advantage of the capabilities of Simotion and Sinamics. The machine manufacturer has worked closely with Siemens to develop several functions, built on the Simotion Print Standard library, that are of crucial importance for flexible, high-quality corrugated cardboard printing. Examples include the feeder function with electric cam disks, which enables corrugated cardboard sheets to be drawn from the stack quickly but gently and fed precisely into the printer, and APM print-length correction, which balances tolerances in the print length of individual plates. These special functions operating in perfect unison enable outputs from 11,000 to 20,000 sheets per hour at speeds of up to 300 m/min. Each process – from set-up to normal operation to maintenance – is simple and intuitive to control.

The safety functions implemented in the Sinamics S120 drive system ensure maximum safety during both set-up and operation. In particular, Göpfert uses the Safely Limited Speed function to safely limit the maximum permissible speed, as well as the Safe Speed Monitor, which signals if a drive is working below a specified speed – the speed at which a safety door can open or is allowed to be opened, for example.

To strengthen its technological expertise, Göpfert is looking to continue working on new and innovative solutions with Siemens. A current area of focus, for example, is the use of Simotics T torque motors as direct drives for printing units, making them even stiffer and more dynamic, meaning that, among other things, print-length correction can be further improved and waste further reduced.

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goerg.reh@siemens.com
Shaftless design for premium printing

Packaging printing: The flexo printing machines from XI’AN Aerospace-Huayang Printing & Packaging Machinery Co. Ltd. impress with rapid job changes and user-friendly operation. To achieve these characteristics, the company complemented standard Simotion motion control system software with its own special functions.

The company’s portfolio includes flexo and rotogravure printing machines, cardboard and coating lines, and wallpaper production equipment. The company built its first flexo printing machine in 2000 and adopted electronic motion control with individual drives very early on, using Siemens control and drive technology. To date, Huayang has delivered more than 20 of these flexo printing machines to customers in Asia and the rest of the world. Over the years, the machine manufacturer has established a close relationship with Siemens as an automation partner. Today, all flexo printing machines are equipped with Siemens automation technology.

The company’s staffing: more than 130 of its 900 employees work in development and have already registered more than 60 patents.

High throughput at premium quality
The E-Boss central impression cylinder flexo printing machine is one of Huayang’s premium machines and is used to print packaging materials for food and sanitary products as well as secondary packaging. The machine has a tempered central cylinder, which supports the effect of the interdeck dryer between the printing units and contributes to a sharp printed image. The machine also features a chambered doctor blade system for application of ink to the anilox rollers and a continuously operating winder and unwinder with automatic roll changers. Unique selling points in the Chinese market include innovative job management, a very easy-to-use preset system, and a servo-controlled roller contact pressure system. The machine can print web widths of up to 1,350 mm, works at a maximum web speed of 400 m/min, and can handle 350-mm to 800-mm format lengths. The machine has a color register accuracy of 80 µm and brilliant print quality.

Technology leadership in the Chinese flexo printing market with Simotion motion control
The automation solution is based on the Simotion motion control system, Sinamics S120 drive system,
The E-Boss CI flexo printing machine is one of the premium machines built by Chinese manufacturer Huayang and Simotics S, M, and T servomotors. The Simotion motion control system provides web transport and handles the print unit functions as well as the positioning functionality for the plate and anilox roller. This is achieved with the tried-and-tested software modules contained in the modular Simotion Print Standard software library. The library includes electronic drive and winder modules as well as a high-performance web tensioning controller for web transport through the printing machines. With the Simotion Print Standard software modules, implementing printing machine functionality in a Simotion application is simple and efficient. The modules available in the library are open and can easily be adapted to special mechanical conditions or extended to provide customer-specific functions. Depending on the modularity and performance needs of the given application, the system can be implemented with one or multiple Simotion CPUs. Distributing the machine’s functionality over multiple CPUs supports the clear functional division of the machine modules, thus improving maintenance characteristics. For instance, Huayang optimizes the performance of its premium machines by using one Simotion CPU for the web transport and printing unit and a second CPU for positioning the plate cylinder and anilox roller.

The printing process automation is handled by a programmable logic controller (PLC) program running within a higher-level Simatic S7-315 PLC. It controls the machine movements specified by the Simotion application via a standard interface, which simplifies engineering and diagnostics.
Indian manufacturers go global

Packaging printing: Increasing prosperity across all levels of the population in India is driving a high demand for print media and printed packaging, creating optimum conditions for Indian printing machine manufacturers.

The Indian population is currently the second largest in the world. Experts expect India to overtake China within the next five years. This growth is accelerating the demand for print media, packaged food, and consumer goods – conditions that are creating the perfect environment for machine manufacturers in the printing industry. Among these are specialists such as slitting machine manufacturer SP Ultraflex Systems and the internationally active rotogravure machine manufacturer Kohli Industries, two machine suppliers to the packaging industry.

Specialist in fast cuts
Originally a manufacturer of rotogravure printing presses, laminators, and slitters, SP Ultraflex decided to shift its focus toward developing high-quality slitting and rewinding equipment in 2005. The company today offers the world’s largest range of slitters for flexible packaging.

SP Ultraflex Systems are completely convinced that success is something that can be achieved only when mechanical and technological expertise go hand in hand with state-of-the-art automation and drive technology. It was for this reason that the machine manufacturer chose to use Siemens systems for its automation solutions. 

The new Roboslit from SP Ultraflex with dual turret slitter and innovative trim winding unit
The company’s flagship Robosit dual turret slitter can process plastic films and flexible paper and aluminum-based packaging materials with webs of up to 1,650 mm in width and a maximum speed of 800 m/min. The Robosit can optionally be fitted with a servo-driven positioning system to ensure precise positioning of the cutters. This significantly increases productivity and reduces setup time to less than five minutes. The trim winding unit, fully integrated and synchronized with the machine, is a particularly interesting product for production. As well as supporting a cleaner and less noisy production environment, this technology simplifies waste removal.

High performance for short runs too
For more than 45 years, Kohli Industries has been a leading manufacturer of rotogravure printing presses, laminators, coaters, and slitter rewinders for flexible packaging. The company introduced its “Thea” gravure printing press for small to medium print runs in 2015, and it quickly proved to be a real best seller. The outstanding features of this model are its completely automated reel changeover, web width control, and optimized drying system. The consumer also benefits from very short set-up times thanks to shaftless print cylinders, recipe-based job management, minimum wastage through quick pre-register, and extremely high register accuracy during continuous run, acceleration, and splicing. The multiple-width print cylinders and ink trays ensure a high level of flexibility. What’s more, production and energy costs can be kept to a minimum thanks to the optimized power ratings of all motors, heat recovery from exhaust air, and online monitoring of all parameters by energy meters.

“Thea” features seamless automation and servodrive technology from Siemens, with Simotics motors, Sinamics drives, Simatic HMI, and the latest Simotion Print Standard. Standardized automation minimizes the use of disparate components, offering a user-friendly, cost-effective, and convenient solution for users. Spare parts are thus readily available worldwide. The system can be connected to the existing customer ERP network, and an integrated modem allows easy remote maintenance without additional hardware.

Collaborating with a global partner like Siemens has greatly facilitated Kohli’s efforts to design a sustainable, profitable, and efficient portfolio of machinery, making the company one of the industry’s market leaders.

Experienced automation partner: SA Automation Pvt. Ltd.
When it comes to engineering, both SP Ultaflex Systems and Kohli Industries rely upon the expertise of experienced partner SA Automation Pvt. Ltd., a pioneering automation company located in India’s metros, focusing on converting and textile machinery. The company has a wealth of experience from cabinet building and PLC and HMI programming to complex motion control applications. The young and flexible team uses scalable products from Siemens to fully satisfy customers’ requirements with regard to performance and costs. Commissioning, customer service, and servicing during retrofitting complete the picture.

siemens.com/printing
bernhard.dirsch@siemens.com
Customized decorative containers

**Digital printing:** For its custom-printed bottles, flasks, and plastic and aluminum containers, Machines Dubuit uses a directly driven, electronically indexed rotary table. This minimizes the color offset in digital printing and achieves a higher output.

One way to customize serial products is through digital printing. This allows customer-specific motifs to be applied directly to the product or the packaging. The Parisian company Machines Dubuit is a specialist in printing on bottles, flasks, mugs, tubes, and boxes made from glass, metal, and plastic. If the area of the container to be printed on has a developable surface – whether round, oval, triangular, square, or polygonal; cylindrical, conical, or spherical; symmetrical or asymmetrical – then Machines Dubuit has a solution for printing on it. The French company manufactures its own colors and inks for the machines and supports users throughout the process up to the prepress stage – for example, with color management.

Machines Dubuit introduced digital printing on objects back in 2010, and systems of this kind have been used in production since 2013. The printing principle is a patented, application-optimized inkjet process. In addition to the CMYK standard and the possibility to use special colors, the process allows for digital white and digital varnish application.

**Rotary indexing machine for customized mass-produced products**

Machines Dubuit has developed two machine lines for digital printing on objects. The machines in the 9964 series are rotary transfer machines that offer great flexibility and maximum output. The latest machine of...
As a technological leader, we are always working with our customers to find new solutions that are highly productive, efficient, and stable.«

Didier Trolio, Managing Director, Machines Dubuit

For a rapid change of object type, the machine has quick-release spindle holders.

this kind, a 9964/20 for tubular containers, is equipped with stations for CMYK digital printing plus digital white and digital varnish as well as UV dryers. It has additional stations for screen printing with special colors, for extensive varnish application, and for infrared drying. In total, the machine has 20 stations that are controlled by a master computer using a job list, and operation continues without interruption during a design or motif change. The entries in the job list include large and small series as well as individual pieces. It is thus possible to manufacture even custom-printed individual products with the speed and efficiency of large-scale production.

The number of stations makes the 9964/20 extremely versatile, but it has a substantial diameter and requires a large space for the rotary table. For the required output of 4,000 containers per hour, this rotary table must be repositioned within 300 milliseconds – and the repositioning needs to be so precise that the individual process colors form a clean printed image. “This cannot be achieved with mechanical indexing,” says chief developer Francois Dumenil, “so we developed and implemented electronic indexing for the rotary table.”

Extremely precise positioning

The core element of the electronic indexing is a Simotics T-1FW3 torque motor as a direct drive. In conjunction with the Simotion motion control system, the torque motor positions the rotary table in precise 18° steps in accordance with its division into 20 stations. The crucial factor here is perfect interaction between the high-precision mechanics, the torque motor, and the servo-controlled product spindles, which rotate the container around its axis during the printing and drying processes. “Forces, dynamics, precision: the performance required here can be only achieved with coordinated system components from a single source,” asserts Dumenil. Machines Dubuit therefore included Siemens in the selection and design of the automation components from the outset.

The innovative rotary table application adheres to the color register to an accuracy of 10 µm – an outstanding figure for printing on containers. The print quality achieved even meets the high requirements of the cosmetics industry. Another advantage: the accuracy of the electronic indexing is independent of the wear and maintenance condition of the machine. The torque drive makes the production process more stable, increasing availability and reducing the need for maintenance.

Efficient customization thanks to automation

Customized products cannot be produced in advance and held in inventory, and it is therefore crucial that the digital printing machines of Machines Dubuit have a high degree of availability to ensure the success of entire business models. End customers perceive the production response time to be a direct aspect of product quality. For this reason, a transparent, easy-to-diagnose automation structure; simple maintenance; and rapid service become an even higher priority than in the past. Integrated system technology from a single source, as used by Machines Dubuit, offers decisive advantages in this respect.

siemens.com/printing
keller.stefan@siemens.de
Rapid reel changeover in digital printing

**Digital printing:** The new rewinders and unwinders in the CR and CD series from Goss Contiweb facilitate rapid reel changeover – even at full production speed. The web tension remains stable when the web width or paper quality is changed.
Machines in the digital printing sector are now expected to offer higher productivity and greater flexibility. The fastest digital printing machines are web presses that print continuously. They do not require any complex sheet handling; they allow jobs to be changed without the usual need to change the plate, printing block, or cylinder; and they are not bound to fixed formats. The need for faster reel changeover is becoming more and more important to ensure the productivity of machines as the speed of printing increases. In addition, winding and unwinding stations, splicers, and slitters need to cope with changes in web width, paper quality, and format in digital printing without negatively affecting web tension.

**For any winding diameter and full production speed**

Dutch company Goss Contiweb B.V., one of the world’s leading suppliers of splicers and dryers for web offset presses, has designed and developed a paper web-handling system that is fully geared toward digital printing requirements. These optimized rewinders and unwinders allow reels to be changed regardless of the winding diameter. The system can even handle rolls with greater residues or with just a short reel, as is often the case with rewinders at the end of a print job. The web guidance and winding parameters are dynamically adapted to suit the paper quality and web width of each new print job.

Goss Contiweb also offers nonstop versions of these reel changers, as shown by the “N” in the name of the device (CDN or CRN). The splicer for joining consecutive paper webs together operates according to the “zero speed” principle, which facilitates reliable joining of webs of various paper qualities, finishes, and widths. The length of paper web required for continuous, uninterrupted printing during reel changeover is stored in a buffer/accumulator beforehand. At the end of the print job, the rewinder separates the web as needed and starts a new reel for the next job on a new roll.

**Compact design, streamlined automation**

Despite the enhanced functionality of these new unwinders and rewinders, they do not require more space than conventional stations. The machine manufacturer has also succeeded in creating a very streamlined solution from the perspective of control. Paul Slaats, head of the industrial automation department at Goss Contiweb, says, “We are systematically exploiting the possibilities of the motion control system, both in terms of motion control and for all the technological and PLC functions. This means we need only one controller.” The Safety Integrated functions of the Sinamics S120 converter system and their control via PROFinet are used to deliver the machines’ sophisticated safety functions.

The applicable functions of the user software are easily activated or disabled to adapt the automation to various machine options or modular variants. Simotion provides the basic functions required for this purpose. This means Goss Contiweb needs just one version of the automation program and can retrofit machine options in existing systems without the need for reprogramming.

**Faster remote maintenance, diagnostics, and servicing**

The company’s managing director, Bert Schoonderbeek, stresses, “Version maintenance, remote maintenance, and remote diagnostics are extremely important to us because we now look after more than 1,500 installed systems from our office in Boxmeer.” Slaats adds, “The advantage of the Siemens solution for us is that we can now also analyze a fault reported by a customer after the event. Diagnostics data stored by the system allow incidents to be tracked for up to a whole year – and with a temporal resolution of five milliseconds for processes from the last three days.” This allows Goss Contiweb to resolve the vast majority of all error reports worldwide in next to no time, without the need for an employee to travel to the plant in question.

An optional industrial PC can also be used for long-term storage of the diagnostics data and even more extensive control center operation. The machine manufacturer can thus analyze the machine status on a regular basis – even if no acute error message has been received – and offer the customer helpful information regarding preventive maintenance.

**High-performance digital printing on continuous web presses**

Efficient production and customer satisfaction in the digital printing sector depend largely on highly available, flexible, and high-performance printing machines. The functions of the new rewinders and unwinders from the CD and CR series and the nonstop variants of these systems are specifically tailored to the requirements of digital web printing, allowing Goss Contiweb’s customers to enjoy the optimum ability to fully exploit all the possibilities of digital printing.

Further information:

siemens.com/printing
keller.stefan@siemens.de
Servos for precious cases

**Finishing:** More servo–individual drives, high-performance motion control, and a modular multi-touch operating concept all contribute to the high degree of efficiency of the new casemaker at Kolbus GmbH & Co. KG for lining large-format semifinished goods for high-end packaging and displays.

> »No other Kolbus casemaker has ever had such a high density of servomotors.«

*Jens Erich Beermann, Head of Mechanical Engineering, Kolbus*

The machine manufacturer Kolbus from Rahden in Germany has drawn on its decades of experience in book slipcase production to develop the new DA 290 casemaker for fully automatic and thus very efficient lining of large-format semifinished goods for high-quality luxury packaging and displays. The goal was to enable production without additional product-specific forming tools, in order to achieve the shortest possible change-over and cycle times while maintaining consistent quality. This would enable low unit costs when producing both smaller and larger formats.

The DA 290 is designed for case sizes from around 300 x 200 mm to large formats up to 1,050 x 735 mm. With the former, the machine completes around 40 rectangular, covered cases per minute with turned-in edges on all four sides. These can also be grooved and split in the direction they pass through the machine (lengthwise along the case). It is also possible to add a second cover to a board.

**More servos allow for even greater flexibility**

A quality-related aspect that is even more important for large-format cases than for smaller ones is that the glue must be applied as quickly and as thinly as possible, yet thickly enough...
to guarantee good adhesion in the shortest of cycle times without any material warpage. To offer an even greater degree of freedom, Kolbus has equipped the gluing unit with two Simotics servomotors, a frequency-controlled individual drive, and other adjustment drives. As a result, the deflection of the long glue applicator rolls can be corrected very precisely, thus allowing for a gap size that is accurate to within a few hundredths of a millimeter across the entire width of the covering. Thanks to the servodrives on the rollers, the two application rollers can achieve precisely coordinated speeds, which means that gluing can be optimally adjusted to different products. Equally decisive for a stable process are the two suction bars for lifting and moving the glued cases for wrapping. These can be moved individually or together using servomotors so that products of any length can be moved. Additional servos are installed on the main drive and on the board feed and cover feed.

Overall, more than a dozen servo-axes guarantee a stable, flexibly configurable process that is perfected from the feeder to the stacker. “No other Kolbus casemaker has ever had such a high density of servomotors,” says Jens Erich Beermann, head of mechanical engineering at Kolbus. “Thanks to the individual drives, complex couplings and gearboxes are now unnecessary, which considerably improves accessibility.”

**Motion control at its best**

The motion sequences of all the sections are coordinated by a high-performance Simotion D445-2. The clock generator for the entire system is a virtual master axis generated in Simotion. Subordinate to this are further virtual master axes for the individual sections, to which the real axes are ultimately linked. Kolbus uses all the options offered by motion control here, from simple positioning of axes, to standard gear synchronization, to complex format-dependent curve calculations during the machine’s changeover process. Communication via Profinet IRT allows for the shortest possible cycle times.

**Modular monitoring and control with multi-touch**

The DA290 casemaker is also the first to feature a new class of modular HMI systems that can be applied to all individual machines at Kolbus (the Copilot). The goal is to substantially simplify functions with standardized screen masks and operating sequences that can be individually combined like building blocks, further simplifying engineering. Key components here are robust Simatic IPC477D industrial PCs that can be integrated into the systems. Kolbus is one of the first in the industry to implement multi-touch operation. This means that operator functions familiar from smartphones and tablets can now also be used in industrial systems. A simple swipe on the main panel switches between the individual units in the line. Also included is a favorites bar in which every machine operator can put together his or her own individual menu containing shortcuts to preferred operating screens by using a finger to simply drag and drop them. “When it comes to multi-touch, we are still open to go in any direction and are happy to incorporate the requirements of the market in future developments,” says Beermann.

All the goals of the first innovation phase have been reached, an achievement that would not have been possible in this time frame and with this degree of quality and flexibility without high-performance control, drive, and HMI technology from Siemens.

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»When it comes to multi-touch, we are still open to go in any direction and are happy to in-corporate the requirements of the market in future developments.«

**Jens Erich Beermann**, Head of Mechanical Engineering, Kolbus
Books and newspapers on demand

Finishing: manroland web systems develops innovative finishing solutions for the digital printing age based on tried-and-tested motion control solutions and drive technology from Siemens.

Shorter and shorter print runs, tighter delivery schedules, and a greater variety of formats and versions are the driving force behind the trend of digital printing on demand in the book and newspaper market. Augsburg-based manroland web systems GmbH has developed the FormerLine (for books) and FoldLine (for newspapers) modular folding systems in order to meet these same requirements in finishing. The Simotion D motion control system, the Sinamics S120 modular drive family, and Simotics servomotors are at the heart of the automation of both solutions.

Highly flexible, from reel to book block
The FormerLine folding system – which can be used both offline and inline – is designed for use in digital book production for even the smallest of print runs in industry sizes. In both cases, the printed web is guided synchronously over two or three longitudinal folds and into the variable cutting unit for the crosscut before continuing for further processing. Cut lengths from 145 to 420 mm are infinitely variable, and the flexible former positioning provides the option of variable page numbers for book signatures. With accessories, the system can deliver stacked signatures or an output of up to 6,000 preglued book blocks per hour.

»Smotion facilitates complex drive tasks and allows the extremely high demands placed on our finishing systems to be met in a highly flexible and dynamic way.«

Ralf Losert, Automation Systems Developer, Web Press Division, manroland web systems

Multivariable solution for newspapers and more
The FoldLine multivariable pin-type folder is specially designed for finishing digital newspaper printing. It allows individual broadsheet and tabloid newspapers with up to 12 variable sections or up to 96 pages to be produced cost-effectively. It also provides a flexible option for finishing advertisements, direct mail, cylinder-stapled booklets, and book signatures.

When format changes are frequent, short set-up times are crucial for ensuring profitability. With this in mind, the two folders facilitate a dynamic change of pagination and book structure on the fly as well as dynamic adaptation of cut lengths for all folding options while keeping synchronization times to a minimum. Adjusting the former takes three minutes at the most, and set-up for a different paper type with a web width of up to 1,067 mm takes five minutes.

High-performance motion control...
The clock generator used by the two folding systems is a Simotion D455-2. As with the folding units, the motion controller is also designed for modular extension – preferably via CX32-2 controller extension modules, which contribute the intelligence for the six axes controlled in each case. Addi-
The two real axes of each pair of cutting rollers are operated synchronously in order to achieve a clean cross section in two stages with a precision of 0.2 mm through the conveyor belts. Both pairs in turn follow a virtual master axis that specifies the throughput speed. Cam disk synchronization with the option for modification during ongoing operation can also be selected for each pair of cutting rollers in order to enable variable cut lengths and the formation of spaces between pages. Deviations from the set-point dimensions are also detected and corrected via print marks in the process.

The Simotion Dynamic Servo Control spline uses polynomial functions to create interim reference values (bases) for position, speed, and torque in the rotation speed regulator. manroland uses this solution for the purpose of dynamic torque feedforward control, allowing for the highest possible positioning accuracy of the electronic cam disks. Code readers are used to track each individual page during throughput, divert it via the waste gate if necessary, and guide it to the appropriate destination.

“Simotion facilitates complex drive tasks and allows the extremely high demands placed on our finishing systems to be met in a highly flexible and dynamic way,” says Ralf Losert, who develops software for drives and other technology at manroland web systems. These extremely flexible and high-performance folding systems are now being used by well-known companies worldwide, producing various high-quality products in the smallest of batch sizes despite frequent changes.
Gämmerler, an internationally successful manufacturer of machines for print finishing, sees the trend toward project-based business in a positive light. “Plant operators are able to achieve significant savings thanks to the interaction of several machines all coordinated by a single master computer,” says Oliver Bredow, head developer at Gämmerler. For the machine manufacturer, however, project orders for entire lines also come with the challenge of delivering and commissioning several machines simultaneously. To be able to offer systems that meet the requirements of a digital company, Gämmerler opted for Siemens’ comprehensive automation and drive portfolio.

Flexible handling for printing and packaging
Gämmerler’s flagship product is the compensating stacker – a compact unit for the uniform stacking of folded print products that is enjoying global success. A new version of the stacker – a complete innovation from an automation perspective – is being presented at this year’s Drupa, with the new Simatic S7-1500 T-CPU as its control system. It has expanded motion control functionality and communicates via Profinet with the three Sinamics drives, which are used to position the guides and the pusher. High speed and dynamics can be achieved thanks to the compact Sinamics V90 servodrives. The servodrives were the decisive factor in Gämmerler’s choice to equip future stacker units with the T-CPU, as this will make the system exceptionally future-proof. It is therefore possible that in the future, job-specific format settings could be implemented via the T-CPU and the Sinamics V90 from a central location. This eliminates the need for manual set-up on-site, and with it another source of error.

With a wide diversity of variants and many seasonal items, the picking and packing of folded boxes is far more complex than the handling of normal print products. Gämmerler uses KUKA’s KR 10 R1100 sixx gripping robot for all its handling tasks. Despite its high functionality, the robot can be incorporated into the line and controlled simply and easily via the Simatic S7-1500. “It is only now, with the ability to configure the robot using TIA Portal via the S7-1500, that its use in our sector has become a really interesting prospect, as many of our customers have no
prior robot expertise,” says Bredow. By switching to the Simatic S7-1500, however, Gämmerler enables its customers to benefit from built-in safety technology as well. Failsafe Simatic S7-1500F controllers process standard and safety-related signals. This eliminates the need to provide separate wiring for emergency stop switch controllers and for the relevant associated hardware.

Efficient engineering and diagnostics
For historical reasons, Gämmerler had previously equipped its machines with disparate automation and drive systems. Maintenance of the software with the various engineering tools was correspondingly complex. Switching to Simatic S7-1500 controllers, Sinamics converters, and visualization via Simatic panels means that a single engineering framework, TIA Portal, is sufficient for the entire configuration, programming, and commissioning process. As a result, producing new software takes only a few weeks – when previously the expectation was several months. Project engineer Ralf Merk particularly appreciates the S7-1500’s built-in trace function. “This function speeds up work-step testing, which is concerned with eliminating mechanical collisions.”

Paper jams are a nightmare scenario in the printing industry. The Simatic’s built-in diagnostic functions and the constant communication with control systems, drives, and motors via Profinet ensure that the cause of the malfunction and the error location are visualized automatically. “Customers are intrigued by the possibility of displaying the Simatic panel’s operator interface 1:1 on their tablet,” notes Bredow. In the event of a defective module, configuration data are saved in the control system and automatically transferred to the new module. Further diagnostic possibilities are planned, such as the monitoring of drivetrains for predictive maintenance. Here, critical values are defined for relevant parameters and monitored in case they are exceeded. Warnings are displayed via the Simatic WinCC visualization system, the control system’s built-in web server, or the employee’s cell phone. The service therefore knows a replacement is necessary before a malfunction even occurs.

Sustainable and cost-efficient
Because of the low price of brochures and leaflets, overproduction as a result of job changes is often tolerated. Gämmerler’s idea for the future envisages a higher-level Simatic S7-1500 that ensures that no more is printed than is actually needed. Job-specific machine settings in the form of coordinated formulas for all components involved enable greater cost-efficiency and sustainability. The integrated configuration planned for new Gämmerler projects provides the best possible conditions to achieve these goals.

»The ability to configure the robot using TIA Portal via the Simatic S7-1500 makes its use in our sector a really interesting prospect.«
Oliver Bredow, Head Developer, Gämmerler
Chrome trims stamped on plastic

**Finishing:** When Madag Printing Systems AG employees were building a new hot stamping machine to finish car interior components with stamping foils, they drew on their experience with machines used in the cosmetics industry.
Chrome trims and gleaming borders give car interiors an elegant look. However, real chrome trims are increasingly being replaced by alternative finishing processes such as hot stamping with foils, in which a thin metal layer is pressed onto plastic components to provide a high-quality finish. Previously, metalization was deposited on the plastic by thermal evaporation. The metal vapor produced would be deposited on the component in a vacuum chamber—a complex and costly process.

A tried-and-tested approach to arrive quickly at a new machine
In the cosmetics industry, where tubes, caps, bottles, and even pots of cream are also finished with a metallic look, hot stamping with foils has become established. In this process, a hot stamp presses the metal layer from a foil onto the plastic. Madag, in Fahrweid near Dietikon in the Canton of Zurich, produces these hot stamping machines. In spring 2015, Madag’s managing director, Xaver Stöckli, presented a customer from the automotive industry with a new modular hot stamping machine, which unlike previous machines completely eliminated pneumatics and used only servomotors. In order to meet customer requirements, the machine had to be developed and built in five months. “Years ago that kind of development process would have taken much longer,” says Stöckli. “Today we use a tried-and-tested basic design, both for the control system and for the mechanics, which means we are able to make progress much more quickly.” The servo-axes are controlled by a Simotion D, which in turn processes all motion functions and the application software. The set-point values are transferred to the Sinamics S120 drives using the DRIVE-CLiQ drive bus. To control the 13 axes, the Simotion D was expanded with two CX32-2 controller extensions.

The project team met the deadline, and Madag delivered the hot stamping machine on the date requested. With this new machine, the plastic components are placed by hand in the parts holder on a rotary table. On its way to the embossing stamp, each workpiece is first checked with a line sensor to make sure it is positioned correctly in the slot. Then a jet of ionized air is used to remove dust from the surface—and the plastic component is ready for hot stamping. A heated embossing stamp made of silicon transfers the metal layer from the foil onto the component surface. With up to 4 tons of pressure generated by a spindle via a servomotor, the metal layer is pressed onto the plastic, and then the backing foil is pulled off.

Using existing software components
Guillermo Modena, a developer at Madag, programmed the software for the control system in the space of two weeks: “Because we always use the same hardware, I was able to use both existing software modules from other machines and software components from Siemens—for embossing stamp temperature control, for example, and for torque control during stamping.” This means the stamp’s power can be regulated precisely, as the drive controls the values via the servomotor. “The stamp is usually lowered using pneumatics or hydraulics—simply from lock to lock,” explains Modena. Using servomotors means not only that the stamp can be controlled more precisely but also that it is raised just a small distance above the foil during operation and returns all the way to its parking position only for longer breaks. These breaks are necessary to avoid heat damage to the foil.

Another important software component that Modena used is the Simotion Winder application for foil handling. This application automatically calculates the diameter of the rolls in order to calibrate the exact feed rate and the correct pull. In addition, the foil must lie loosely on the workpiece during stamping; it is tightened only afterward. “All these functions were already included in the software component, which made implementation significantly easier,” says Modena.

Exact mechanics
Madag outsources the production of mechanical components to external suppliers. Precision is of the essence here, as the rotary table must be aligned to a hundredth of a millimeter so that the stamp always presses the foil in exactly the right place on the workpiece. Currently, the second machine is already being assembled on Madag’s premises. Stöckli is confident that the company will soon be selling more of these machines.

The technology in brief
- Sinamics S120 drives and Simotics S servomotors controlled via a Simotion D445-2 controller
- Hot stamping machine operated using a 15-inch Comfort Panel
- Touchpanel and on/off module controlled via Profinet
- Safety functionality via Safety Integrated
- Software programming in Simotion Scout

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Newly automated and fit for the future

Retrofit: With integrated automation in TIA Portal and electronically coupled single drives, BST eltromat International is bringing a new level of flexibility to tried-and-tested rotogravure technology while reducing waste and making the technology more future-proof.

BST eltromat International, an established systems integrator operating in the printing sector, has completely modernized a six-color rotogravure printing press for high-quality vinyl flooring for Forbo Novilon B.V. The central line shaft drive has been replaced with single drives on printing cylinders and blades, and a system has been developed to ensure efficient presetting for all the printing cylinders when resetting the machine.

Compact single drives create more space
An end-to-end automation concept was developed in TIA Portal Version 13 in cooperation with Siemens for this project – the largest-scale turnkey project for BST eltromat to date. All the hardware and software used in the project are integrated in the engineering framework, from the control systems to the HMI and the technology for motion control, drives, and safety. This allows all the components to be configured, designed, and programmed in an efficient, convenient manner.

Compact, perfectly synchronized single drives consisting of a Simotics S-1FK7 servomotor and a Simogear gearbox replace the line shaft drive on each of the printing units. Mounting these drives vertically considerably enhances their accessibility. A Simotion D435-2 with the CX32-2 controller extension ensures precise interaction between the drives. The blade drives can now also be moved individually and independent of the printing cylinders. Their movements can thus be varied, preventing streaks from forming on the printing cylinders. The Sinamics G110M distributed frequency inverter is perfect for this task. It is easily mounted on Simogear geared motors and Simotics general-purpose motors in place of the terminal box. The high degree of protection (up to IP66) allows for use near the machine and saves space in the control cabinet. Profinet and power cables were easily looped through from drive to drive, thus simplifying the installation process.

Resetting with standard functions
The project partners developed a number of innovative machine functions based on the Simotion Print Standard software package. For instance, printing cylinders can be...
referred on the fly and synchronized with ease on a virtual master axis. The group of axes can be controlled via PLC by means of set-point input, plus any angular misalignment of the individual printing cylinders can be corrected manually or automatically via the “regi_star_20” register control system from BST eltromat.

Presetting is also easy and allows optimized machine parameters to be stored and read again at the touch of a button if automatic presetting of the printing cylinders is required. During automatic presetting, the material web is moved at a lower speed and independent of the printing cylinders. This reduces the amount of misprinted paper for each product change from up to 70 m to around 45 m. Another new feature is an automatic start-up sequence that reduces the amount of misprinted paper created when setting up new products by almost half. One of the crucial advantages of the single-drive technology is the fact that it allows printing units to be stopped individually and, for example, to be serviced when they are not needed. Given that the axes can now all be operated at different speeds, it is also possible to use printing cylinders of varying diameters. This creates more scope for new designs.

Efficient safety in PLC and drives
Another new feature is the distributed design of the functional safety system. The interlocks, emergency stop buttons, and cable-operated switches on the machine are monitored by a failsafe Simatic S7-300F. Features incorporated into the Sinamics S120 drive system include the Safely Limited Speed safety function, which restricts the drive speed to the prescribed limit during set-up without the need for additional safety hardware or wiring. An additional Simatic HMI TP700 Comfort Panel has been integrated for monitoring and control.

Outstanding performance in record time
“The effective teamwork between everyone involved has enabled us to produce an impressive solution that delivers consistently high quality with minimal waste, good accessibility, and easy operation,” summarizes Jörg Donnermann, head of automation at BST eltromat. Thanks to the thorough preparation and the prior assembly of almost all the automation technology by the systems integrator, the machine was put back into operation after just two weeks. “Ever since, it has been running with perfect registration like never before, and our operators are very happy to work with it,” report the delighted staff at Forbo.

 Vertically installed Simotics S-1FK7 servomotors with Simogear gearboxes create space on printing units and enhance accessibility

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bernhard.dirsch@siemens.de
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