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Flying splice with PROFINET doubles the yield per employee

The coating system for the Herma Company is the largest individual machine that the Swiss machine OEM Polytype from Fribourg has ever built for the converting industry. Thanks to the use of the latest drive technologies and through the consequential implementation of Totally Integrated Automation, this fully automated system has resulted in an outstanding increase in the production and quality.

The machine is impressive from its imposing size: Herma – based in Filderstadt-Bonlanden – built a new production hall to specifically accommodate the 100 m long coating machine. This will be used to produce adhesive materials on rolls, a semi-finished product for the production of labels. With this new system, Herma has been able to more than double the yield per employee. Briefly, the process involves combining two material webs – the carrier material and the label material. The carrier paper is siliconized, coated with an adhesive and then dried. It is then combined with the label material and wound up as roll.

High requirements placed on the drive technology

This "monster" is not only huge, but also extremely fast. The two material webs travel through the process at a velocity of 1100 m/min – and more specifically, without stopping. This is because the roll is automatically changed and the material web spliced at the full velocity of the material web. Just for the material webs alone, 64 drives must be open-loop and closed-loop controlled in a coordinated fashion. This is complemented by numerous pump drives to pump the process media such as coating material, adhesives etc. as well as the drives for the drying and ventilation systems. Another challenge was in implementing web tensions for the various label materials with different tensions and/or torques. "In order to be able to fulfill these wide-ranging requirements, in a first evaluation together with the end customer, a decision was made to only use the latest Siemens drive and control technology," - explained Jürg Spillmann, CEO of Indur Antriebstechnik AG. Polytype awarded Indur a contract to engineer and program the electric drive and control technology – including the process control system. Indur also built the control cabinets and commissioned the system.

Totally Integrated Automation consequentially implemented

For this system, Totally Integrated Automation was implemented at a high level. All of the actuators and sensors are sensed using a total of 30 SIMATIC ET 200S distributed I/O modules which communicate with a central SIMATIC S7-416-F PN central computer. Among other things, this significantly reduces the cabling costs in the control cabinets. Thanks to PROFIsafe, even the safety functions such as light grid protection for personnel, Emergency Stop buttons and the dryer protection were able to be implemented in a distributed fashion. A WinCC server was used for the central operator control level; this allows the monitoring and input of process parameters such as material web tensions, infeed quantities, dryer and cooling roll temperature, etc. If the server fails, there is

a 100% redundancy through the touch panels that were programmed using WinCC flexible. A WinCC multi-client solution combines the data from the various systems in the Herma environmen

Flying splice

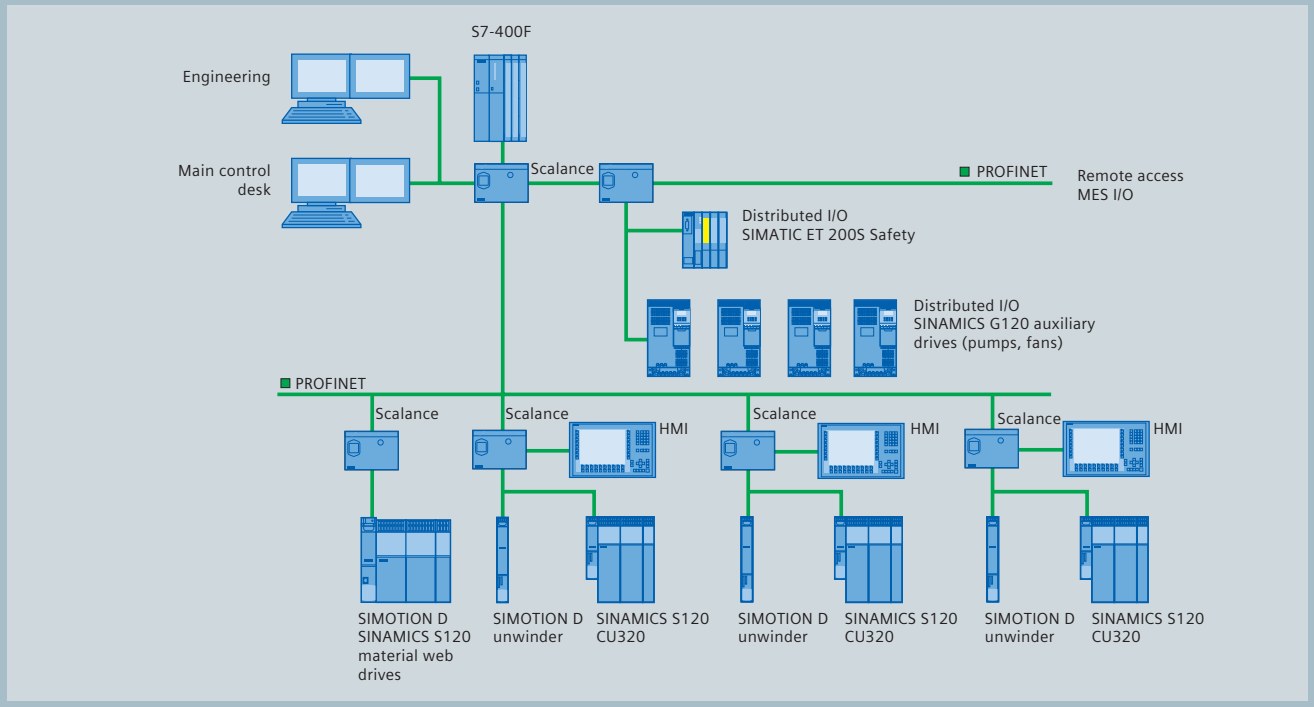
The real crux in the drive technology was the solution for the flying splice when the material rolls have to be changed at the full machine velocity. “The roll that is coming to an end is swiveled into the unload position using the turret, the new roll is accelerated and synchronized to the actual web velocity. At the splice position, the overlapping ends of the material are pressed together and cut,” explained Bernhard Haas, responsible for the project with Indur. The use of the SIMOTION/SINAMICS series permitted an extremely precise position control and exact timing at the roll change. This is manifested by a minimum and reproducible splice length – i.e. the overlap of the old and the new material web – which has a very positive impact on the process and the product quality.

Application support

The Siemens Application Center in Erlangen supported the project – especially when it came to implementing the patented flying splice using SIMOTION, but also with the new safety solutions and the use of the Scalance switches (refer to the box). The so-called “Converting Toolbox” was also used and in part was supplemented and further developed to include new functions. “Just from the quantity structure, the drive solution for this coating system represents real pioneering work,” - Jürg Spillmann is completely convinced of this. “Never before was a similar number of controls and I/O devices networked with this complexity using PROFINET. I would call this a ‘state-before-the-art’ solution”.

Brief overview of the technology

The functionality of the SIMOTION D motion control system – a fixed component of Totally Integrated Automation – was an essential precondition for the solution of the automatic roll change with flying splice. The winder has an additional hydraulic axis, which is also controlled by SIMOTION. The SINAMICS S120 motion control system and the SINAMICS G120 frequency converters from the SINAMICS drive family replace Masterdrives and Micromaster; they had been used in this machine type up until now. They have proven themselves thanks to the compact design in the control cabinets and the closed loop control functions integrated in the drive. For the winder, the drives were able to be directly integrated into the turret. This permitted an extremely compact design. To permit energy recovery, the drives are coupled to the central infeed/regenerative feedback units via a DC link. As a result of the distributed synchronous operation using PROFINET IRT (Isochronous Real Time) an extremely stable material web travel is achieved, especially when braking and accelerating. Machine communication is established via glass fiber optic cables; this required special Scalance switches for the glass fibers. A slipring is used for the winder, where PROFINET is transferred via copper link.



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