



Rexroth Technology leads to "less" – less waste, shorter changeovers – for new flexographic press

Newest generation system integrates frameless motors, regenerative drives, an advanced controller platform and linear motion components for a sophisticated press that provides more productivity and excellent print quality.

Paper Converting Machine Company – PCMC (www.pcmc.com) of Green Bay, WI/USA, is a global leader in tissue converting, packaging, flexographic inline tag and label printing, and nonwovens and envelope technology.

As PCMC began developing a new generation of presses in 2008, the company sought to satisfy several customer requirements – most of which focused on reducing the factors that affect printers' productivity and competitiveness.

"The industry wanted faster changeovers to help increase profitable printing time", said Dave Wall, Engineering Value Stream Leader for Printing, Coating and Laminating at PCMC. "Printers wanted to eliminate waste – both physical waste such as film, as well as wasted time". Customers also wanted to reduce the time it takes to set up registration and impressions to print good products. To achieve those goals, PCMC focused on using servo drive technology to make this step faster and easier.

Two additional factors PCMC wanted to address were reduced energy consumption and reduced system complexity, to keep costs down and make press maintenance easier.

To satisfy these requirements, PCMC integrated a range of electric drives, controls and linear motion products from Bosch Rexroth Corporation (Charlotte, NC/USA, www.boschrexroth-us.com) into the new Fusion Flexographic System.

The Rexroth IndraMotion MLC control system provides a full range of pre-engineered technology function blocks, helping PCMC speed the Fusion's commissioning time and enabling printers to set image registration faster and reduce non-productive changeover time.



Fusion – Wide Web Printing and Converting

The PCMC Fusion Flexographic printing press is an all servo-driven platform that includes up to 21 axes for a ten-color press, or 17 axes for an eight-color machine. There are also seven axes for web conveyance and tension control from the unwind axis to the rewind axis. All axes are connected to the Rexroth control system via the highly synchronous Sercos® bus.

To develop the Fusion system, PCMC worked closely with long-time supplier Bosch Rexroth and local distributor and system integrator CMA/Flodyne/Hydra-dyne (Brookfield, WI/USA www.cmaf.com).

The Rexroth drive and control systems powering the Fusion press include IndraDrive M servo drives with regenerative and DC bus sharing capabilities and IndraDyn T frameless torque motors, all controlled by the IndraMotion MLC motion logic controller. IndraMotion for Printing provides a full range of pre-engineered technology function blocks to solve the most complex printing and converting application. Implementation of these proven algorithms shortens engineering time and minimizes field support typical with implementation of new control algorithms. The easy configuration and the high diagnostic level of the Sercos automation bus reduces engineering efforts during start-up and commissioning. The service computer can be connected to any free port of the Sercos communication system having access to all the Sercos nodes via the Unified Communication Channel (UCC) without affecting the real-time behavior of the bus at any time. »

The redundant ring architecture of Sercos with auto-healing means that an interruption in communication anywhere in the bus will not cause an interruption in motion, and redundancy will be restored automatically as soon as the cause of the interruption is removed. Advanced diagnostics further allow the location of a break to be determined so that this location can be examined for loose or faulty cables, etc.

Reducing Press Setup Time

Changeovers were the first area the development team focused on: Reducing changeover time when a new job is put up on the press adds to profitable printing time. Each Fusion system consists of a large central impression cylinder, eight to ten feet in diameter, radially surrounded by eight or ten printing “decks” with two cylinders, one containing the image and the other applying the ink. All of these cylinders are driven by Rexroth IndraDrive drives and motors.

During changeover, once the color cylinders are exchanged and the press web rethreaded, setting the image registration and impressions is the next step. In the past, this involved time-consuming manual adjustment, deck by deck.

Using Rexroth intelligent IndraDrive servo drives, PCMC developed a new setup feature called Print-Sense. The image cylinder and anilox inking cylinder in each deck are brought together to reach “the kiss point” where the image impression will be correct. IndraDrive motor feedback data generated by each cylinder’s drive is captured and used by pre-established algorithms to calculate when the proper feedback setpoint is reached from both drives, eliminating the need for time-consuming initial print setup.

Drive-integrated Safety Improves Efficiency

IndraDrive systems set new standards in drive engineering, with intelligent functionality, integrated safety features and regenerative power capabilities.

According to Wall, both the safety features and the regenerative drive capabilities provide the Fusion with a competitive edge. “During setup, we can use the IndraDrive Safe Halt feature while we change the plate; normally we would have to build a brake or lockout mechanism to safely hold the axis in position, adding more parts to the system”. The regenerative drive feature lets the Fusion system capture energy typically wasted when machine axes slow or stop, feeding it back into the system power bus to reduce energy demand – a feature that PCMC prominently promotes about the system.

MLC Controller Enhances Printer Expertise

Printers are more than machine operators; they are skilled craftspeople tasked with ensuring the highest quality printing production. To help them exercise their craft, PCMC chose the Rexroth IndraMotion MLC motion logic controller to operate and control the tension and registration of the Fusion press.

The compact IndraMotion MLC system is suited for synchronizing multi-axis systems up to 64 axes. It features pre-engineered function blocks for winding, registration, tension, and other key settings; open system interfaces such as the Sercos automation bus; and support for IEC 61131-3 function blocks and motion sequences. According to Wall, the MLC helps to complete image registration faster, using an integrated end-of-line vision inspection system.

“The vision system shows the press operator the image registration at operator controls; the operator can use the controller to advance/retard a color, or move left/right, to get the registration correct”, Wall said.

Frameless Motors Help Reduce Costs

For major systems like Fusion, cost control is the result of smart engineering that reduces component counts. To accomplish this goal, PCMC, working with CMA/Flodyne/Hydradyne, chose Rexroth IndraDyn T frameless motors to drive 11 of the Fusion’s axes.

IndraDyn T torque motors are liquid-cooled kit motors consisting of a separate stator and rotor designed for maximum torque applications up to 13,800 Nm. The rotor is mounted directly to the extended journal of the cylinder, rather than coupling a traditional servomotor shaft to the axis. The central impression cylinder can be > 80" diameter. In order to hold 0.001" accuracy on a 40" radius, Bosch Rexroth utilizes a 32 million ppr sin/cos feedback device. Bosch Rexroth is one of the few companies in the world with this level of control accuracy.

With Sercos, the position commands to the printing cylinders are synchronized with less than 100 nanoseconds of jitter. This, along with the high-bandwidth servo gains that are achieved with direct-drive motors and IndraDrive Advanced control sections, results in highly accurate print registration that is limited only by mechanical and process influences that are outside the scope of the drive and control system. Doug Anderson, sales engineer from CMA/Flodyne/Hydradyne, worked with PCMC from the outset to select and size the IndraDyn motors.

“One of the strengths that Rexroth offers is its vast array of kit motors”, Anderson said. “We selected one torque

motor size for the large impression drum, which needs to stop within 10 to 15 seconds, and then another size to handle the different widths of the image and color rolls”.

Using the IndraDyn torque motors enabled PCMC to reduce the Fusion’s part count by nearly 60 percent compared to the previous generation machine.

“I don’t know of any other company besides Rexroth that could have supplied us with the range of products that we needed – for example, the frameless motors let us accelerate the Fusion six times faster than in the past”.

Linear Components Deliver Critical Rigidity

A crucial mechanical design challenge on a printing press is the decks mounting the image and inking rolls. These rolls range in width from 42" to 75"; each deck must move in and out for job changeovers when the press is re-webbed and the rolls exchanged. However, once printing commences, the decks must be extremely rigid and hold the rolls in position, to keep each color layer in perfect registration while the rolls spin up to maximum speed.

To provide the flexibility and rigidity needed, each image cylinder and inking cylinder incorporates two Rexroth precision Ball Screws and four profiled Ball Rails. Rexroth Ball Screws and Ball Rails combine high rigidity and high load capacity in compact sizes, engineered to deliver precise tolerances and operate error-free for thousands of hours with minimal maintenance.

“We can’t have the mechanical elements of the press moving around, because that will show up in the print”, Wall said. “The Rexroth Ball Screws and Linear Rails give us the rigidity and resistance to backlash and tolerances the Fusion needs”.

Fusion: Successful Launch

Since the Fusion’s launch in 2010, it has been a success: According to Wall, PCMC has been continuously building machines, secured repeat orders, and is expecting more growth.

“The improved changeover times, the simpler system design, which makes it much easier to maintain and thus increases their profitable printing time, and the energy savings are all helping to contribute to the Fusion’s success”, Wall said.

PCMC credits both CMA/Flodyne/Hydradyne and Bosch Rexroth with contributing to that success – through technology and the support both provided during development and production of the Fusion.

“Working with Rexroth and CMA/Flodyne/Hydradyne we did a lot of complex engineering up front and chose the technology to help us make the system less complex”, Wall said. “Since the Fusion was launched, we’ve had several customers tell us that the most compelling aspect of the design is its simplicity – and that’s helped to differentiate us from the competition”.



Advanced Rexroth technology such as IndraDrive regenerative drives enable the Fusion to operate with increased efficiency while consuming less power.

PCMC was able to reduce the component count in the Fusion press by close to 60 percent, in part due to using Rexroth IndraDyn frameless torque motors and other components.