Servomotors Increase Output In Web Presses

By Robert Morelli, VITS America; Scott Morrill & Tigest Bekele, Industrial Indexing Systems

As bright as Johannes Gutenberg was when he came up with movable type in 1454, he probably couldn't have foreseen the advances we've made since then in putting ink on paper. Today's high speed web presses churn out catalogs, brochures, newspaper supplements, preprinted forms and other sorts of printed pieces at more than one thousand copies a minute, materials that lubricate our economy by putting needed information in front of interested readers. But once that web of paper is printed, it has to be cut to the right length for it to be useful - a sheet of continuous paper thousands of feet long is obviously not a convenient size for reading or mailing.

And that's where a piece of equipment called a sheeter comes in. This mechanical marvel takes that web of paper and cuts it into sheets of a specific length. It doesn't sound very complicated, until you actually see one running at 1000+ feet per minute. Then you wonder how it could run at all. It's a maze of wheels, pulleys, gears, belts, mechanical fingers and a very impressive cutting cylinder moving so fast you cannot see the razor sharp knives mounted on it. And it's these cylinder-mounted knives that do the real work here. As the web of paper is drawn into the sheeter by the infeed roller, it passes under the rotating knife on the cutting cylinder. In an action resembling a scissors, the paper is squeezed between the knife cylinder and another knife blade mounted on the bed of the sheeter. Voila! In less than a hundredth of a second you have a neatly cut sheet, ready for follow-on operations like stacking, folding, etc. The sheeter can be equipped with optional slitting knives that cut the web along its length, thereby producing multiple cut sheets for each cycle of the cutting cylinder.

In the old days - that was just a couple of years ago - the sheeter was permanently mounted in place, mechanically tied to the web press via a lineshaft. The sheeter ran at a speed synchronized to the press speed, and the cut length could not be changed, at least not easily. Making the cut sheet longer or shorter meant some major dismantling and rebuilding of the sheeter - changing out pulleys, wheels, gears, belts, etc. Although it could be done, and the procedure was not that difficult, it took about half a day. Unusual cut lengths - those that were not some standard fraction of the diameter of the cylinder-knife combination - required custom parts costing thousands of dollars and weeks of delay.

And while the sheeter was being changed to accommodate a different cut length, the very expensive web press it was attached to was sitting idle. Once the modifications had been made, there was a period of adjusting, since, like all purely mechanical devices, there was backlash and other positioning error that had to be compensated for so that the sheeter cut at exactly the right place on the web. Running adjustments on mechanical sheeters tended to be very finicky - all this while the press was cranking out 1000+ feet per minute. And the poorly adjusted sheeter was creating large stacks of scrap while the operator was trying to adjust to the right cut length. Like so many modern pieces of equipment, the sheeter has been updated by using digital servo systems. It's a much more docile, cooperative beast these days.

A servo sheeter like the VITS Model L.P. or H.P. delivers some significant benefits over the previous mechanical versions. According to Robert Morelli, Sales Director of VITS America in Blauvelt, NY, a worldwide maker of web press finishing equipment for more than 70 years, "The shaftless sheeter gives you the opportunity to have mobility. You can move the sheeter from one press to another, something that was impossible with a lineshaft-connected machine. As a matter of fact, the first two servo sheeters we sold went to China, and they move them around on the floor. They have about ten presses, and now they can take the roll off the press and cut it off-line, rather than buying individual sheeters for each press. So the expensive press can go back to work a lot more quickly."

"And with servo control," he continues, "make-ready time is dramatically cut. We can change cut lengths in a few minutes. It's just a matter of pushing a couple of buttons on the operator interface

panel. We save an enormous amount of down time."

According to Morelli, the conversion to servo-driven sheeters has given customers a number of other advantages over the previous mechanical models. Cutting accuracy has improved, and the company now specifies ±0.010" at speeds of 1200 feet/minute. At lower feed rates accuracy is even higher, and cut-to-cut tolerances of ±0.005" are common.

And registered cutoff control on the new VITS sheeters is now automatic, a built-in feature that's almost a free side benefit of having servo control. The addition of a high speed scanner to the sheeter enables the machine to recognize pre-printed registration marks on the web. Small changes in cut length are done on the fly to maintain print to cut edge alignment by adjusting the phase relationship of the servo motor powered feed roll and cutting cylinder. The older mechanical systems depended on the sharp eye of an experienced pressman to make this adjustment, and given the very high speeds involved, thousands of sheets could be wasted before the adjustment was correct.

The sheeter runs in two basic modes of operation, in-line or off-line. When running in the in-line mode the sheeter pulls the paper right out of the press and precisely follows the press to cut the printed material. In off-line mode the sheeter pulls the paper off a roll previously made by winding up the output of the press or blank paper right off the roll.

In in-line mode the servo system must provide precise phase synchronism between the press and the sheeter. To accomplish this synchronization, an optical encoder is mechanically coupled to the press and is fed to the servo controls as a speed and position reference. The servo controller drives the motors attached to the feed roll and cutting cylinder. The servo controller accepts operator input as to cut length and press pitch and calculates precise electronic ratios between the press and the two motors to facilitate the correct cut length. The most demanding part of the application is keeping the cutting cylinder phase locked to the press cylinder so the cut occurs precisely at the proper edge of the printed sheet. The operator can also trim the feed servo speed to provide just the right tension between the press and the sheeter without disturbing the cutting cylinder.

In off-line mode the feed roller in the sheeter pulls the paper directly off the roll and provides master position information for the cutting cylinder servo. The electronic synchronization between the feeder and the cutter servos controls the cut length.

The scanner can be used in either mode to keep the cut precisely aligned with the printing on the paper or the servos can be programmed to cut at a multiple of the press pitch, thereby maintaining the proper cut location without the scanner. In either case the operator can make simple phase advance or retard adjustments on the fly.

The sheeter houses a cutting cylinder sitting over a web running at about 1,000 ft/min. As the web of paper moves into the sheeter through an infeed roller, it passes under the rotating knife on the cutting cylinder. The paper squeezes between the knife cylinder and another knife blade mounted on the bed of the sheeter. In less than a hundredth of a second it cuts the sheet, and readies it for stacking and folding. The sheeter can be equipped with optional slitting knives that cut the web along its length, producing multiple sheets for each cycle of the cylinder.

Morelli notes that perhaps the major customer benefit of changing the VITS sheeters to servo control has been in the area of price. Since the new machine offers greater accuracy, greater speed, significantly reduced downtime, press-to-press mobility, greatly improved user-friendliness, and the ability to make adjustments on the fly, you'd think that it would cost a lot more money. It doesn't. Because of reductions in the number of mechanical parts, servo-driven

sheeters are only a few percent more expensive than their mechanical brethren, a hardly noticeable amount when their associated web presses retail in the millions of dollars.

Morelli believes - and sales bear him out - that the servo driven sheeter will likely supplant its mechanical ancestor in the near future. And why not? The new model is better, faster, and - feature for feature - cheaper. Who would have thought you could get all three?