Newspaper Maker Transitions to PC-based Control Network Using Off-the-Shelf PCs and InTouch MMI

USK, WASHINGTON — Ponderay Newsprint Co. was founded by a consortium of five U.S. newspaper publishers and a forest products company specifically to provide a consistent and cost-effective supply of continuous web paper for newspaper printing operations. Located about 60 miles north of Spokane, Ponderay Newsprint started production in November, 1989, with what was then state-of-the-art paper making equipment and subsystems managed by a distributed control system (DCS), programmable logic controllers (PLCs) and digital DC motor drives.

Almost from the start, however, the company experienced small but nagging problems with making the paper and winding it in customer-specified roll sizes. Product quality was acceptable, but achieving it was not as efficient as it could be and the process was not cost-effective. The winding operation was particularly troublesome. After spending time and money on equipment upgrades and consulting services over nearly a two-year period, the company's own Electrical & Instrument Services group solved the problems in-house by implementing a low-cost solution based on personal computers (PCs). The solution provides supervisory control and data acquisition capabilities for the PLC and DC motor drive systems using the Wonderware® InTouch™ man-machine interface (MMI) package.

The result is that the company has attained the production efficiency and high product quality sought in its winding operation — and the new system was implemented in just a few months at a cost of less than $18,000. The solution has worked so well that other PLC-based production systems have now been converted from the original vendor supplied man-machine interfaces (MMIs) and much of the plant is run using a network of PCs that run under Microsoft Corporation's Windows for Workgroups™ (WFW) operating system.
The newsprint production process is as much an art as it is a science, so having very capable control of the process is essential. The manufacturing operation consists of five major applications:

- The wood chip refining process,
- The pulp mill,
- The paper-making machine,
- The winder system,
- The final roll wrap line.

All of these production steps are important, but the winder application provides a good example of the problems encountered with the vendor supplied MMI system. Customer orders specifying the paper thickness, density, and web length and width are entered into the company’s “Millway” roll tracking system. Operators download the information to the Valmet KL1000 Winder by entering the “TAPPI” number, the caliper or sheet thickness of the paper, and the basis weight of the paper ordered. At this setup stage, operators can also modify numerous operating parameters such as the roll diameter, rider roll loading, torque splits (to balance the load between drive rolls for controlling wrap tightness), winder speed, hole search speed, linear footage measurement from one to 10 locations on the “parent” roll, and the roll density of the wind. This data previously was loaded manually, which required keyboard data entry and increased the possibility of typing errors. With the new MMI system, a recipe program handles setup of operating parameters, if a customer orders a standard size. All recipes are adjustable and can be over-ridden for special order handling.

A Hole Detector system, installed on the paper machine, passed information to the winder to alert operators when to slow the machine down from its normal 4,500 feet-per-minute rate to a search speed, so that the sheet could be observed to determine whether a splice was required. This was done so that holes in the web coming off the parent reel would not cause a sheet break, which would cause lost production time as well as necessitate splices. When detected, larger holes (up to an inch in size) were indicated with ink marks on the parent roll edge so the defect detection system could anticipate hole positions and reduce the winder speed in time to prevent sheet breaks.

The system also required positioning of the multiple slitters used to cut the web into specified sizes. Up to 40 trim recipes could be used for as many as 15 different roll widths. The PLCs specified where each slitter was to be positioned during the production cycle and no cycle could be started unless the recipe has set the slitters in position.

Both the winding and the slitting operations presented major problems and trying to resolve them was like trying to solve a simultaneous equation. It simply couldn’t be done using only the PLCs and DC motor drive controls with the original MMI system.

In-House Team Solutions

The team that created the enhanced systems includes Charles Green, Electrical & Instrument Services manager; Rich Hatten, systems engineer; Dennis Killmer, pulp mill E&I technician; Ronney Blair, shift E&I technician; and Gary Gangl, DC motor drive technician.

The original control system was running in Siemens 150U PLCs, each with a hard disk drive and two serial communications cards. The operator interface was little more than a keypad, an RGB color monitor, a video graphics card and a curve generator card. “The hardware was expensive and it failed frequently,” Charles Green said. “For example, the serial communications boxes by themselves cost $6,000 each. In addition, the software had to be loaded from the hard drive to the PLC memory each time a run was made, and it consumed the entire memory. We couldn’t make any enhancements or add-ons to the PLC logic because there simply was no room. We felt we were going to have to replace the PLCs in order to fully implement the hole detector and winder auto-slowdown system. We also knew that our slitter positioning system was not optimized because with some recipes we were frequently locked out of startup.”
The single most important quality problem resolved with the new software was the issue of "soft" paper rolls. "We had programmed the PLCs and DC motor drives to start the winding of each roll with an 84/16 torque split percentage between the takeup reel and the parent roll," Blair said. "We could never quite figure out why the rolls weren't wrapping properly, even though all systems told us that programs were being run properly.

"We discovered the problem immediately upon implementing the MMI software because on-screen real-time trend charts showed us that the torque split was actually 50/50 upon startup of the winder, not 84/16," Blair added. "It changed to the proper percentage and modified appropriately as the paper was wound, but it was wrong at the start and that was why we were getting loose wraps and sometimes breaks. The PLC expected to see the 84/16 torque split and that's the data it assumed it was receiving, rather than getting the real split from the motor drive. Until we had the visibility into the system, we never realized the programming error existed."

The winder solution was created using the InTouch MMI to provide visibility into system operation and to do a better job of collecting real-time data from the hardware. It uses Intel 486/50-based PCs, each with 32 megabytes of RAM memory, a 250 M byte hard drive and a 20-inch SuperVGA monitor. Each system has an Ethernet III communications card, a serial port comm card port, and a 32,000-tag InTouch package. Incorporating the PLC programs with the PC software has freed up at least half of the 64 K bytes of memory in each Siemens PLC. This means that Ponderay doesn't have to replace the Siemens PLCs. And because of the highly visual operator interface screens that were created, the more extensive operator alarms available and the use of on-line help documents, the E&I Services staff has eliminated 90 per cent of all maintenance calls and downtime on the winder.

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The slitter positioning problems that had frequently locked out winder startup were also eliminated with the new system. Once again, startup problems were caused by a data feedback fault resulting from a position sensor not being read properly by the PLC program, and no one diagnosed the error until the MMI provided the visibility into the real-time data. "On the 'slitposi' page of our
InTouch program, operators now enter position requirements by keypad entry or by selecting from up to 40 trim recipes for up to 15 different roll widths that can set,” Blair explained. “This system tells operators where each slitter is positioned during the cycle and provides visual feedback of that data. There are numerous faults that could stop the ‘slitpos’ and the winder systems from starting, and all of these can now be alarmed to the operator as well as tell him what to do to correct the problem, via pop-up windows.”

In addition, the hole detector now can report results automatically to the MMI, to indicate actual hole sizes and the linear footage measurements between holes in the parent reel. This data is compared, hole size significance is rated on the fly, and the linear footage is back-calculated to slow the winder automatically, without operator intervention. The ink marking system has been eliminated and Ponderay has saved a $50,000 investment in auto-braking equipment for the winder.

Company-wide MMI Use

The PC-based supervisory systems have been so successful that they have been extended to manage all paper production operations. Nine PCs are directly involved in plant operations and another 16 used for office automation tasks are linked in the same Windows for Workgroups network. The InTouch MMI consists of three PCs that run the refiner, one used for the pulp mill, one on the paper machine and one on the winder system. Two units are used for development and as an engineering workstation. PLC control has been added on the refiner system and on the Reliance DC motor paper machine drive system. The InTouch application numbers close to 10,000 tags so far. In addition, an interface is provided to a Novell Netware 3.11 network that runs the company’s “FactNet” statistical analysis package.