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Linear-Position Sensors

MTS SENSORS

PLC Concepts Inc. Reduces Waste and Setup Time in Paper Slitters / Stations with Flexible Linear Positioning Sensors Case Study

Document Part Number
551439 Revision A

R-Series Model RF Flexible Sensor

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ENSURING PRECISION FOR OPTIMAL EFFICIENCY

It is hard to find faster manufacturing operations than those in pulp and paper production. According to TAPPI, more than 300 million metric tons of paper and paperboard are produced each year at hundreds of facilities. To meet that demand, paper winders, which are used to slit large rolls into smaller sizes, operate at speeds averaging 2,000 to 6,000 FPM depending on machine size.

To meet industry standards, rolls of paper typically cannot deviate more than ± 1/32nd of an inch. Slitters need to position automatically to accommodate the various sizes today's on demand customers are looking for. In addition single drum winders use individual stations to build the rolls. These stations also require precise positioning to align them properly with the used slitters, and to park the unused units when necessary. Improper alignment or slippage in any element can easily translate into thousands of dollars in waste material and lost production. Even worse, this can directly affect a mill's relationship with a customer by impacting delivery times, and potentially allowing product through that does not meet proper specifications.

PLC Concepts Inc. is a control integration company primarily specializing in quality controls for the papermaking industry – specifically winding and sheeting systems. In the past 14 years, the company, in conjunction with JNE Engineering, has helped paper companies in the western hemisphere retrofit their equipment to remain competitive and continually address the needs of one of the fastest growing industries in the modern world.

"In addition to dealing with the ultimate commodity – paper – the demands of the industry require highly advanced technological equipment," Jeff Turcotte, Controls Integrator with PLC, explained. "This presents companies with a challenge – staying ahead of the technology curve while keeping the costs as low as possible. Achieving the repeatable precision these machines require while maintaining profitability has been something the industry has struggled with since its inception."

This has been a particular challenge in paper slitting applications where deviations greater than a 1/32nd of an inch no longer can be shipped. Typically the older systems end up unable to position the elements properly. This results in manual intervention by the operators. When this occurs it usually triples the setup time, and with multiple size changes every day production suffers. Couple this with less staff, antiquated machinery and wear and tear – all can directly impact the efficacy of the machine and profitability of the mill.

For decades, most slitters and stations used expensive electronic encoders to gauge deviations in the cutting process. While effective to a degree, the nature of the technology came with significant limitations. First, they required a large amount of festoon cabling systems and were attached to the rack and pinion portion of the assembly restricting access.

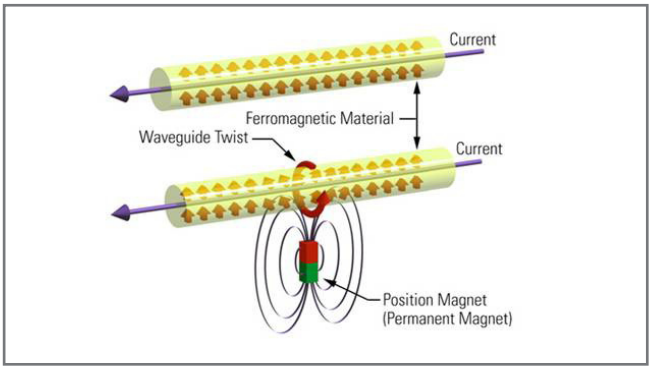
Second, when they did fail, slitters would have to be taken off line for extended periods for repairs – that often, due to the proprietary nature of the existing control systems, added to the cost considerably. Finally encoders experienced considerable wear and tear due to vibrations, heat, dust, and mechanical deficiencies in their mounting system. Some systems also used magnetic tapes with a movable photo eye to measure the leading and trailing edge of the slitters. These systems were not reliable over time for the most of the same reasons the encoders weren't.

"Our customers needed a better solution – one which eliminated the electrical deficiencies and provided a solution to the mechanical wear issues," Turcotte said. "At the same time, they did not want to abandon the major capital investment they have made in their current slitters. Our solution was to take a step back and look for alternatives to linear encoders."

That solution led them to MTS Sensors and the Temposonics® R-Series Model RF sensor. Because the Model RF sensor uses a fixed electronics head and simple moving magnet, PLC was able to remove all of the problematic and costly festoon cabling systems associated with a traditional moving encoder on each section. In addition, the MTS sensor is wired directly into the system, allowing traditional PLC controllers direct access to the feedback data. This enables faster positioning sequences and easier detection when a blade is outside acceptable parameters.

Systems using encoders required the entire encoder assembly to transverse the machine during normal operation. This constant movement and the cabling required increased the likelihood of damage and failure from constant cable flexing, along with the mechanical Festoon cable management system wearing from constant movement. In addition, after many hours of operation the rack and pinion system used on the AC motor driven units would suffer significant wear, resulting in potential drifting over time.

By utilizing the R-Series Model RF sensor from MTS, PLC removed virtually all moving parts from the process. The R-Series sensor uses a process known as magnetostriction to provide the level of control desired. Magnetostrictive-based sensors work by inducing a sonic strain pulse in a specially designed magnetostrictive waveguide by the momentary interaction of two magnetic fields. One field comes from a small movable permanent magnet (the system's only movable part) which passes along the outside of the sensor tube, the other field comes from a current pulse or interrogation pulse applied along the waveguide. This interaction produces a strain pulse, which travels at sonic speed along the waveguide until the pulse is detected at the head of the sensor.



The magnet's position is determined with high precision by measuring the elapsed time between the application of the interrogation pulse and the arrival of the resulting strain pulse. Consequently, accurate non-contact position is achieved with absolutely no wear to the sensing components.

"The results have been nearly universal acceptance," Turcotte said. "Replacing encoder systems that require extensive movement with minimal contact magnetostrictive sensors have helped our customers increase production, improve costs and reduce downtime." We install machined brackets that hold the magnets in a precise position relative to the sensor, and require virtually no maintenance once they are in place.

Additionally, PLC Concepts was also the first company in the world to utilize a 480 inch flexible sensor. Previously the limitation was 300 inches or less in these applications. The longer sensors, first installed on a single-drum winder in 2004, allowed them to eliminate the encoders for each station. Now the same features that were applicable to the slitters would now be available for the individual stations. Additionally, flexible sensors are ideal for these applications as the can be easily packaged and shipped, regardless of the length of the sensors.

PLC is now offering the solution for use with many different PLC controller protocols. Originally they used Start/Stop and Canbus interfaces to utilize the capability of multiple magnet systems. With the addition of Profibus, the MTS sensor feedback went directly into the controller so it is easy for the various technicians or electricians to verify that the system data is correct. While most modern systems utilizing this system work with the Profibus interface, PLC is exploring Ethernet/IP as industry progresses in that direction.

“Modern systems work at speeds high enough to allow for real time data acquisition from the sensors,” Turcotte said. “This, coupled with the various advances in drive technology, allows an operator to control the elements in a fast precise manner that simply wasn’t possible in the past.”

ABOUT MTS SENSORS:

MTS Sensors, a division of MTS Systems Corp., is the global leader in the development and production of magnetostrictive linear-position and liquid-level sensors.

MTS Sensors Division is continually developing new ways to apply Temposonics® magnetostrictive sensing technology to solve critical applications in a variety of markets worldwide. With facilities in the U.S., Germany, Japan, and China, MTS Sensors Division is an ISO 9001 certified supplier committed to providing customers with innovative sensing products that deliver reliable position sensing solutions.

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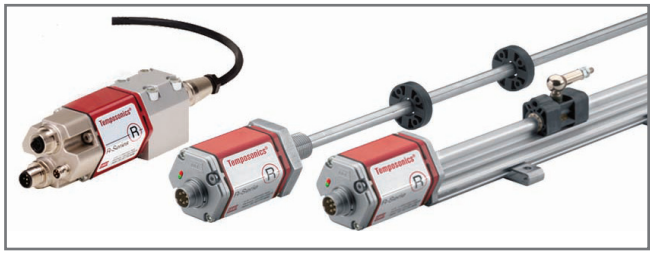

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Document Part Number: 551439, Revision A 06/13

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