Web Handling Machines: Automation Heavyweights

Rockwell Automation drives systems experts from all over the globe contributed to this comprehensive technical update.

Today’s automation takes on many forms. Up close, it’s a robot assembling components or a sensor detecting that an item is complete. At the other extreme is a giant web handling machine with its intricate combination of rolls, aerodynamics, and tension control to transport material through processes and machine sections with zero defects.

OEMs take charge of the industry, partnering with control suppliers like Rockwell Automation Drive Systems to engineer faster, smarter and more productive machines and processes. User demands for higher productivity, return on investment, and reduced waste have charged suppliers with proliferating global capabilities and advanced technology.

For a top-down view of today’s web handling industry, Automation Today talked with industry experts from Rockwell Automation Drive Systems to review past evolutions, take stock of today’s market, and predict future solutions. Rockwell Automation Drive Systems (RADS) has more than 50 years experience working with OEMs to supply web handling machines controlled by drive systems.

This experience, combined with a unique knowledge of full product line integration, makes RADS an expert in providing Complete Automation solutions that add value to automation processes.

Web handling: The basics

The Web Handling Research Centre at Oklahoma State University defines the term ‘web’ as materials that are manufactured and processed in a continuous, flexible strip form. Web materials range from extremely thin plastics to paper, foil, textiles, metals, and composites.

‘Web handling’ means the physical mechanics of running and controlling continuous strip materials (webs) through web processes and machines. The goal of web handling is to transport the material through the process without incurring costly defects like wrinkles, breaks, or incorrect registration and guiding.

Reaching this goal depends on the machine’s components, which are constructed by the OEM and on mechanical or digital system controls, which are engineered by control suppliers such as RADS.

The Web Handling Research Centre works with OEMs and control suppliers like RADS to advance the technologies that make the transport and control of continuous strip materials faster and more productive. This complex research involves web and roller velocity, roller radius, wrap angles, slip flow, web tension, web mass per unit area, and web permeability.

Production machines that handle a web include pulp and paper mak-
Stone Container, Ontonagon, Michigan, teamed with Rockwell Automation Drive Systems to install a coordinated drive system on a paper machine that has increased production speed and improved the quality of its corrugated medium.

How web technology evolved
Advances in web handling technology have picked up speed during the last decade. Demand for increased production, quality, and information, in parallel with the goal of decreased installation and integration costs, has established a need for integrated, sectioned digital drive systems as opposed to the mechanical approach of the past.

This means that in the majority of today’s continuous web processes, materials move through machines via a series of tension-programmed drive and motor sets, networked to programmable controllers, I/O and operator interface.

High-precision sheeting machines, for example, are traditionally controlled by a mechanical coupling between the knife and the draw drum. Today, more end-users and OEMs are migrating toward independent configuration of the knife and draw drum machine control, each of which uses high-performance AC and servo drive technologies.

Incorporating new technologies such as high-speed communication, open architectures and faster processing speeds into today’s processes is critical for users to stay competitive. New technologies help differentiate a process—and often, a final product—from competitors.

The key advances
Drives coordination into a system is, for the most part, an engineering function, rather than a direct end-user task. But to choose the right OEM and drive system expertise for a web handling process, it’s important to understand the recent, most significant advances in industry technology.

These are DC to AC technology in drives and motors; advances in logic and drive control; and open networking and improved diagnostics.

DC to AC technology in drives and motors: Part of managing web movement involves speed. Trends toward higher, faster performance of web-based machines have led to more sophisticated algorithms for web tension control, which have yielded more stable web transport, less web wrinkling and significantly fewer breaks.

Advances in AC drives have made achievable torque and subsequent speed control loop bandwidths significantly higher for pulse-width-modulated AC drives as compared to DC drives, causing many web processors to consider retrofits on outdated DC-based machines.

Installing an AC drive system on a paper machine winder backstand, for example, delivers more effective closed-loop tension control across a wider operating range, without the interrelated over-voltage and over-speed concerns of DC systems. AC motors, due to their relatively uncomplicated rotors, are more compatible with higher motor speeds. This is especially important on machine rolls with smaller diameters.

Also, with AC-based systems, the bi-directional energy can be shared between drive sections via a common DC bus supply. Power absorbed from and re-generated back to the line is at near-unity power factor. Overall system cooling is more effective.

Advances in logic and drive control: Today’s drive systems allow greater integration of closed loop, digital tension control and greater implementation of feed-forward reference control. On paper machine winders and unwinds, this means more accurate profiled torque control and less material waste. These capabilities are gradually becoming inherent in new drives, which allow for better control and integration of the entire process.

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An advanced web handling machine featuring four plant floor-based Allen-Bradley PanelView terminals—these are used to set machine speeds and draws, take up slack, monitor load sharing and machine stop/start.

Rockwell Automation Drive Systems has applied new drive technology toward achieving more accurate tail length control. This is essential in unwinding processes where webs are cut and spliced at machine speed.

At these splice positions, the length of the sheet ‘tail’ must be accurately controlled to minimise sheet flapping and prevent overlapping. The RADS solution uses...
WHAT IS ROCKWELL AUTOMATION DRIVE SYSTEMS?

Rockwell Automation Drive Systems (RADS) provides coordinated drive systems and system integration solutions to the printing, metals, forest products, pulp and paper, film and paper converting, fibre and textile industries.

RADS, which is part of Rockwell Automation’s Engineered Systems and Services Group (ESSG), combines global industry experience and integration expertise with OEMs, and the leading technology of common platform products such as Allen-Bradley/Rockwell Automation ControlLogix and ProcessLogix.

The international web handling market is very competitive. With machines speeds and productivity increasing, now is the time for users to re-examine processes and take advantage of new technology. The ideal solution will minimise waste, improve productivity, increase the bottom line and compete in the worldwide market.

What’s coming tomorrow?

The global web handling market has been called cyclical, with a series of both installations and retrofits occurring throughout North America, Latin America, Europe and Asia. The typical buying cycle begins with a general discussion and research into the process by the user – a stage when many now seek advice from both OEMs and other suppliers to ensure protection of investments.

Machine selection often happens next, with control vendor selection following.

Drive control data to track the position of the splice, rather than relying on time delay strategies. The result increases accuracy, reduces waste, and increases productivity.

Open networking and improved diagnostics bridge process information: Web handling has benefited from recent advances in operator interface software and diagnostic capabilities. Today’s process control managers can access data at the device, system and overall process control levels.

Manufacturers of drive products and systems have incorporated high-speed diagnostics into drive and system products for analysis of both the devices and the driven processes. Open networks allow communication of both real-time and historical data. This means line speeds are faster, production is higher and quality is better.

Retrofits of existing machines are gradually increasing and deliver increased productivity, low maintenance costs and more process flexibility.

In recent years, the web handling market has been tough on machine suppliers, especially in North America. The cause is global competition, lower North American capital expenditures, and new machine suppliers. Other factors include Europe’s economic unification and instability in the Asia-Pacific market.

With OEM market domination presiding in Europe and Asia, the need for multiple partnerships and global resources to complete a solution has significantly increased. While this enables users to choose the best of breed, it also requires a more knowing view by suppliers on how turnkey solutions should be managed.

In many applications today, RADS serves as controls supplier and also as product manager. A multinational converting company recently installed two coaters in Europe, major components of which were built in different countries.

The drives were engineered in one location, and the supervisory software was developed in another. In addition to acting as system supplier, RADS engineered and coordinated the multiple-site sourced system by leveraging industry and technical expertise and completing the job on schedule.

Another challenge affecting global web handling users is the need to integrate multiple technologies in single applications. In Latin America, for example, where retrofits are more common than new installations, users look to integrate existing DCS systems with advanced drive systems.

These technologies must communicate on a single platform. RADS is in a unique position to meet these needs by combining decades of engineering expertise, intense teaming experience with OEMs, and the leading technology of common platform products such as Allen-Bradley/Rockwell Automation ControlLogix and ProcessLogix.

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This paper machine was upgraded from manual to automatic speed and torque regulation – a technological advance that reduces speed variances in different sections of the machine, which often caused reject paper or waste.