# Trends Forcing Innovation in Tension Control

By **Mark Breen**, Marketing Manager at Dover Flexo Electronics, Inc

While it wasn't the case 35 years ago, most flexible packaging printers and converters today know that by retrofitting their web-fed machinery with direct tension-sensing and control equipment they can control their overall process better while preventing poor quality in finished roll material.

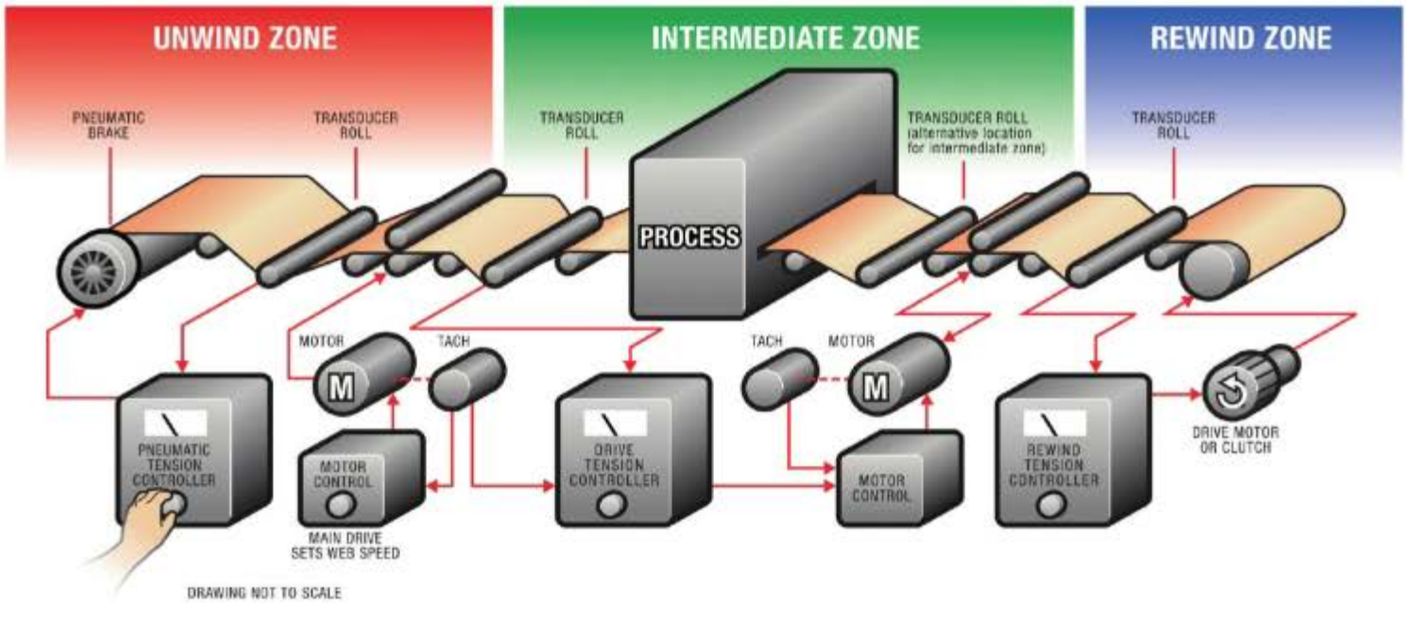
When we look at the factors that shape the evolution of tension control products for the converting industry there are several key drivers of technological change for us today, and several macroeconomic trends driving innovation in the indus-try.

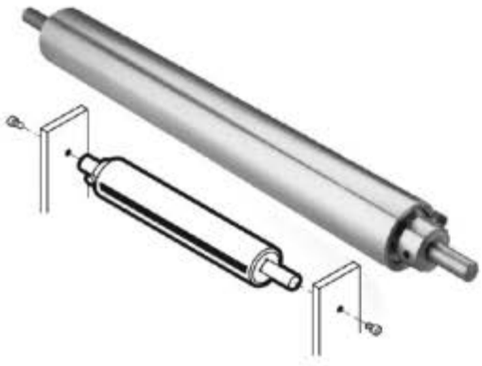
Flexible packaging converting and printing—one of the manufacturing segments growing at a healthy pace globally—has been the leading industry force for inno-vation from the manufacturers of tension measurement and control equipment over the past two decades.

## Competitive and Regulatory Forces Downstream Force Changes by Machine Builders

Product line segmentation by the consumer packaged goods manufacturers, and the necessity of differentiation due to intense competition at the retail level, have forced increased demand for shorter print runs, faster time to market, more deco-rative aesthetics, longer shelf life and environmental-friendliness for packaging. Cost-containment, environmental conservation (green) and security drivers have pushed the demand for thinner films, improved film barrier characteristics, em-bedded security technology and package size minimization.

Web machinery builders and press manufacturers respond to the challenge by designing presses that yield faster turnarounds, greater process versatility, in-creasing sub-process and finishing capabilitie, and the capability to print on a wider variety of substrates and to deliver shorter print runs.





Tension Roll transducer: an idler roller with tension sensors built-in at each roll end.

Tension control equipment manufacturers have likewise had to respond to the fast turnaround demands and substrate variety by developing control devices that are quick to install and setup and easy-to-use. The tension sensors and electronics must operate over a wider substrate tension range, for a broader se-lection of web widths, in more challenging industrial environments, and with more input and output capability.

Also, The RoHS Directive from the European Commission has already had a strong impact on the design and manufacture of products for many North Ameri-can electronics manu-facturers as they scrambled to meet the regulatory compli-ance to remove lead solder and other "hazardous" materials from their products and their manufac-turing environments. Compliance with the current directive is not optional for electronic device manufacturers selling into Europe.

Product development by the tension controls manufacturers has had to keep pace with the printing industry roughly over time. Although the innovation re-quired by the converting industry hasn't been nearly as rapid nor drastic as we've seen


Older, larger, analog tension controller


Current, compact, digital tension controller

in some other industry segments like robotics, motion control and computer processing.

With respect to direct tension measurement, the sensing tech-nology hasn't changed much in recent years since the low cost and reliability of foil and semi-con-ductor strain gauges remain unmatched for most web tension applications.

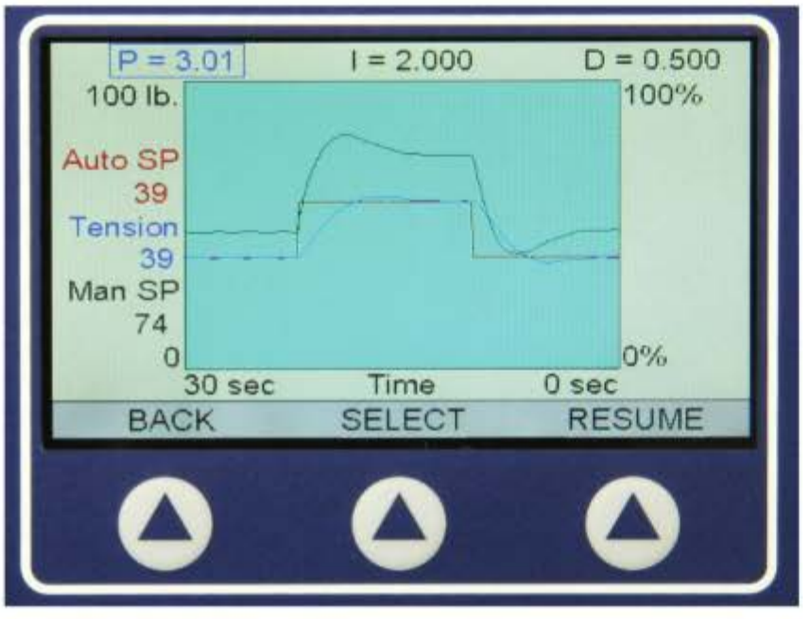
Tension transducers (aka load cells) are still the predominant sensing device in a mature market due to their relatively low cost, their reliability and the lack of any better tension measurement solution to be discovered.

Controller technology is a different story. Tension control-lers that use the tension signal input from the load cells (to make a closed-loop tension control system) have been advancing continuously through the efforts of the world's competing tension equipment manufacturers. As with the consumer electronics device in-dustry, microproces-sors shrink and become more powerful. The number of fea-tures and benefits that can be realized in a single industrial electronics device is increasing too. As an industry, the tension controls manufacturers are leveraging the technologies and components (like touch screens) that have been growing in popularity for years in the consumer electronics sector.

Features such as adaptive tuning for applications with rapid accelerations or de-celer-ations, digital calibration and touch screens with color displays are now common. When a new tension controller with more advanced technology, a larg-er feature set and a smaller footprint becomes available on the market, and at a reasonable price, users can often justify the retirement of an older controller on a cost/benefit basis.

Tension controllers are evolving incrementally in the sense that while they still take input from the tension trans-ducers and put out a compensated control signal to a drive, or a clutch or a brake that's deter-mined by a tuned PID algorithm. To-day's digital processors allow finer tuning capability than those of yesteryear.

One example of a recently added software feature that is helping converters im-prove their




TuneView shows how tuning changes in the PID algorithm effect changes in tension over a selected time frame.

tension control and web process consistency is an easy-to-access P.I.D. tuning feature, branded as TuneView™. This feature allows the machine operator to view a time-lapse line graph of fluctuations in tension and make ad-justments to the system's Porportional gain, stability and response values. The operator can change P.I.D. values and see a graphic of real-time output re-sponse. This allows fine tuning of the process to achieve a flatter system re-sponse.

## Connectivity and the Migration of the Tension Control Function

Tension, temperature, static electricity, speed, web path alignment and many other process variables need to be controlled in the creation of defect-minimized flexible packaging. Fortunately, the converting industry has plenty of competition between the auxiliary component suppliers to keep pace with the growing sophis-tication and expectations of the customers in this marketplace.

Other sources of competition that tension control device manufacturers have to contend with in the blossoming age of the Internet of Things are from the smart drives and the PLC manufacturers. New drives and PLC's are now equipped with PID algorithms that can control tension. This capability reduces the converting plant's need for standalone tension controllers. It also increases the pressure on the tension controls equipment manufacturers to build more connectivity capabil-ity into the tension sensors and the sensor interfaces that are integrated into the process machinery and presses.

We see the future of the standalone, fully-enclosed full-featured tension controller as giving way quickly in the next few years to network-connected smart tension transducers and amplifiers with self-diagostic capabilities. These smarter tension-sensing devices will connect to idler rollers in the web path the same way they do today, but their built-in fault detection and self-diagnostic capabilities will reduce machine maintenance costs and allow increased machine up time.

The tension controls manufacturers are all assessing which connectivity proto-cols to pursue in the next few years. Which ones will win? Ethernet/IP? Profinet? Modbus TCP/IP? We're all paying close attention to these market forces and others. ■


### ABOUT THE AUTHOR

Mark Breen is the marketing manager at Dover Flexo Electronics, Inc. Now serving its customers for 45 years, Dover Flexo manufactures components and systems for the measurement and control of process tension in converting, flexible packaging and web printing applications. Products include tension transducers, indicators, automatic controllers and pneumatic brakes. You can contact Mark at mbreen@dfe.com.