

Plug-and-Produce

The faster, smarter way to put mechatronics solutions to work in packaging automation

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A new approach to creating mechatronics solutions, called “smart mechatronics” is widely available and leverages an array of online design tools and advances in mechatronics controllers and software.

One of the most constant and consistent challenges consumer packaging companies face is to find new manufacturing technologies that can help them be responsive and ready to face rapidly shifting consumer trends and preferences. They need technology that can help them improve productivity, achieve faster changeovers and more sustainable production—while keeping their production line footprints lean and flexible.

This isn't all they're looking for: consumer packaging companies also want manufacturing systems with interfaces, integrated sensors and software features that make it easier to leverage the intelligence, connectivity, and productivity enhancements that Industry 4.0 technologies and automation solutions promise to deliver.

As a result, many packaging automation OEMs are incorporating smart, connected components and subsystems into their next-generation machines. Built upon an array of online design tools and advances in mechatronic control, hardware and software, a new technology concept called “smart mechatronics” is becoming more widely available. Smart mechatronics focuses on intelligent ready-to-use systems that are more sophisticated, yet easier to specify, order and deploy.

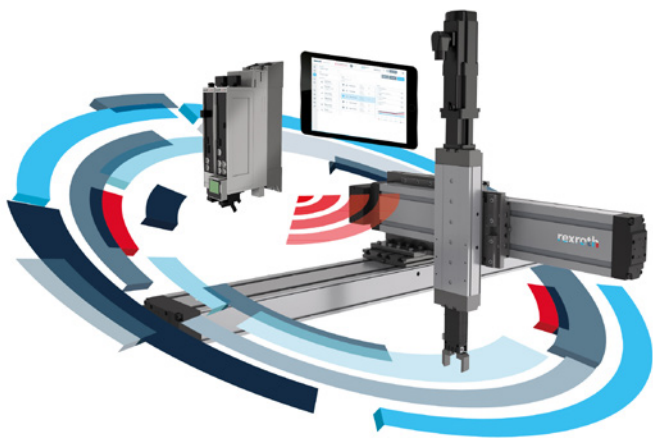
This new approach in automation can be used to improve packaging machine applications such as package sealing, embossing and package forming. It also has the potential to improve the development and performance of Cartesian robot handling and pick-and-place systems, which are critical elements in many automated packaging operations.

Mechatronics Packages Multiple Technologies into Single Solutions

Mechatronic systems are already an essential part of this manufacturing landscape—extending and expanding the value of linear motion and automation technology. This integration of linear components, electronic controls, software, electric motors, and sensors provides a versatile toolbox for machine builders to engineer and commission complete manufacturing systems for demanding applications.

Mechatronic technology suppliers like Bosch Rexroth are leveraging the advantages of intuitive interactive design tools and improvements in digital controller technologies to give packaging OEMs and end users the capabilities that let them “plug-and-produce, perform and proceed.”

This outcome is driven, in part, by packagers who, more and more, seek production machinery that offers both



As part of its new Smart MechatroniX family of mechatronics solutions, Bosch Rexroth recently launched the compact, plug-and-produce Smart Function Kit for Pressing.

versatility and simplicity. The goal is to achieve quicker time to market by simplifying the engineering task for systems that can quickly shift to make different variants or add new functionality on the same production line.

To satisfy this demand, packaging machinery OEM engineers want to streamline how they specify, purchase and commission mechatronic components, using online tools that deliver complete, intelligent systems ready to operate “out of the box” with minimal or zero machine programming.

At the same time, next-level mechatronics must support transparent production processes, with features that automatically capture process data and enable real-time condition monitoring and predictive maintenance.

Smart mechatronics technology is now available to satisfy many of these requirements. Used widely in other applications ranging from product assembly and metal forming to single- and multi-axis robots for material handling, these systems are also particularly well-suited for packaging end-of-line functions.

New Smart Mechatronics Solve Pressing and Sealing Challenges

This coming-of-age for smart mechatronics is opening more possibilities for customization in packaging equipment. For example, Bosch Rexroth recently developed a compact, plug-and-produce smart “function kit” for pressing. Suitable for many different industries, it can be easily implemented for use in packaging applications such as bag sealing in form, fill and seal (FF&S) production lines.

This type of smart mechatronics system can greatly reduce the time, cost, and complexity of implementing new or custom FF&S capabilities. The kit is offered as a complete mechatronic system, from one supplier, that seamlessly integrates an electromechanical cylinder (EMC), electric servomotor and drive, motion controller and industrial PC, power and communications interface and browser-based HMI software compatible with standard HTML platforms.

The concept allows for versatility as needed, but it can be used, for example, to precisely control electromechanical pressure to seal filled bags or to join multiple bags in a single

group. Embossing product logos or promotional labels onto existing containers is another application.

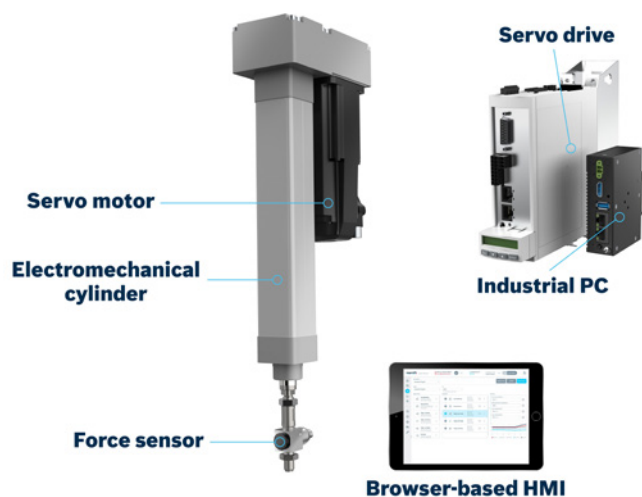
Until the advent of smart mechatronics, machine builders may have developed their own mechatronic assemblies by ordering and integrating separate components. However, this process is often cumbersome and time-consuming.

In a typical scenario, the mechanical engineering group may be responsible for specifying and ordering one set of components, while the electrical group orders its components. Not only is this more challenging for the purchasing department, but the engineering staff is then tasked to make it all fit together physically and program the functionality. Smart mechatronics can eliminate that complexity, providing a complete realization of the plug-and-produce concept.

Bosch Rexroth has simplified the process to achieve this concept. First, they are deploying advanced, well-designed online configuration tools that make it possible to specify and order all the components as a single part from one supplier.

The engineers at a packaging OEM can enter parameters such as stroke, workpiece size, and cycle time, which then generates an output that can be verified and includes a complete set of CAD drawings that can be integrated into the overall digital plan of the FF&S system. In this way, a complete bag-sealing tool or subsystem can be ordered as one part number with a single mouse click and shipped with pre-programmed motion sequences ready for implementation.

In addition, a system like this can come with preinstalled operating software and automatic parameterization of the servo drive, so no motion control programming knowledge is needed to bring it online. It features a drag-and-drop graphical user interface that lets operators build production sequences—e.g., for sealing together a set of juice bags—simply and intuitively.



A key advantage the Smart Function Kit for Handling offers for packaging systems integrators and end-users is its intuitive online configuration and ordering tools.

The “smart” in smart mechatronics includes more than just simplifying ordering, integration, and startup. These systems can also incorporate force sensors that can track and report each motion sequence: was the proper force applied, for the proper length of time, to ensure a correct seal?

As this sequence is typically repeated hundreds or even thousands of times per hour, the system's controller can measure and record each motion cycle for quality control purposes. This kind of information can give warning about malfunctions or other issues, which can be used to drive preventive maintenance programs, as well as incorporated into overall equipment effectiveness (OEE) analysis.

This is the kind of critical, real-time data that's essential to Industry 4.0 production systems—and it is as easy to implement and utilize as the rest of the smart mechatronics kit operating software.

Versatile New Handling Systems with Smart Mechatronics

Many packaging lines use automated mechatronic handling systems extensively, both linear robots and multi-axis systems. Whether for transferring material from one part of a production line to another, or for end-of-line applications such as case packing and palletizing, linear robots and multi-axis mechatronic systems provide high performance and reliability.

They are commonly built-in similar fashion to other mechatronic systems: linear modules, servomotors, drives and controllers ordered separately, along with individual orders for items such as power and communications cabling and the HMI (often pieced together from different vendors at the best cost for each item).

Then the systems need to be integrated. One common challenge for handling systems is connecting the x, y, and z axis linear modules, especially if their physical connections don't incorporate well-engineered physical interfaces. Another time-consuming engineering step is planning and implementing the cable runs in the system—including all the engineering drawings that document these steps.

Similar to the Smart Function Kits from Bosch Rexroth for pressing and sealing operations, the new generation of smart mechatronic handling systems will also provide true “plug-and-produce” platforms for Cartesian and multi-axis systems.

Smart mechatronic handling systems will utilize intuitive, well-engineered online configuration and ordering tools that streamline the process for specifying all the components

needed for a given packaging application. This is particularly useful when multiple linear modules of different sizes and weight-bearing capacities need to be ordered and integrated.

Without smart mechatronics commissioning systems, it can be time-consuming to capture all these key specification details when ordering linear modules and servomotors separately. Equally valuable, smart mechatronics for handling systems will come with preinstalled operating software and automatic parameterization of the servo drives. Drag-and-drop programming of motion sequences to configure a range of common pick-and-place functions can also be provided.

This will make it possible for packaging system OEMs to quickly design and integrate single-axis or multi-axis handling systems as part of a new installation. They will also be able to rapidly update existing packaging end-of-line systems when changes in production or product mix call for Cartesian functionality.

And as with other smart mechatronics solutions, these smart mechatronic handling systems will support real-time data capture and integration with higher-level machine controls, as well as the ability to export data via interfaces such as OPC UA to provide valuable productivity and quality information.

Plug-and-Produce Technology Transforms Mechatronics

Smart mechatronics offers a new, Industry 4.0-ready way to simplify the effort required to configure, order, integrate and begin using high-value mechatronics systems in packaging machine applications. Complete solutions, delivered in a single package or “kit” that's ready to plug-and-produce, has the potential to reduce the time and cost required to build packaging machines.

For packaging companies, as well as the OEMs supplying their production systems, there are advantages to working with a single mechatronics supplier with a complete portfolio of products and components, easy-to-use online configuration tools and a proven record of creating high-performance smart mechatronic solutions specifically for the demands of today's packaging industry.

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Similar to the Smart MechatroniX function kits for pressing and sealing operations, the new generation Smart Function Kit for Handling systems will provide true “plug-and-produce” platforms for linear robot and multi-axis systems.

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