



# Are You Ready for Gen3?

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**Gen3, the latest generation of packaging equipment, has a servo-controlled design that provides easier operation, maintenance, and integration.**

**H**ave you heard of Gen3? If not, you will. It's shorthand for Generation 3, and it refers to the latest generation of packaging equipment. Succeeding all mechanical Generation 1 machines and Generation 2 mechanical-servo hybrids, Gen3 equipment is designed from the ground up to be servo-controlled. As a result, it's easier to operate, maintain, and integrate than its predecessors.

In a servo-controlled mechatronic packaging machine, electronics and software replace mechanical components. Instead of using mechanical line shafts, cams, gears, and other devices, electronic motion control shrinks the machine footprint and streamlines structures as well as increases reliability and reduces maintenance.

Gen3 machines also combine motion and logic and often operator interface, temperature control, programmable limit switch, and other previously discrete functions in a single controller. This combination eliminates time-consuming handshaking interfaces between motion controllers and programmable logic controllers.

Many packaging machinery manufacturers have begun building Gen3 machines. Some of these manufacturers include

Harro Höfliger Packaging Systems, Inc. (Doylestown, PA), Bosch Packaging Technology (Minneapolis, MN), SIG Pack Systems AG (Beringen, Switzerland), Uhlmann Packaging Systems LP (Towaco, NJ), Weber Marking Systems, Inc. (Arlington Heights, IL), Klöckner Tevopharm (Sarasota, FL), and Norden, Inc. (Branchburg, NJ).

As an example of a Gen3 machine, a liquid filler FLM 4080 from Bosch Packaging Technology targeted to the pharmaceutical industry is a fully servo-driven system with an electronic drive shaft. Available in cleanroom or isolator-equipped versions, the filler is described as a "world design". The base unit is built in Germany and shipped to the company location nearest to the customer for finishing. The finishing involves the installation

of controls, infeed/outfeed, pumping systems, and change parts. An intelligent time-pressure system provides programmable bottom-up filling and minimizes product contact parts (SmartFill, Bosch). However, rolling diaphragm or rotary piston pumps also may be specified. The machine can accommodate fills ranging from 0.25 to 500 mL. A touch-screen control panel and servo drives allow operators to store and recall set points for repeatable production runs. North American customers may choose Gen3 controls from one of two companies: Rockwell Automation (Milwaukee, WI) or Elau Inc. (Chicago, IL).

Gen3 machines are especially well suited for pharmaceutical packaging. The combination of integrated motion, logic controls, and fewer mechanical parts results in smaller, more-modular machines with broader production flexibility. This translates into faster, toolless changeover and reduced maintenance requirements. Perhaps most important, electronic machine control simplifies the tracking of production data for electronic records that are used for validation and regulatory compliance. Control language standardization and the use of pretested off-the-shelf software libraries also help reduce FDA audit time, expedite new product launches and shorten operators' training time.

Dovetailing the introduction of Gen3 packaging machines is the work of the OMAC Plug-and-Pack Workgroup. As a segment of the OMAC Users Group, which was organized in 1997 to develop open modular architecture controls, the Workgroup has been dedicated to the creation and adoption of this control technology for packaging machinery since 2000. Workgroup members represent all facets of the packaging industry, including packaging equipment buyers, packaging machinery manufacturers, and control technology providers as well as educators, trade association officials, and analysts. Advancing packaging machinery automation through the application of the Plug-and-Pack concept is being accomplished by five working committees: PackML, PackAdvantage, PackConnect, PackLearn, and PackSoft.

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## Packaging Forum

The PackML (packaging machinery language), one of the first guidances released by the OMAC Plug-and-Pack Group, improves equipment interoperability by standardizing terms for machine status and data output. The result is Plug-and-Pack integration. One of the first pieces of equipment with PackML is a thermal-transfer printer (SmartDate 3, Markem Corp., Keene, NH). The printer's latest software revision displays machine status using PackML terms such as *stopping*, *ready*, *standby*, and *producing*, and records the time spent in each state. This function makes it easy to calculate machine performance and optimize packaging lines. "This really hasn't been possible before because machines have not had output data in a uniform way before," says Fred Putnam, PhD, PackML team leader.

PackML naming guidelines for Modes and PackTags also have been accepted and will be included in the next release of the Workgroup's publication, *Guidelines for Packaging Machinery Automation*. PackTags define data elements related to machine performance so inter- and intramachine data senders and recipients can communicate. Tags also carry a PML prefix to identify them as PackML tags and to differentiate them from other systems tags. Modes define and specify the range of activities related to packaging machine maintenance, setup, and operation.

The PackConnect and PackSoft committees currently are addressing interface guidelines. PackConnect ensures interoperability at the drive-controller interface as well as the ability to communicate with various device-level buses regardless of the equipment vendor. The PackSoft committee's goal is to provide a common look and feel to the software regardless of platform and to facilitate translation between platforms. To this end, the committee has endorsed the IEC 61131-3 programming standard for industrial controls and plans to work more closely with PLCopen, a group committed to ensuring IEC 61131-3-compliant products and to expanding the standard. The global IEC 61131-3 standard defines the syntax and semantics of a unified suite of programming languages for programmable controllers. Relying on an accepted standard means a reduced learning curve as users change applications or move between different brands

and types of controls. The standard also provides a basis for the machine model that the PackML committee is developing and supports the educational efforts of the PackLearn group. The PackLearn committee's goal is to develop a standardized mechatronics curriculum to educate machinery builders and users about the guidelines for digital logic, motion and communication in modular packaging systems and their implementation.

Finally, the PackAdvantage committee is defining and explaining the business benefit of these technologies. A case study prepared by the PackAdvantage team that compares a mechanical (Generation 1) cartoner with a Gen3 unit showed that the servo-based unit achieved a higher output: 150 versus 135 packages/min. The Gen3 unit is also 15% smaller, costs 30% less, and experiences significantly less downtime than its mechanical counterpart. When problems occurred, the troubleshooting Gen3 unit averaged 3 min. compared with the mechanical unit's 120 min. However, the greatest benefit of the Gen3 cartoner is most likely in the changeover process during which it performs a size change in one-third of the time and reduces ramp-up to optimum performance from 4 h to 5 min. The servo-based equipment also represented a substantial decrease in sanitation and maintenance time.

Pharmaceutical manufacturers and packaging equipment suppliers are adopting Plug-and-Pack guidelines. Pharmacia Corp., now Pfizer (Peapack, NJ), will be one of the first pharmaceutical companies operating a machine because the company placed one of the first orders. The tube filler Nordenmatic 2002S from Norden, Inc. (Branchburg, NJ) combines PackML with a unified motion-logic controller, (PacDrive, Elau Inc., Chicago, IL). Plug-and-Pack attributes also are available in controls from several other suppliers such as Rockwell Automation (Milwaukee, WI), Bosch Rexroth Corp. (Hoffman Estates, IL), Baldor Electric Co. (Fort Smith, AR), and Siemens (Alpharetta, GA). To date, most other Plug-and-Pack machine orders and installations that follow Plug-and-Pack guidelines involve flow wrappers, which form, fill, and seal product inside pouch packaging.

To prove that the Plug-and-Pack guidelines work and to encourage the specification and design of conforming equipment, the workgroup is organizing a demonstration project. The project will apply the guidelines that were approved in June 2003 to a flow wrapper and will incorporate machine components and application software from various suppliers to show how seamless the system can be. A spokesperson from sponsor ARC Advisory Group (Dedham, MA) will describe the Plug-and-Pack project scope, cost, objectives, and schedule at PACK EXPO Las Vegas, an exhibition organized by the Packaging Machinery Manufacturers Institute on 13-15 October 2003 in Las Vegas, Nevada. Results of the Plug-and-Pack demonstration are scheduled to be presented at PACK EXPO International, 7-11 November 2004 in Chicago, Illinois. The testing will be conducted by the Louisiana Center for Manufacturing Sciences (Palmyra, PA), another OMAC User Group partner. The demonstration project enhances a PackML pilot test involving a control-drive retrofit on a wrapper at Hershey Foods Corp. (Hershey, PA).

### What's next?

To improve Gen3's scalable, standards-based hardware and software foundation, Gen4 packaging machines will incorporate a higher level of software content. At The Future of Packaging Engineering Forum held in March 2003 at the headquarters of Elau AG (Markttheidenfeld, Germany), Klaus Bender, professor at the Technical University of Munich (Munich, Germany), predicted that by 2010 software will account for 60% of the cost of a packaging machine. The remaining 40% will be split evenly between mechanical and electronic content. In comparison, Gen3 machines contain roughly 40% software, 40% mechanics, and 20% electronics.

In a presentation at the same event, Thomas Cord, research and development manager for Elau, predicted that Gen4 equipment will address other packaging machinery trends, including simplified operation and diagnostics, integration of processing and packaging, vertical integration with manufacturing execution systems, and expanded regulatory compliance requirements. **PT**