



## Motion Control: Product Handling, Re-Feeder Challenges

**Integrator Update: Controlling The Product Flow In Adjacent Machines Can Be Challenging. Polytron And Finesse Manufacturing Address Product Handling And Re-Feeder Interruptions, Turning A Three-Legged Race Into A Winning Relay.**

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01/23/2013

Two closely coupled machines can each falter from each other's stumbles, like two runners in a three-legged race. Three-legged races can cripple even two fit athletes. Although production processes are automated, a process interruption can delay a packaging machine's ability to keep up with the volume coming from the making area, creating havoc on the line. This is particularly true when critical upstream processes, such as complex cooking processes or freezing operations, need to operate as a continuous process.

Most packaging systems are designed to account for the inevitable stoppage by adding some form of buffer. Many buffering methods can minimize the effect of an interruption and manage the volume of product waiting to be packed. Oftentimes, the simplest and "cheapest" method is to dump product in a bin for manual re-feed or packing offline. But that can negatively impact product quality, batch yield, throughput, and labor costs.



What is needed to solve this buffering challenge is a piece of equipment that can both buffer high-speed production and re-feed products to the packaging line at a predictable, manageable rate. Until the late 1990s, there were few inline buffer solutions for manufacturers to tackle these issues when dealing with flexible and difficult-to-handle products and packaging. In the late 1990s food manufacturers were experimenting with modifications to re-feed systems that had been designed for rigid, nonfood components. These alternate uses for commercially available equipment proved unworkable. In 2002, Polytron and partner Finesse Manufacturing Solutions developed a re-feed system to provide the marketplace with the ability to accumulate, orient, singulate, and re-feed difficult products discharged on a constant pitch for use by an automated secondary operation.

The re-feed machine turns a race of products into more of a relay, where each runner can perform in top form and add to the combined success, rather than trip each other up and accumulate each other's stumbles. Tighter motion controls decouple operations to carefully move difficult-to-handle (flexible, wrapped, or soft) products.

Standard elements of a re-feeder include ability to:

- Receive product in bulk from tote dumper, upstream operation, or manual feed
- Buffer product in a hopper that is appropriately sized for the product and application
- Spread product to a consistent and constant stream
- Separate product into single units
- Orient product to meet the requirements of the downstream equipment, typically a cartoner or tray packer
- Position product consistently spaced to a known pitch by increasing or decreasing the gap between products
- Inspect and sort product for specific graphic orientation or removal of damaged product
- Synchronize the feeding of each product with the target pitch downstream equipment.

As the diagram shows:

1. Hopper (on the right side of the diagram) receives products from a tote dumper, manual dump, or automated delivery; holds them in bulk; and reintroduces the product on demand.
2. Metering conveyor gently spreads the product from bulk using load cells and a loss in weight algorithm.
3. Smart modules, using individual conveyor sections and product sensors, complete the orientation and provide the spacing and rate required to feed the downstream equipment.
4. Graphics orienter can be added to the system if graphics orientation is required.

Plug-in equipment solutions: When correctly implemented, product handling equipment can quickly reduce product waste with a continuous process application and reduce labor with automation. The challenge becomes how to effectively and efficiently install and implement unique equipment along the line for special-purpose product handling while maintaining and increasing the return on investment (ROI) of the production line. The good news is that this type of equipment is relatively easy to install along the line or even in another part of the manufacturing facility to facilitate the completion of the specialized packing processes.

Technology solution considerations: When selecting packaging equipment, consider how well the equipment's technology fits the manufacturer's specs, overall line architecture and layout, and long-term maintainability. Several factors facilitate ease in installation of product feed equipment into the current operations or into a new line design. One significant component that facilitates installation and integration into the line is the equipment's technology:



- Open architecture allows the manufacturer to maintain code, add data collection features, and integrate with other equipment and the manufacturing execution system (MES) or enterprise resource planning (ERP) system.
- PLC platform can be in a dedicated PLC, or the logic can be integrated into a PLC in the existing line.
- Machine wiring is reduced with use of remote I/O, allowing for cleaner installation with shorter install time.
- Human machine interface (HMI) options allow plant personnel to select product size, rate, and pitch by either setting the values or selecting a preconfigured recipe. This demonstrates flexibility to run multiple products.
- Stepper motors, not servo motors, are appropriate technology for the application, to lower costs, eliminating gearboxes and extensive cabling.
- Product metering software has a standard, proven control algorithm that allows the machine to use lower cost hardware.
- Hardware options can be tailored to the end user's specifications.

#### **Beyond the inline buffer**

What happens when the packing requirements get very complicated based on the type of production process, product, and packaging? Especially challenging are products with odd-sized, difficult-to-handle packaging, combo packing, and multi-cook processing along the line. Scenarios include:

- Variety packs in collated groupings
- Meal kits
- Co-packing operations and being able to run multiple product on one platform
- Off-site packaging of multi-component products
- Multi-package combo or rainbow packs
- Metal or plastic packaging
- Display cartons or trays

These complex packing requirements call for a variety of more sophisticated functionalities that include equipment combinations, such as:

- Synchronizing with downstream equipment
- Product counting
- Bulk feed from a dumper
- Buffering product in a hopper
- Orienting pouches in directional flow
- USDA sanitary requirements for packing fresh or frozen meats
- Multi-lane feed for multi-product packing
- Multiple re-feeders integrated into a complete system

Re-feeders also provide similar solutions for automated kit assembly packaging, which requires the combination of various prepackaged parts and accessories into one specialized package. With technology that spaces, positions, counts, and inserts product appropriately, the process can be completely automated for greater ROI.

The right equipment at the right location on the line enables effective product handling and efficient feeding to complete the packing operation. The result then allows the ability to decouple the line between process and packaging to enable operations to maintain required production and minimize manual handling of the product, which helps achieve yield, quality, and ROI levels for the manufacturer.

#### **Case study: Fruit bars**

Situation: A global fruit bar manufacturer needed a unique packaging solution to accumulate product and re-feed product in an efficient packaging process. Requirements for packaging included the ability to create variety packs for two to four flavors of product; the ability to dynamically change the flavor mix based on capacity and accumulated product in the hopper; a packaging system to handle multiple-sized fruit bars; and consistent and effective accumulation.

Challenge: Fruit bar production involves a complex, continuous cooking process requiring a packaging system to allow the appropriate handling of product. Any disruption downstream created significant accumulation in the packaging area, creating discarded product on a regular basis.

Solution: Re-feeders with an advanced design were deployed to allow flexible packaging processes to handle the production volume without disruption. The ability to buffer and use open PLC architecture to coordinate between machines allowed the re-feeders to function as a variety pack assembly system. The system included:

- Four two-lane re-feeders with hoppers equipped with collation units at the discharge end of re-feeders
- Automated system to dynamically change the packaging mix of the product, within acceptable variation, based on the level of accumulation in the hopper
- Automated collation unit to package correct mix and number of fruit bars re-feeder dispensed into carton.
- Lugged carton conveyor system coupled with re-feeders

Results: The new automated re-feeder system provided a flexible production operation that decoupled process and packaging through automated systems. The implementation resulted in:

- Reduced product waste through controlled accumulation and re-feed
- Improved throughput for higher volume salable product
- Reduced labor due to automation in the packaging area
- Flexibility to use assets to run multiple products.

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