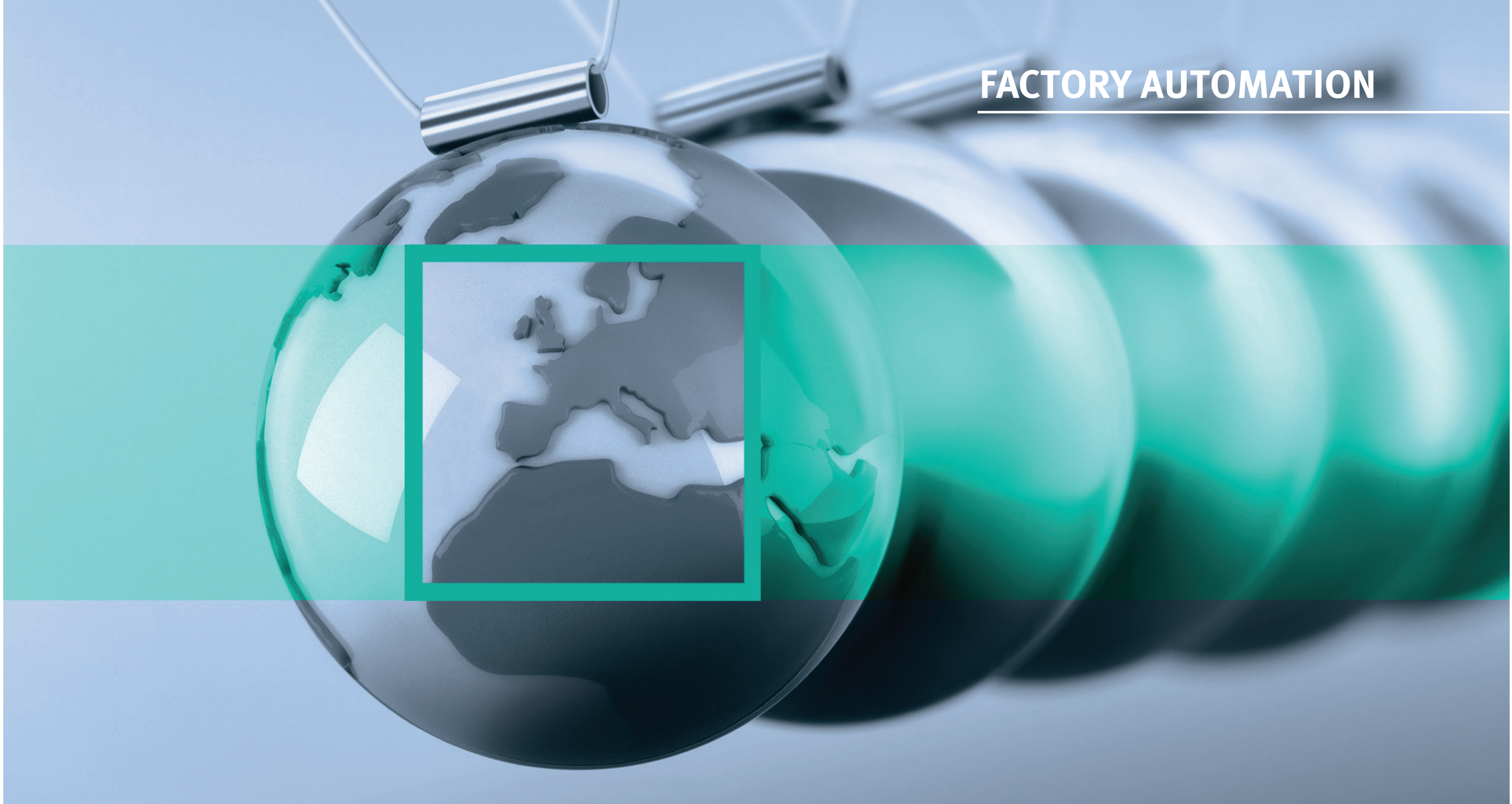
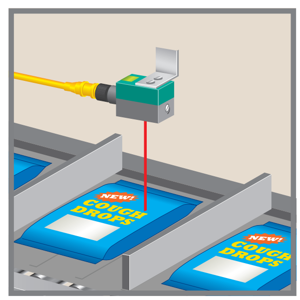


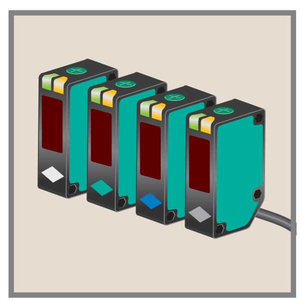
FACTORY AUTOMATION

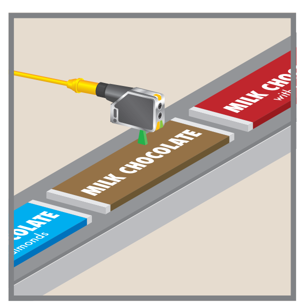
Minimizing Packaging Changeover Costs by Smart Component Selection

Changeover for packaging equipment poses a costly and time-consuming dilemma. But a little forethought on component versatility and simplicity goes a long way in reducing changeover efforts. This white paper explores some straightforward methods of selecting and using sensors that help and not hinder you from getting your packaging process up and running quickly.

Jeff Allison,
Product Manager







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SENSING YOUR NEEDS

Changeover—the #1 priority

The number one packaging machinery attribute on the minds of everyone from technicians, to manufacturing engineers, to executives is changeover. According to research by PMMI (Machinery Trends survey, 2003) involving technical and executive staff in the packaging sector, changeover adaptability is the most critical machine feature. Additionally, a 2007 report from Summit Publishing indicates 74% of packaging companies consider rapid changeover as "very important" with another 14% indicating it is at least "moderately important." And adaptability and versatility of packaging equipment has never been more key in reducing changeover time.

Changeover is the process of switching a line that runs one product type to run another product type. Changeover most often occurs in response to a new product introduction, a product line extension, or an increased product mix, but it can also be triggered by other influences such as the implementation of eco-friendly packaging or simply reducing packaging costs.

Changeover encompasses three basic phases: the clean-up of parts and tools from the old line, the setup of new parts and tools, and the start-up of the newly fitted equipment. According to a 2003 PMMI report, half of overall changeover time is devoted to the third phase, specifically trial runs and adjustments. Selection, mounting, programming, and trouble-shooting machine components thus consume a large chunk of the overall changeover effort. This paper highlights some basic strategies for reducing changeover time as it relates to sensors.

Proper sensor selection

Selecting sensors that allow the highest degree of flexibility in an application is essential to changeover-friendly equipment. Considering some key features that allow a sensor to adapt to changing product and packaging media makes all the difference at crunch time.

One example of this is the use of sensors with universal outputs. Rather than only selecting and stocking a sensor with a sourcing PNP transistor output, a sensor that has both NPN and PNP outputs reduces selection and stocking requirements. If a customer requires a different controller that accepts only sinking NPN transistor outputs, then using sensors with multiple output types saves time. Some sensors not only have NPN and PNP outputs but normally open and normally closed modes as well. Sensor output selection time can be completely eliminated by using sensors that automatically select the output based on the connected load. For these automatic-detection outputs, an NPN output is present when the controller has a sourcing input card, but a PNP output is present with a sinking input card.

Consider worst-case scenario

Another way to reduce changeover time by intelligent component selection is to always consider the potential worst-case scenario. This means selecting a sensor or component that does not operate at its specification limits. Using a proximity sensor at 75% of its sensing range rather than 95% of its range means future machine changes and tolerances are much less likely to affect it. This also means selecting the most versatile technology for an application, as in the following two examples.

In the first example, detecting a web of material using a retro-reflective photoelectric sensor is a straightforward application that any number of sensors could easily accomplish. But what happens if the web is replaced in the future with a transparent material or a web with a highly reflective surface? Using a sensor for clear object detection or a sensor with a polarization filter respectively are the means to error-free detection of these new potential webs. Using a polarized sensor for clear object detection is a smart way to detect all of the above materials, should the need arise in the future. Better to select a flexible component now than discover its limitations later.

Another example of forward thinking is a powerful sensing tool called background suppression technology. Background suppression, a photoelectric sensing mode, is uniquely equipped to eradicate changeover time because it detects various materials—regardless of color, print, and reflectivity—at nearly identical distances. (See Figure 1.) Sensors equipped with background suppression also ignore the shiniest background machine panels, and they do not require the use of reflectors. So a background suppression sensor that detects one type of carton today will pick up another type tomorrow and yet another one next year with no adjustment or realignment.

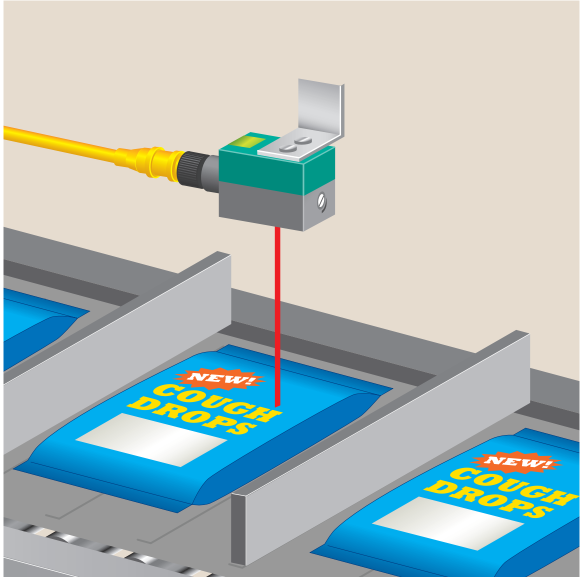

Figure 1

Easing the effort of selecting a sensor can be as simple as color-coding. It is faster to recognize that a sensor with a blue marking is used with a reflector and a sensor with a gray mark is used as a thru-beam rather than learning manufacturers' nomenclatures or pulling up data sheets. Some sensors are available from the factory with color-coded marks for this purpose. (See Figure 2.)

Versatile mounting methods

On another front, changeover effort can be diminished with some attention to mounting methods used for machine components such as sensors. Versatile mounting brackets, by swiveling and rotating the sensor's position and alignment, allow quick, multi-axes adjustments without the need to remount the sensor. An alternative to adapting mounting hardware is replacing it faster. Tool-less

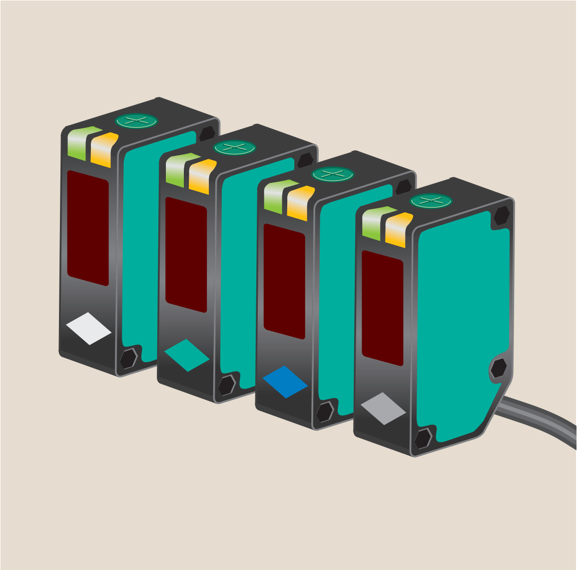

Figure 2

mounting means no fumbling with screws, nuts, or washers, which cuts sensor installation time to a fraction of traditional right-angled bracket mounting time. Also, using sensors and components that provide multiple means of mounting affords future flexibility. So a sensor that can be mounted either by threading a mounting nut on a cylindrical housing or by thru-holes in the housing is more adaptable than a sensor with just one mounting method.

Optimal programming

Optimizing the programming of sensor settings to recognize new products or packaging materials is another tactic of reducing changeover time. Rather than laborious "tweaking" of each individual sensor setting, automatic and speedy adjustments are the goal. User-friendly, simple adjustments, whether they are potentiometer, pushbutton, or other methods, mean less time becoming a sensor expert and more time completing the changeover.

One way to reduce programming time is for the controller—rather than the technician—to teach the sensor. Many sensors, such as contrast (or "eye-mark") sensors for registration mark detection, can be triggered to learn new targets by a signal from the PLC. This means automatically relearning the eye-marks on a roll of web-stock every time a new roll is loaded with no prompting.

Sensitivity adjustments for sensors are typically set manually, most often by potentiometer or pushbutton. These settings can either be incremental or automatic. Incremental adjustments mean that the sensor's potentiometer or pushbutton must be adjusted to the optimal position at the discretion of the user. This can involve a fair amount of "tweaking" or adjusting the gain above and below the desired point until sensing is optimized. Automatic adjustments mean the sensor selects the optimal setting for the application. Automatic adjustments are faster because there is no judgment call on the part of the user: the sensor chooses the optimal setting in one step.

In some instances, such as sensing case or carton magazine level with a retro-reflective photoelectric sensor, using sensors without adjustments may be preferred. These "tamper-proof" models mean a sensor will operate at maximum sensitivity with no chance for someone to either accidentally or intentionally readjust its settings. Thus not having adjustments can be another ticket to expediting changeovers.

Yet another way to reduce changeover costs is to minimize the number of changeovers. This can mean running multiple, different products on one line. Critical to the success of this line is the ability to differentiate multiple products. For example, if different chocolate bars are packaged on one line, using a multi-channel color sensor to distinguish the wrappers may be necessary to divert the bars to the correct cartoner. (See Figure 3.)

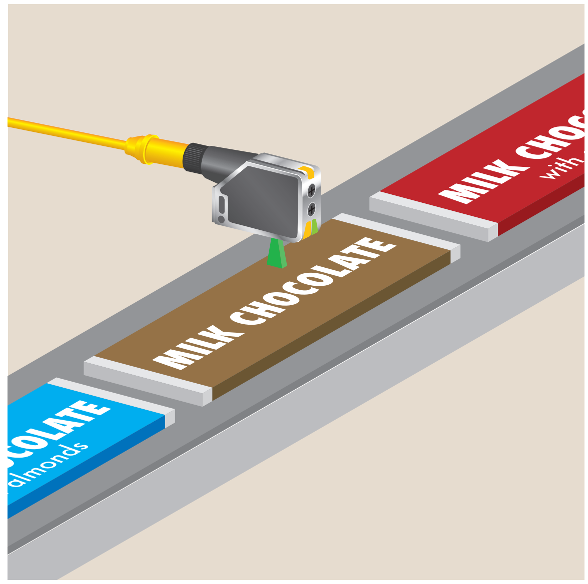

Figure 3

After all components are installed and adjusted, it may be necessary to perform trouble-shooting. Having a consistent, universal set of diagnostic LED indicators on sensors is very helpful. For example, do some photoelectric sensors have power LEDs that are green and others are red? Perhaps short-circuited outputs on multiple proximity sensors are indicated different ways. Sensor power, alignment, and other operating conditions can be confirmed at a glance with consistent diagnostic LEDs. In addition to sensor LED diagnostics, sensor diagnostic outputs are also available, typically on photoelectric sensors, to indicate signal strength. This can be used as a flag to the controller to indicate if signal strength is marginal, such as if a sensor lens has dirt or other contaminants or if the sensor needs to be realigned.

Two step to success

When considering how to use sensors to streamline the inevitable changeover, it is important to keep two guiding principles in mind. The first: simplicity and versatility don't have to be mutually exclusive. That is, only consider adding features that make sound sense in an application, otherwise those features only serve as a complication. The second is to think in future tense, not in present. What works today may be insufficient for tomorrow's changeover.

FACTORY AUTOMATION – SENSING YOUR NEEDS

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