BALLUFF

WHERE VISION MEETS SENSORS

Eliminating Packaging Defects with New Optical Sensing Technology

White Paper

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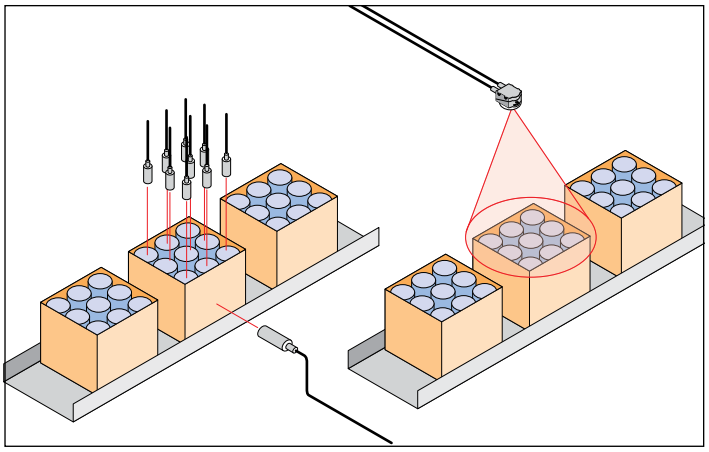
When it comes to the level of quality that is acceptable in today's packaging marketplace, one fact stands out – reliability and simple to use products that provide a higher value-added ROI by increasing throughput are always needed. Advanced packing operations can only meet the requirements of these customers by delivering flawless packages all day, all the time.

A few years ago, the focus on quality rested on the PLC, but today the quality focus rests on sensors and vision based solutions to make sure products are within the customer's requirements. We at Balluff see the next step in quality improvement as the merger between sensors and vision systems.

Sensor-Driven Package Defect Detection

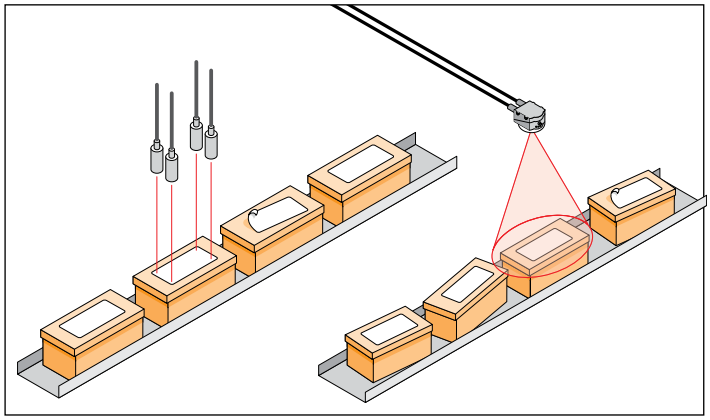
Over the past few years, the terms total quality management, lean manufacturing, error proofing, mistake proofing, package defect, and Poka Yoke have been used to describe various programs designed to drive out mistakes in the packaging process. Today, it's recognized that the most effective error proofing programs use sensors to eliminate errors as an integral part of the core process itself. Sensors monitor each package assembly process to prevent out-of-spec products from being produced in the first place. They do this by checking each step and either eliminating packaging produced out of tolerance, or stopping the process altogether.

Most discrete sensor-driven error proofing works best when a manufactured part can be automatically positioned for inspection exactly the same way each time, so that sensors can be used to verify a specific aspect of the product, thus indicating the package assembly step was done correctly. This calls for sensors stationed at the critical locations necessary to make their individual inspections a vital part of the manufacturing process.



Several discrete sensors are needed to error proof a carton of cans, while one optical sensor can handle the same task.

Vision based inspection calls for more expensive equipment to execute in-line or final inspection. Vision methodology has the advantages of being able to inspect parts in various attitudes relative to the camera and inspect more than one attribute simultaneously. Attributes can include: appearance, presence/absence, dimensional attributes, and positioning. And because vision technology can do more in the long run, it will actually be very cost effective. Discrete sensors and vision tend to be at polar opposites in complexity and capability. In the past, sensor driven error proofing has been limited to discrete functionality based on specific technology. This includes photoelectric sensing, proximity sensing, or laser based sensing, for example, to error proof a production step. This process works very well in the discrete manufacturing arena, providing relatively inexpensive solutions based on application expertise. On the opposite side of the spectrum, vision systems typically provide more complex multi-tasking sensing. These methods can perform error proofing operations similar to discrete sensors, but with the addition of complex sensing that requires interconnection between sensing methods.



When using multiple discrete sensors, box corners need to consistently appear in the same location in order to error proof labels; one optical sensor can do the same job, plus many other tasks, while boxes are not in exactly the same position.

Sensor suppliers are now providing more sophisticated sensors and application techniques advancing up the curve towards vision solutions. Meanwhile, vision providers are trying to expand down the curve towards the discrete sensor world. But instead of a crash of technologies, there is evolving a new layer of technology that combines the best from each. With the combination of both technologies and the simplified "sensor like" approach to configuration and usage, the user can apply higher level sensing at a lower cost. This allows these new optical sensors to be applied more readily in a true error proofing or package defect scheme.

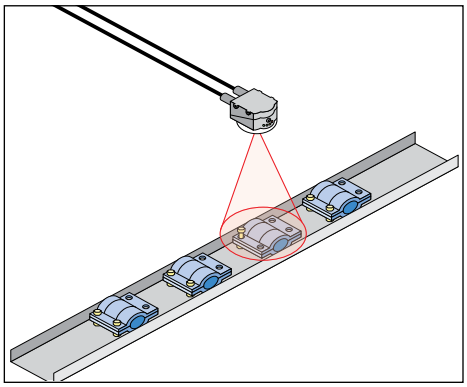
Simplified Vision Technology

New vision based optical sensors such as Balluff's Vision sensor bridge the gap between the two technologies. They provide a simple, practical, and cost effective way to error proof production by simultaneously checking several aspects of the product with a single device. These devices use a simple configuration interface that can be learned and used quickly by plant technicians. New optical sensors also have multiple inspection/measurement algorithms to drive multiple sensing options, that can store multiple configurations for quick part changeover. They provide more information than a single function "smart camera" or a standard discrete sensor. At the same time, optical sensors avoid the traps of complex vision systems in cost, complexity, and needed expertise for achieving reliable error proofing.

This new type of optical sensor combines aspects from both technologies to provide the following benefits to the end user:

- Comparative simplicity, with simple configurations and interface, but with multiple sensing functions within a single device.
- Faster set up, part changeover, and operation with the solid reliability of discrete sensing methodology.
- Lowest overall cost to implement and maintain compared to vision systems at the high end or multiple sensor arrays (including single purpose smart sensors) at the low end.

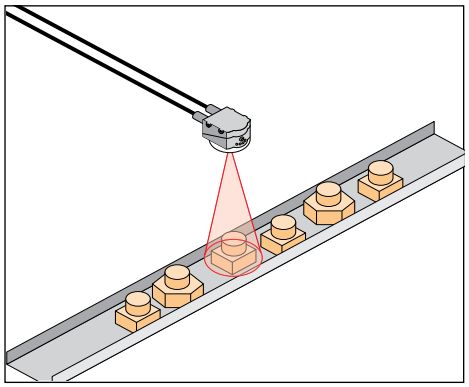
When and how should these new optical sensors be used?



All quality aspects of this clamp – two drilled holes, bolts in position, overall configuration – can easily be handled with an optical sensor.

This new type of vision based sensor is used more like a smart sensor than a vision system. Just like a sensor, it is configured to look for certain attributes of a package or product to make sure specific aspects are present, everything is configured correctly, and positioning is verified. But unlike a discrete sensor, the optical sensor does not need the product to be presented exactly the same way for each inspection, thus reducing fixturing costs. And unlike a discrete sensor, it can check for multiple characteristics at the same time, thus justifying its cost sooner with a higher ROI. This is accomplished by taking the place of several sensors, each of which can only check one attribute at a time. As opposed to using a more traditional sensing array, these optical sensors can significantly reduce the complexity and cost of error proofing and product checking while improving the overall reliability of the packaging process.

This opens up a whole new world of error proofing that was not available before to reduce both unplanned and planned down time, making changeovers easier, better, and more flexible. The optical sensor is a well placed solution specifically for applications that have multiple points of discrete inspection but do not have tight fixturing. This type of sensor is also good when different products are run on the same line and require line configuration changes that would seriously hamper sensor arrays. Optical sensors do not require significant changeover or planned down time to allow for changes in sensor placement. However, an optical sensor would not be as useful where a single discrete sensor or two could also solve the application. It would also not be as useful in applications where complex inspection algorithms or complex internal logic would be necessary. In these cases, a vision system would still be the better choice.



An optical sensor can not only count different types of products, it can error proof these products in different attitudes and locations on the assembly line.

Thus, in most cases, the field is left wide open for optical sensors to be used during the manufacturing process to check for specification and quality adherence at each step of the production process. Optical sensors provide the missing piece that before had caused many users to force the use of more complex vision systems for these types of applications to accommodate the needed functionality.

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