

Inspecting Print Quality Inline of a Flexo-Folder Gluer

Inspecting the entire printed sheet on a Flexo Folder-Gluer is possible with today's camera and processing technology, but is understood to be very expensive and difficult to install on existing machines. However, there are actually strong justifications to support a more affordable print inspection investment.

Advancements in CCD line-scan camera technology (Fig. 1) have made the inspection of a number of corrugated box properties possible. Glue joint issues, folding problems, skewing and slotting errors can all be detected with a high-quality camera system. Using this same technology, print characteristics can also be inspected. A typical camera system can inspect widths up to approximately 4" (100mm). This width could be expanded by raising the distance between the camera and the product. However, the light intensity is disproportionately less as the camera distance increases leading to a poorly illuminated image. Further, due to the increased number of pixels required for a wider field of view, the CPU power required becomes very expensive. Therefore, by only observing a portion of the box printing, quality assurance of most important printing characteristics can be obtained.

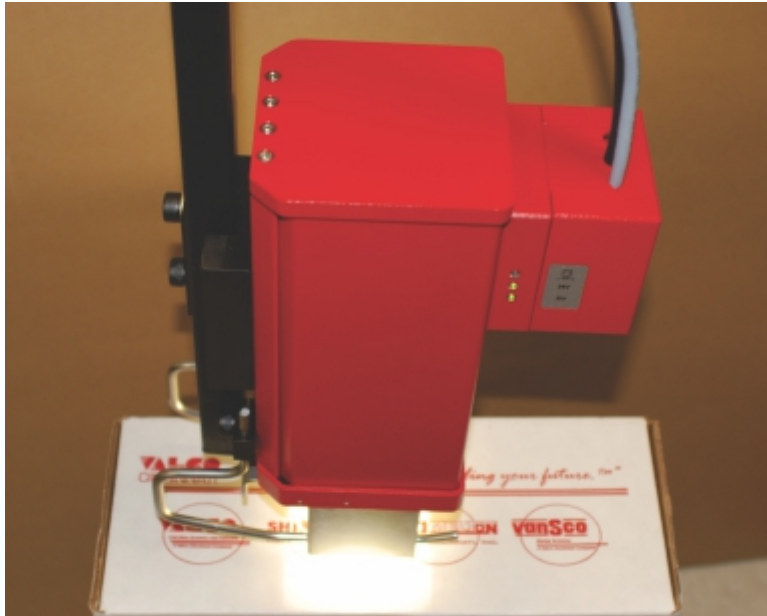


Fig. 1: Typical CCD line-scanner housed in IP 44 enclosure with integrated lighting and photocell trigger

Registration

Many printing issues in the production of corrugated containers are related to registration. Registration problems typically take two forms. First, registration between two or among multiple colors can be observed with a color camera that separates individual colors and their outlines into their constituent RGB parts. By analyzing the spectral signature of each color, its position relative to the other colors can be quantitatively measured. On sheets with complex graphical images, registration marks provide the most ideal location for determining registration among colors. Second, registration of all colors with respect to the edges of the box can be established with any image portion and a neighboring edge. If a box corner is used, registration in both the x- and y-directions can be assessed. Either type of registration problem can be identified and rejected with inspection software.

Smudged print

Caused by anything from contaminated print plates, defective anilox rolls or poor quality liner, smudges are easily detected by comparing a learned image to the one actually printed. However, if the smudging is localized, the camera's placement may not permit detection in all cases. For 100% assurance of smudge-free printing, a full-sheet inspection system would be warranted.

Striped printing

Due to the variations in applied print pressure due to the corrugating deformations in the liner, striping is a common side-effect of flexographic printing on corrugated sheets. Since striping typically occurs across the entire sheet, camera-based print inspection systems do an excellent job of detecting ink where it should not be. Since good quality learned images of each job can be stored, each setup of the same box can be compared to the original learned image to immediately detect striping, even on the first test sheet.

Print Density

Using the original learned image of a good quality box as comparison, the print density of each sheet can be determined. Since RGB values are easily obtained from the camera as long as the lighting conditions are consistent, images from different job runs can be compared. Long-life, high-intensity LED lighting ensures this repeatability. If the measured density falls outside a tolerance band around the learned measurement, the box is rejected. User-defined zones (Fig. 2) can aid in the selection of each ink color. Inline measurements of print density require a zone with each color present.



Fig. 2 – Selected print tests

Wrong ink color

Despite the normal quality checks done at the beginning of a job run, sometimes colors are misprinted. Either the wrong ink color is selected or perhaps the ink mixing is faulty. In these cases, the same inspected zones used for print density determination can be compared to a known good original image. An incorrect ink color will not be random or self-correcting, so every box will be indicated as faulty.



GLUING & QUALITY ASSURANCE SYSTEMS.

Missing print

If a portion of a flexographic die has been damaged, a small zone of print may be missing since the sheet will not make contact with the die. These types of errors could be difficult to detect with an inspection system that only examines a narrow portion of the sheet since, like smudges, they tend to be localized. However, if a die has not been installed at all or installed in the wrong print section, this will be easily seen by an affordable imaging system. Good practice will position the camera to printed locations on the box that are particularly critical or subject to damage. As with other print detection tests, it is important that a good quality master image is learned. This image can be repeatedly recalled when the box design is re-run for another job.

Motorized camera positioner

Since many of the print detection tests described in this article rely on an initial good-quality master image, accurate and repeatable camera positioning is very important. A high-precision, motorized camera mount that traverses the entire machine is optimal. This system not only allows the camera to be moved independently from the folding rails, but also permits the camera to return to a previous location to inspect the same zone of the box as the last time the box design was produced. Once this library of box designs has been built, setting up the camera system for print detection can be fully automatic. Camera position is stored along with colors used, densities and special print features so that the first box out of the press can be fully inspected. Camera positioners also should be fully automatic as they may be in inaccessible locations for bottom-printing machines. Line-scan CCD cameras offer the added benefit of only requires a small slit through which to view the image. Therefore, they can be located in tight-fitting places in a variety of machines.

Box quality inspection systems are only as good as their ability to remove, or assist the operator in removing the defective product from the delivery stream. Bundle ejection systems offer the most security by automatically tracking the defective box in its bundle and removing the bundle from the conveyer. Once the bundle is removed, the spray-marked box can be located and taken out of the stack. These measures, combined with visual and audible alarms, raise operator awareness and provide the ultimate in accountability for manufacturing defects.

Dave Swedes

Director Engineering & Manufacturing

Valco Melton
497 Circle Freeway Drive
Suite 490
Cincinnati, OH 45246
T: 513.874.6559
F: 513.874.3612
info@valcomelton.com
www.valcomelton.com

www.valcomelton.com

