Print Inspection Systems

New Standards in Quality Control to Meet Today’s Print Challenges & Demands

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Why do we need a sophisticated inspection system today? With new presses pushing the envelope in terms of printing speeds, the need for high tech inline monitoring of print quality on the press has become obvious. Years ago, visual or other inspection methods, like simple strobes or rotating mirror units, were enough to show print defects to the operators. At speeds of 2,000 fpm achieved by today’s flexo presses, not detecting defects in real time—and correcting them immediately—can quickly create large amounts of waste. More so, if not found and removed, those defects end up being shipped to your customers, which could result in rejects, reruns or, worse, loss of business.

OPTIONS

There are three main varieties of inspection systems:

- Video inspection systems are purely visual systems. They take a snapshot of a certain area while the web is moving and display the image on a monitor. Digital cameras with 1 or 3 CCD (charge coupled device) chips, typically 1,280 x 1,024 pixels resolution, are used with optical lenses for magnification.
- Video inspection systems with image analysis are capable of tasks like defect detection, bar code verification, color monitoring, makeready, register and impression setting, and more. They too use area scan cameras with optical lenses.
- 100 percent inspection systems inspect 100 percent of the material going through the printing press, slitter or rewinder/doctor machine at high speeds. These systems use line scan...
cameras, which have one line of pixels across the web, but at very high scan rates of up to 85,000 lines per second. They have fixed lenses, which means image magnification is often limited and achieved by digital enhancement.

The typical printer inspects either on an inspection rewinder or on press. Systems installed on an inspection rewinder usually provide 100 percent print defect inspection of the web, 100 percent of the time. Inspection systems that are installed on a printing press can be one of three types:

- A basic web viewer, which has no automatic defect detection functions
- 100 percent repeat inspection over time (or sampling systems), which use area scan cameras that automatically move across the web on a traversing mechanism, sample the web and provide defect detection on these pieces. They work well for repetitive defects
- 100 percent web inspection, which uses line scan cameras to do defect detection on 100 percent of the substrate being printed

STANDARDS & TECHNOLOGIES

The standard in wide web applications has been inspection systems with some sort of print process management like defect detection, color monitoring, bar code grading, register setting, etc. Because of drastic advancements in camera technology and computing power, we finally reached a point where these multiple systems are integrated into one, with only one GUI for all different tasks. This integration has a tremendous positive impact on simplifying and shortening setup time, operator training and knowledge requirements.

The use of one common software platform and a modular architecture makes inspection systems more flexible. These systems are almost endlessly customizable to meet unique application requirements. Modular design allows a printer to start with a basic vision system and add/upgrade as needed to 100 percent defect detection, or inline spectral color measurement or any combination, all without having to replace the complete system each time. This means the system can grow with needs and customer requirements. Furthermore, it can help spread out a larger capital investment into multiple smaller, affordable portions.

Some of the crucial components to understand include:

**Line scan camera**: Today, line scan cameras are used to inspect 100 percent of printed material. With improvements in speeds and pixel resolution, color line scan cameras for print inspection applications have come a long way. Today, 3-chip line scan cameras are emerging onto the market and being utilized, resulting in much higher image quality and color reproduction compared to single chip technology. With a typical array of 4,096 pixels per camera, the use of fewer cameras to cover wider webs is now a possibility, while still maintaining high resolution image quality.

**Camera size**: Mechanical integration of earlier generation line scan cameras into existing presses raises the challenge of finding the required space. New generation cameras, with the aid of integrated mirrors, allow for more compact housings, thus resulting in a much smaller footprint.

**Illumination**: Light Emitting Diode (LED) lighting has become the standard illumination for line scan print inspection. LED lighting can be electronically controlled to optimize brightness for image quality on multiple substrates. Extreme longevity and low maintenance are key advantages.

**Data transmission**: Analog data transmission is still being used by some inspection systems on the market, which requires frame grabbers and analog to digital converters, causing them to slow down data transport and evaluation. Digital data transmission is the new standard: It is not limited in the amount of data that can be processed.
and data and signals are no longer affected by cable lengths—nor is the image compromised by electronic noise in the plant—resulting in far more effective and reliable defect detection.

PDF inspection: A PDF software program compares the golden image template or live image and the customer approved digital artwork file, alerting the operator of any difference in content or structure.

Software & defect detection algorithms: Detection algorithms are extremely sophisticated. They work by incorporating the registration of the live image to a saved golden reference, and implementing defect detection for specified occurrences (registration, ink spots/splashes/streaks, fill ins or missing print, hazing, pinholes, color variation, etc.).

Monitors: Large monitors and operator touchscreen technology are now affordable, making operation of systems easier. The use of 50-in. and larger HD displays as additional view monitors allows viewing of printed images at real size with amazing clarity, detail and color fidelity.

Modern UI: Today’s leading edge systems use touchscreens with gesture control (two finger zoom, swipe, etc.) This makes the system extremely intuitive and easy to understand, without lots of training.

CLOSING THE LOOP

Understanding how to deal with defects that have been detected by the inspection system—This is the new frontier.

The solution is an integrated workflow. Every event during production is stored into a database with a given defect’s precise location(s), type and time within the job and roll. That information is accessible through a network, and a data server for long term storage of current and historical data allows access from any department at any time.

This data is used for printing or creating reports, or used by the waste removal system. Quality control (QC) personnel can access, audit and edit information based on defect type, size and location, and decide if certain defects are acceptable or not before the data is used by rewind operation for waste removal.

But it gets better, because what everybody has been waiting for is finally here—inline spectral color measurement. Without inline color measuring capability, there are a few challenges you're bound to run into:

- Color can only be checked at the end of each roll, for roll to roll applications
- Stopping the press and sampling offline is time consuming and labor intensive
- Not knowing if a possible deviation occurred during the run, which puts printers at risk of wasting thousands of feet of material

Color is defined by using L*a*b* values; this is also referred to as spectral data. A spectral inline color measurement device can be integrated into a system to measure spectral data in L*a*b*, Delta E, density and dot gain values at full speeds. Inline system measures color throughout the job and can help the printer match set standards quicker while maintaining them throughout every job. Such a system can take and deliver measurements faster, enabling the operator to...
reduce makeready times and startup waste by taking the necessary corrective actions.

An integrated solution is the best way to deliver total customer satisfaction and minimized waste in a market where standards are extraordinarily high. Spectral data can be shared with either cloud based, standards compliant solutions or an ink kitchen that can dispense the corrective formulation to maintain set targets. Inline spectrophotometer supported devices to monitor color quality can quickly, easily and automatically upload measurement results for brand owner review.

**BENEFITS**

When deciding whether or not to implement a print inspection system, and the degree of the system, there are three areas of benefit that can tip the scales one way or the other. They are the impact on quality standards and improvements, the impact on productivity and savings, and customer satisfaction.

- Impact on quality standards and improvements
  » Inspection systems deliver consistent results inspecting all substrate types (paper, film, foil and board paper), which ensures consistent product quality from roll to roll and job to job
  » 100 percent inspection confidences and accountability to meet ever rising quality standards
  » Using an integrated workflow solution facilitates removal and quality control

- Impact on productivity and savings
  » Immediate correction of issues means an increase of sellable product
  » More sellable product helps increase profits, as do eliminated reruns, quality related allowances and credits for print defects
  » Complete workflow solution on press/via the rewinder helps process webs faster and with less effort
  » A fast ROI thanks to reducing waste, improving setup time and saving material

- Impact on customer satisfaction
  » Current customers are happy
  » New customers are interested

Today’s inspection systems help attract new clients, maintain business from existing customers and even grab new business from them. Only acceptable high quality product is shipped to your customers, which has an immediate positive impact on customer satisfaction. This is absolute leading edge inspection technology, which you will be able to actively sell as a competitive advantage to acquire new business and customers.

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Multitouch displays have permeated our phones and computers, as well as the pressroom. Enabling gestures, as seen below, allows operators to manipulate images on screen in a way they never could before.

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About the Author: Klaus Kraetzer is vice president of vision systems at BST North America in Elmhurst, IL, a wholly owned subsidiary of BST eltromat International. He has more than two decades of experience in the printing and converting industry, with extensive knowledge ranging from vision and inspections technologies, like video web viewing, print process management, defect detection, 100 percent inspection to web handling such as web guiding and automation technology.