The networked 100-percent print image inspection system

New concepts bring improvement in quality and productivity

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Automatic print image inspection systems with cameras are today employed with increasing frequency in quality assurance. Historically they were mostly to be found on finishing or rewinding machines; however the trend is now firmly in the direction of printing presses and the related reduction in waste.

What do the individual, autonomously operating systems actually contribute? Is then the decision on output quality also forced onto the already very busy press operator? Is productivity potentially severely restricted as a result? These are central questions that a printer considering the use of print image inspection systems must ask. The networking of all print image inspection systems on printing presses to the re-winders via a central quality department places these questions in a new light. This concept was developed by *Erhardt+Leimer GmbH* based on the successful 100-percent print image inspection system *Nyscan* and logically implemented by the organization *X-label*. During this process the system was integrated directly into the existing production data acquisition system (PDA). This is a massive, innovative step forward in terms of quality control and productivity.

How have automatic print image inspection systems been used in the past?

Historically automatic print image inspection systems were primarily used for the final inspection of printed products on special inspection re-winders. If the system detected a defect, the machine was stopped and the defect position noted. It is clear that such a system involves a number of disadvantages as well as the related investment costs, the need to stop and position all defects, even those that are potentially acceptable, results in an immense loss of time. This situation can prompt the operator to set the sensitivity of the system very low so that the required productivity can be achieved. Greater cost-effectiveness is achieved if the print image inspection systems for the reduction of waste are not installed on the winder, but on the printing press.

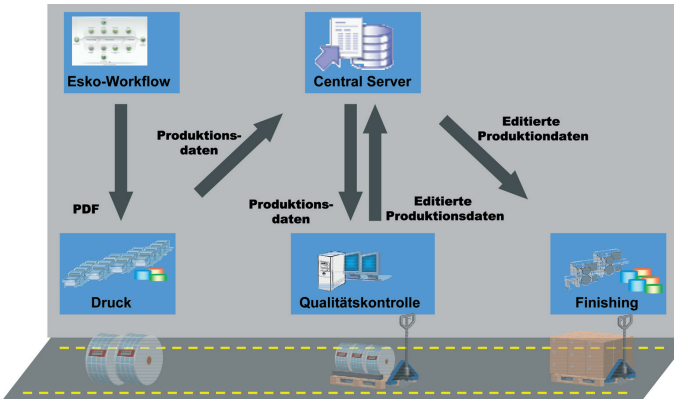

Figure 1 (left): Networking of prepress, printing, quality control and finishing.

Figure 2 (right): Sealing with a label for reel identification.

The advantages and disadvantages of integration on printing presses versus finishing machines have already been described in detail in [1] and [2] and will therefore not be further discussed here.

By using a print image inspection system, a printer can meet the following objectives:

- Consistent and definable quality;
- Increased productivity, and as a consequence a reduction in costs;
- Advantages over the competition.

Use on the printing press as a singular, autonomous system does not, however, bring only advantages. Although waste is detected at an early stage and is avoided to a great extent, the press operator is now responsible for quality and must make decisions based on the feedback from the print image inspection system – clearly not a perfect solution.

Why a networked system?

After a number of tests with various print image inspection systems, *X-label* came to the conclusion that the only option was a holistic approach with standardized stations for which it is not necessary to define the job allocation in advance. Consistent implementation meant that each printing press was equipped with a print image inspection system and an interface to the IT department for production data acquisition. The goals listed above were then expanded as follows:

- It must be possible to plan production independently. Dependencies only stem from operating widths and dedicated work steps/printing techniques.
- Press operators must work to meet common requirements from quality control. In turn this department decides in a dedicated work step whether production is acceptable or waste.
- Individual defects are identified and differentiated from acceptable defects by the quality control personnel via the reel report.
- Waste areas at the start, end, or during printing are defined precisely in the reel report. Paper labels or tags are therefore no longer required.
- The finisher uses the reel report edited by quality control to automa-

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tically control the finishing machine.

- Each job is opened at each station using a barcode scanner resulting in complete integration in the organization's ERP system.

The practical implementation can be seen in *figure 1*. A print image inspection system is installed on all printing presses on site. The PDF artwork is accessed directly by prepress via the existing *Esko-Artwork* workflow. The results from each individual print image inspection system, the so-called reel reports, are sent via the data network to a central computer from where they can be retrieved by quality control personnel and edited for the remaining process. The edited reel reports are then opened at the related finishing machine to prepare and finish the reels as required.

What is the process?

Once the networking of the different stations had been described, the question is then how to control the process. The following basic principle applies: a material flow results in a data flow. This means: first a reel is printed and simultaneously inspected. On completion of the printed reel a coded label with the job or reel name is applied. *Figure 2* shows an example of such a label.

The press operator now scans the code with the aid of a barcode scanner. In this way the name and reel-specific data for the related job are allocated to the reel report. The data transfer to the central server is started automatically; from now on the reel report for any reel can be opened using a barcode scanner.

The result of the scanning is shown in the screenshot (*figure 3*). If a scan is not successful, the information can also be entered or corrected manually.

As soon as the data are saved on the central computer, each subsequent action is initiated by the presence of a physical reel in the related station. So when the reel arrives in quality control, it is identified by scanning the barcode, the reel report is loaded automatically and it is then possible to start editing this report. On completion of the editing process, the reel moves on to finishing, is then again identified via the barcode and then finished based on the information from quality control.

How is prepress integrated?

An automatic print image inspection system is based on a comparison of the moving image as it is printed being compared with a reference image. The best method

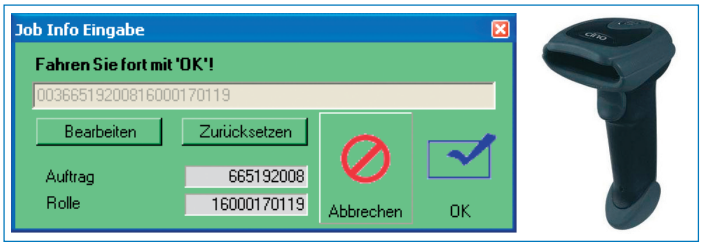

Figure 3:
Acquisition of the job/reel information with the aid of the barcode scanner.

would of course be to use the original PDF artwork directly as a reference. However, this artwork does not exactly match the printed image, but differs in essential elements such as accuracy of colour, different representation on films, labelling, trapping, punching etc., and often in the position of the individual elements. To validate inspection with the aid of the PDF artwork, it is necessary to adapt the artwork to the actual print.

First it is of the highest importance that the inspection camera can detect »all« printed features. This requirement relates, for example, to highly reflective metal films that can be reproduced in their natural colour utilizing the new *TubeLight* lighting technology from *Erhardt+Leimer*. On the left, *figure 4* shows the camera image for a label with different effects such as tactile and pearl refractions and on the right, the related PDF artwork.

You can see significant differences between the two images which must first be compensated by the inspection system's »Pre-Press« module by replacing the colours in the relevant layers, before the consistency of the printing can be checked based on the PDF artwork. PDF artwork already separated into layers from the existing *EskoArtwork* workflow is used here as the basis.

What happens in the individual stations?

Figure 5 shows the integration of a print image inspection system in a *Gallus RCS 330* at *X-label*. The inspection is first defined on the printing press during the set-up phase. For this purpose a reference image is taken from the moving web. Before the actual printing starts, all important parameters and inspection zones are defined. During production the press operator can obtain information on the quality right from the start up to the current point using the current reel report. As a result, for example in the case of a repetitive defect on the monitor, the operator can decide to stop the printing press to correct a defect on a printing plate. *Figure 6* shows an actual reel report for a job with two labels across the web and the text defects currently detected highlighted in the defect display area.

Once the completed reel data are saved on the central server, the quality control personnel can start to edit the reel data. A differentiation is made between two cases:

1. *Definition of waste areas*: These areas are automatically positioned on the finishing machine for waste winding. Waste occurs predominantly during set-up, but can also be generated during production due to register adjustment or problems with printing plate pressure, etc. In comparison with the previous method of working, these areas no longer need to be specifically marked with pieces of paper or flags.

2. *Definition of individual defects*: These defects are automatically positioned on the finishing machine at the splicing table. Measures that can be taken by the operator are either to replace the defective labels or to insert a splice.

On completion of the editing process, the modified reel report is saved on the central server and is now available for finishing. It is automatically transferred from the central server to the computer on the finishing machine after the related reels barcode label is scanned. Finishing starts. The operator simply presses the Start button and the system stops automatically, depending on the type of defect, at the splicing table or the waste rewinding position.

Results and outlook

The workflow described here provides the greatest possible flexibility and continuity. The example of *X-label* shows that central data acquisition should not only cover the data from production, but also include the print image inspection as a quality assurance measure. This configuration generates a high degree of transparency and increases the productivity of each individual machine. The quality supplied is no longer at the discretion of the operator, but is clearly defined by quality control.

As it is not necessary to allocate reels to a specific finishing machine, machine utilization is significantly increased. The reduction in the workload on the operators on the finishing machine also increases the throughput on those machines and ensures less downtime.

In summary, this workflow solution with print image inspection on printing presses, followed by quality assessment and subsequent finishing is an extremely flexible and cost-effective variant that was logically implemented in this form for the first time at *X-label*. ■

Figure 4:
Label image acquired using »TubeLight« lighting technology. PDF artwork on the right.

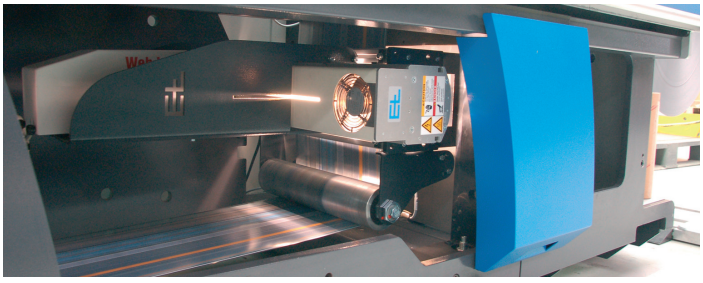

Figure 5:
Integration of a Nyscan print image inspection system in a Gallus RCS 330.

Figure 6:
Reel report during production.