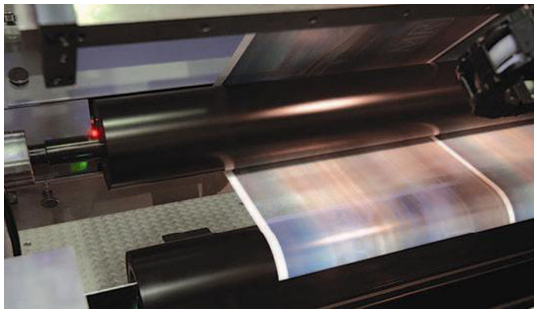
MAX DIAMOND EYE In-line Quality Control System without Color Bar for Commercial Web Offset Press



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1. Introduction

The commercial printing market is demanding the reduction of printing costs and delivery times and the simplification of operational procedures so that even young unskilled operators can operate the presses. Meeting this demand requires the development of new technology to reduce preparation time, stabilize printing quality, cut down on waste paper, and reduce operator training requirements.

Mitsubishi Heavy Industries, Ltd. (MHI) has risen to this challenge by addressing the automation of color adjustment that, until now, has required much skill and judgment on the part of the operators. MHI has developed the MAX DIAMOND EYE® quality control system that enables closed-loop in-line density control of a commercial web offset press without the requirement for a color bar. This paper describes future product directions and provides information about our approaches to the development of the MAX DIAMOND EYE system and its related technologies.

2. DIAMOND EYE for newspaper offset press

The MAX DIAMOND EYE system was designed for commercial web offset presses using MHI's DIAMOND EYE®[1] technology, an in-line quality control system for newspaper offset presses that requires no color bar, the first such system in the world. DIAMOND EYE determines target values based on digital prepress image data and the printing characteristics and properties (calibrated basic process color data) of the customer's offset press.

The system automatically controls the offset press from the start of the printing process by comparing the target values with the actual images on the paper scanned by an image sensor on the press. The advantage of this system is that it does not depend on the skill and experience of the operators to standardize the quality of the tint. Four ink colors (black, cyan, magenta, and yellow) are used for normal color printing, and it is not possible to separate the colors using a general RGB three-light-source sensor in areas where black and other colors are printed on top of each other.

However, the DIAMOND EYE image sensor is capable of separating these four colors using a special sensor with multiple light sources. The actual image scanned by the image sensor is compared to the target values set from the digital prepress image data and corrected using automatic closed-loop density control. This process requires no color bars in the white space to determine the density, unlike conventional in-line closed-loop density controllers. This closed-loop density control can now be used in printing applications such as newspapers, which cannot go through the color bar cutting process after printing.

The DIAMOND EYE for newspaper offset press has already been utilized by many customers, and our customers have expected MHI to develop the system for commercial web offset press using these technologies since the release of DIAMOND EYE.

3. Deployment to the commercial web offset press

Figure 1 shows the MAX DIAMOND EYE system configuration. Like the DIAMOND EYE for a newspaper offset press, this system is composed of a pocket PC (PPC) server, which controls the prepress image data; an Intelligent Press Control (IPC) II+ (Plus), which controls the offset

press job; an image sensor that determines the printing density; and a console.

There are two major differences between newspaper printing and commercial printing. First, commercial printing requires higher printing density than does newspaper printing. Second, commercial printing uses a wider variety of paper than newspaper printing, and the printing paper is changed often. This means that commercial printing requires density measurement and control under more stringent conditions with a wider dynamic range.

Because of this, MHI has redesigned the measurement and control system for the paper white color in conjunction with the development of MAX DIAMOND EYE. The paper white color is the reference for density measurement, and MHI has redesigned the operational procedures and systems so that the setup can be easily changed when the type of printing paper is changed. The MAX DIAMOND EYE meets the requirements of recent developments in computer-integrated manufacturing and interoperability with other systems because it uses CIP3/4-PPF, the industry standard for digital prepress image data.

It also has an automated printing paper selection system, which is controlled by the production control system in the printing factory using the industry-standard CIP4-JDF. The MAX DIAMOND EYE was demonstrated at IGAS2007, the largest domestic printing equipment exhibition in the printing industry, where it was well received.

After that exhibition, MHI released the MAX DIAMOND EYE for the advertisement printing press (BT model) that has a print cutoff length (B system) similar to that of newspaper printing. MHI also demonstrated its products at DRUPA2008, the world's largest printing industry exhibition. We are working to use this technology to create a system for presses with cutoffs different from that of the BT model by developing a system that enables the measurement of image elements precisely and accurately on the rotating cylinders so that the system will work with any cylinder length.

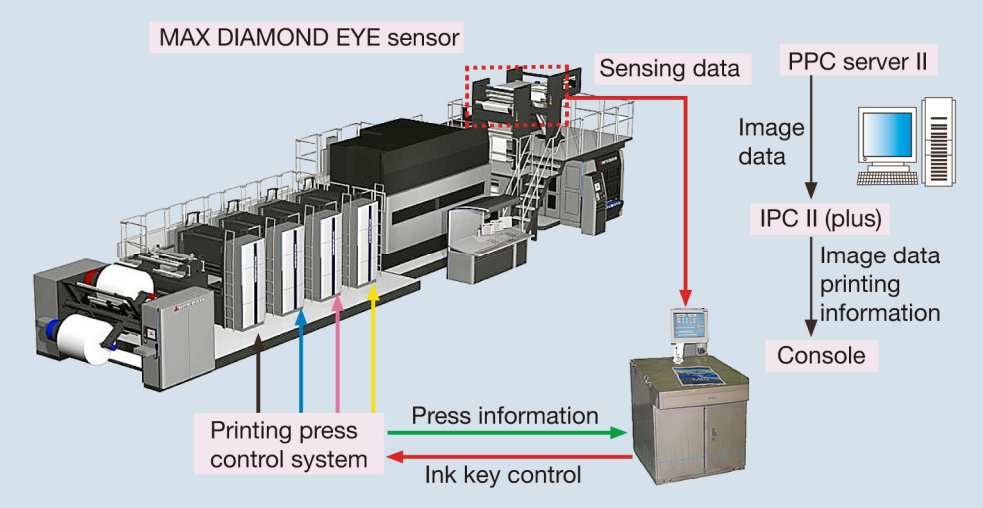

Figure 1 Basic configuration of the MAX DIAMOND EYE in-line quality control system.

4. Performance results

This section explains the color-control performance of the MAX DIAMOND EYE. **Figure 2** shows the distribution of color deviations from the acceptable color (six measurement points each on front and back). The samples were obtained every minute during the printing of 60,000 sheets with the cylinder rotating at 800 rpm. The figure shows that the color was maintained at an average color difference of $\Delta E^* < 3$.

The corrective adjustment of the color occurs automatically, greatly reducing reliance on the operator. This frees the operator to spend more time on other critical activities, such as folding adjustments. A survey of customers who own and operate the MAX DIAMOND EYE indicated that they experienced a 2% reduction in waste paper using the system. Because the price of paper is rising sharply, such a reduction translates directly into cost savings for our customers. This reduction of waste paper is mainly the result of the reduction in color adjustment time when starting the printing processes. This time reduction by itself also leads to increased productivity.

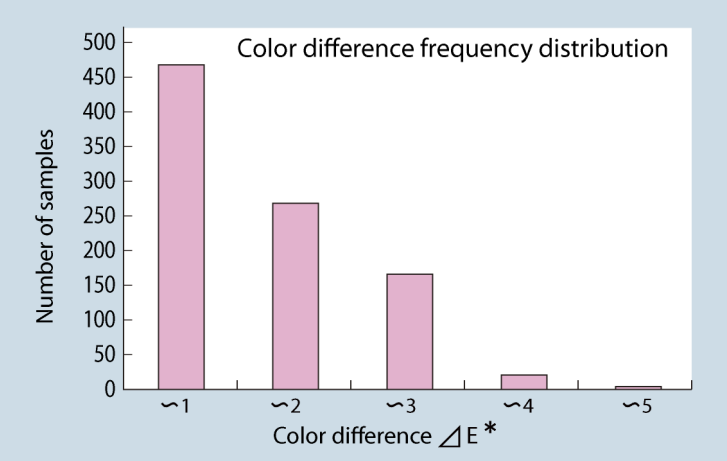

Figure 2 Color difference frequency distribution
The average color difference ⊿E* between each color sample and the acceptable paper is kept at less than 3.

5. Conclusion

MHI believes that the MAX DIAMOND EYE will make a major contribution to the general efficiency of entire printing factories by reducing preparation time, reducing the amount of waste paper, and increasing the stability and quality of printing, all while requiring less operator training and experience. MHI will continue its development activities to meet the evolving demands of its customers.

References

1. Tasaka, N. et al., Development of DIAMOND EYE™ the World's First In-line Quality Control System for Newspaper Printing, Mitsubihi Heavy Industries Technical Review Vol. 43 No.3 (2006)

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