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TECHGUIDE SERIES:

Automation and Scanning in the Pressroom

Inking Control in Offset Printing: The Advantages of Automated Scanning Systems Compared with Handheld Instruments

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Density measurement with handheld instruments: excellent technology, but limited options

For many years the ***color densitometer*** was the only instrument available to the printer for quality control on the printing press. And even then, the use of this handheld instrument was not something that could be taken for granted. Many printers resisted this control of the quality of their work, and preferred to rely on their more or less trained eye. And until the invention of the automatic recognition of process colors in 1984, the printer had to take the trouble to select the measuring filters on the densitometer by hand.

In 1995, the first ***spectrodensitometer*** was launched worldwide on the market. For the first time, it used a spectral measuring head from a spectrophotometer for colorimetric as well as for densitometric measurements. This class of instruments not only provides more exact measuring results but corresponds much better to a practical evaluation of the prints, for the printer is always faced with the choice of measuring color densities or colorimetric values.

Color densities are an indirect gage for the ***thicknesses of the layers of printing ink*** and give the printer a recommendation as to what corrections he should carry out on the ink zones of the printing press. By using suitable screen measuring areas, they also make it possible to determine related variables like dot percentage, dot gain, slurring/doubling and ink trapping. However, they do not say anything about the colorimetric values of the process colors and their combined printing, that is, color rendering in the printed image.

The quality of color rendering, which is what is actually important for the customer, can thus only be determined by ***colorimetric values*** like CIE XYZ or CIE L*a*b* or color differences like ΔE^*_{ab} (DeltaE of CIELAB system). Colorimetric values are very abstract, however, and do not allow the printer to draw any conclusions about which ink zones he has to correct and in what quantity.

With a spectrodensitometer, the printer can perform both measuring modes one after the other and obtain reliable position recommendations. Since a spectral measuring head is used, he can also measure the ***densities of special colors*** exactly. This was not possible in the past, since earlier filter densitometers had measured highly distorted densities under the filter located closest to the complementary color.

Despite their progressive technology, all handheld measuring instruments have one important disadvantage: the printer can only perform individual measurements with them. In principle he is only taking a random sample: he takes one print sheet from the sheet delivery and only measures a few control strip areas of selected ink zones. By the time he can carry out a representative correction of inking in the printing press, many sheets of the print job have meanwhile been printed.

Automated measuring systems:

Scans instead of individual measurements

The objective must therefore be to record ***all ink zones in one single measuring operation***, that is, to use a scanning spectrodensitometer to measure the entire ink control strip. Since the printer no longer has to select arbitrary ink zones here, he does not miss the problematic ink zones either. He can now be certain that ***all possible inking fluctuations*** are detected. In this way, therefore, automation at the same time eliminates all subjective influences.

As in handheld instruments, here too ***spectrodensitometer technology*** makes it possible to determine densitometric as well as colorimetric parameters.

Through the direct ***connection of the scan measuring system*** to the ink zone control of the printing press, measured values are converted into ***corrective signals***. If the measuring system is not connected, but instead simulates the distribution of ink zones, at least ***corrective recommendations*** are given within seconds for all ink zones affected. Either way, the printer gains valuable time for maintaining the quality level.

During scanning, motorized or handmoved scan spectrodensitometers reliably detect all measuring areas of any random ink control strip. By means of the exact distinction of the transitions from one measuring area to the next, such scanning systems achieve a high measuring speed. On average, this time saving ***cuts set-up times by half*** and thus also leads to a significant ***saving of waste paper***.

Scan measuring systems are installed on the control console desk. At regular intervals, the printer takes a sheet from the printing press and measures the complete ink control strip. This guarantees ***representative monitoring of the entire print run***. In conjunction with the corrective operations (carried out automatically or manually depending on the system connection), a ***quality log*** can be saved for the print job.

The logged print run quality is a ***complaint-safe document*** for the printing company. This allows a ***comparison with the customer's requirements,*** or the proof that these requirements have in fact been met. These logs also allow a ***comparison with earlier print jobs*** and can also be used as reference settings for repeat orders.

Inline measuring systems:

Automatic spectrophotometers, denistometers and multi-channel cameras

At least for web offset or continuous feed digital printing, an ***automatic spectrophotometer*** can be implemented in the printing press. The inline measuring system records the control elements, which can be placed anywhere within the subject, at full production speed. In ***heatset and coldset*** presses we find spectral measuring heads traversing over the web width.

Since there are no ink zones in ***digital printing,*** ink control strips and other targets can be located in a circumferential direction (tangentially). If required, the spectral measuring system can traverse in the event that the target should have areas placed beside each other.

In highly automated ***sheetfed offset*** presses we ca find inline measuring systems, positioned after the last printing or coating unit. It's always a measurement under not exactly standardized conditions and even an expensive solution. Heidelberg uses a traversing bar with ***spectral heads,*** manroland uses a fixed bar with ***filter densitometric heads.*** Both are covering four ink zones under each head. KBA, Komori and Ryobi presses can be fitted with a ***multi-channel camera***, spying through a slit over the last printing or transferring cylinder. Originally constructed as inspection system, the camera is now able to distinguish colors and to detect color deviations.

By referencing with an external scan spectrodensitometer, the camera is calibrated like a color densitometer or spectrophotometer.

Open loop, closed loop, preset

The scenarios described above also stand for ***fundamental measuring and control philosophies: "open loop" and "closed loop"***. These philosophies characterize the various data flows, from the collection of the measured values to the implementation of the necessary inking corrections, on the basis of target values which are compared at regular intervals with the actual values measured. This actual versus target comparison in each ink zone leads to corrective action if required.

In an ***open loop***, the data flow is interrupted, that is, it forms a "control line". After the automatic measurement, the software calculates corrective recommendations for the individual ink zones. The printer must manually implement these corrective recommendations – displayed in a appropriate software function – using the operating elements of the ink zone controller. (Not only by software of scan systems is the determination of corrective recommendations possible, but also in the display of some handheld instrument, with functions complying with ISO 12647-2.

In a ***closed loop*** the data flow is continuous, that is, it forms a "control circuit" with the ink zone controller of the printing press, which is connected directly to the quality evaluating software. After the automatic measurement, the software directly calculates the corrective commands for the individual ink zones. Depending on the concept implemented, either the printer can confirm these corrective commands by a click of the mouse or by touching the screen, or the corrective commands are accepted automatically, without confirmation, and executed. The latter option is common above all in inline measuring systems.

Ink zone preset data, which were generated at the prepress stage on the basis of the PDF print forme data, are loaded at the control console of the printing press via CIP3 or CIP4 interfaces. Faster inking-up is possible during makeready with a subject-dependent settings profile for the ink zone controller. The makeready time is shortened even further in conjunction with a closed loop configuration since, from the outset, the inking corrections are smaller and the ideal ink zone settings are found more quickly.

Conclusions

Whatever philosophy the printer decides in favor of, measuring is absolutely essential to meet today's high quality requirements. It seems reasonable to decide in favor of an automated configuration, which not only offers seamless quality assurance but also short set-up times and stable production run quality.