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Control elements of modern quality management in prepress

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The CtP technologies have been further improved during recent years. Infra-red and ultra-violet lasers featuring higher and higher capacities have more and more established themselves as imaging source. The imager architectures are nearly unchanged, based on external drum, internal drum and flatbed systems. Strongest progress was made by the CtP plates. The amount of energy required for imaging has continuously decreased which allows higher output speeds, and the plate technology has been enriched with well-functioning low-process and process-free plates.

This part of our series on control elements in prepress shall go into further details regarding plate control in the CtP process. As with conventional imaging, the qualitative aim is to achieve that the dot size on the printing plate remains constant in order to ensure both stability in colour production during the subsequent printing process and repeatability.

The most important parameters having an objectionable effect are: fluctuating plate sensitivity, fluctuating imaging energy, ageing of plate chemicals as well changing climatic ambient conditions. Control elements – plate control wedges and process control strips, respectively – shall make these influences identifiable (measurable).

The process control wedge described below is just one of many available on the market. They are offered by various suppliers. Wedges adjusted to the plate are in most cases provided together with the purchased CtP device and plate technology by the manufacturer. Alternatively, independent institutions, like FOGRA and System Brunner AG, are offering neutral control wedges. As an example, the wedge of Heidelberger Druckmaschinen AG whose structure is similar to other wedges shall be explained.

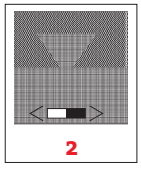
On every printing plate, the plate control strip for a control of the production run is positioned in the non-print area (gripper edge). This is normally done during the assembly in the imposition software. The wedge must be checked at predefined time intervals or on every plate visually and/or by means of measurements.

Status information

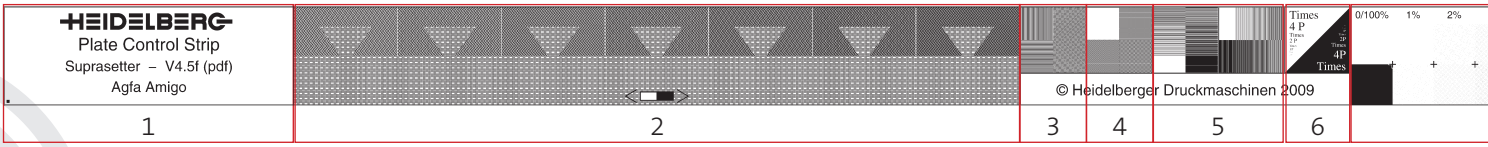
The process control strip consists of several sections. On the utmost left (1), there is the description of the control wedge with status information referring to the output device, in this case a Suprasetter, its version, and the plate material used - here: Agfa Amigo. This section is static.

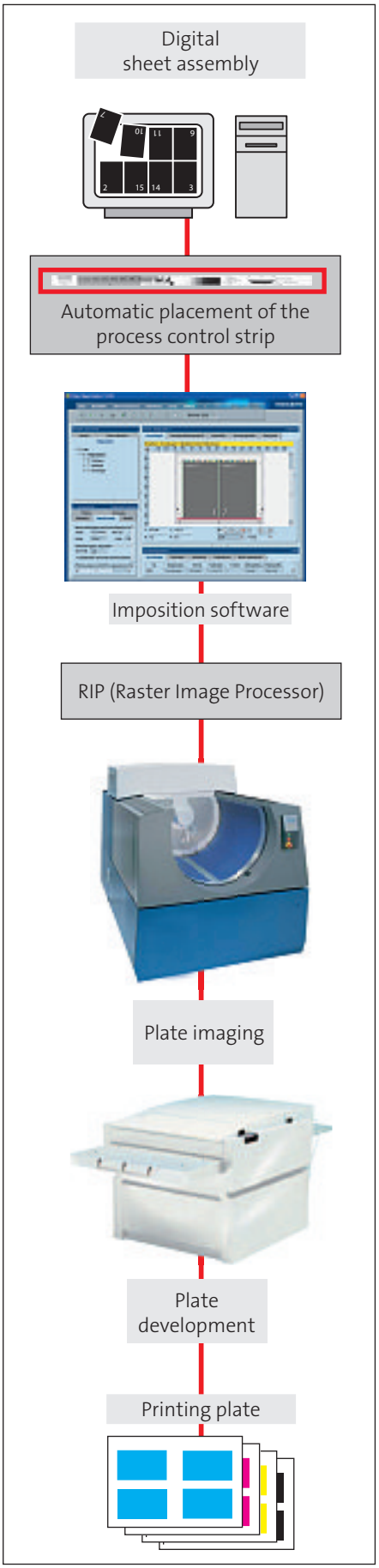
Visual reference

The second section (2), i.e., the 7-step visual reference field, on the other hand, is dynamic and changes with fluctuations in the process chain. This effect is achieved by comparing two types of screens whose sensitivity to varying conditions is different. The zigzag line screen in the background with increasing line widths to the left is less sensitive to variations, while the fine screen in the front reacts very sensitively to variations. So, if parameters change during the process and this goes unnoticed, the comparison triangles of the fine screen seem to be "moving" to the left or to the right, which corresponds to a dot size increase (right) or dot size decrease (left).



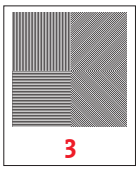
With an 150 lpi AM screen, variation by one patch represents a 1 % dot size change. For FM screens with a dot size of 20 µm, the deviation increases by 3 % per patch. The optimum working range for a wedge adapted to a printing plate is in the middle of the reference patch and should cover three patches. Even if the conditions are not optimal (patches are not in the middle), variations due to "movements" of the patches can easily be seen.



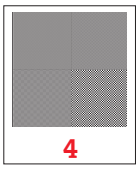


Imaging quality

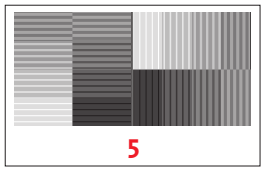
The following graphics (3-6) can be used for an assessment of the imaging quality. They are primarily checked during the calibration of the system or in the event of faults. They are less important for checks of plates on a daily basis. For a correct evaluation of the graphics, a 100-200X magnifying glass is needed.



The first graphic (3) is used to check the spot symmetry. The lines angled to different degrees should in total have the same optical tone value in each of the four patches (even pixel symmetry). If they differ, this is not critical in practice. The same element structure is, however, used for checks for slurring and doubling in printing (see article in the next Printers` Guide) where this may produce unwanted results.

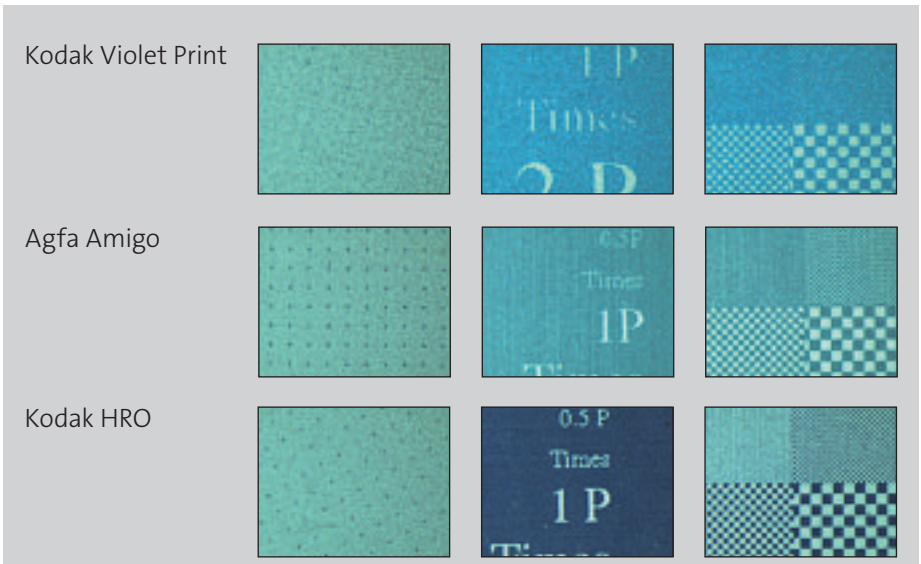


The linearity patch (4) consists of four square sub-areas with checkerboard pattern of sizes 1x1, 2x2, 4x4 and 8x8 pixels. If linear imaging is used, all four patches optically show the same tone value. If this is not the case, corrections need to be made in the RIP. The resolution capability of the plate can also easily be seen in the 1x1 and 2x2 pixel patches. Where the resolution capability is low, the pixel patterns will become blurred (see box).

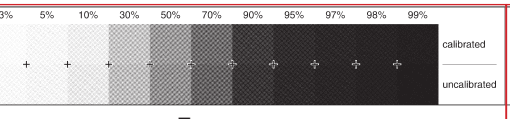


The third area (5) shows positive and negative micro pixel lines of different widths (1, 2, 3 and 4 pixels) in horizontal and vertical direction. The positive and the negative lines must have the same width in both directions. Where the line widths differ, there is an unbalance. Differences of the positive lines in comparison with the negative lines are indicative of missing linearity.

The fourth patch of the graphic (6) shows positive and negative fonts of different size (0.5, 1, 2, and 4 pt). They enable to assess the effects of low resolution of the plate, spot unbalance and/or missing linearity in practical applications.



As can be seen in the example, the three plates shown here differ with regard to their resolution capability. The poorest resolution is seen in the Violet Print plate from Kodak. The pattern in the 1x1 and 2x2 pixel range and the 0.5 pt font are not recognizable. The 1 per cent highlight area is only partly perceptible. A better result is shown by the thermal plates. The Agfa Amigo with thermal fuse technology as well as the Kodak HRO (a conventional CtP plate with chemical development) show the pixel patterns, fonts and highlights in a better way, with the imaging quality of the HRO being even better than that of the Amigo plate.



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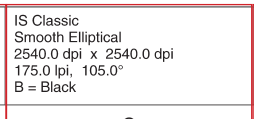

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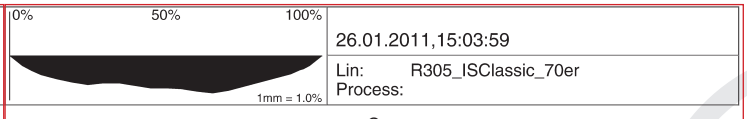

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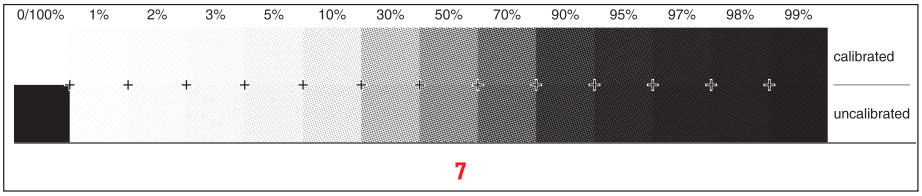
Measuring patches

The defined halftone patches (7) are used to determine area coverage with a plate measuring device. The tone values of the lower row are uncalibrated – i.e., not influenced by the calibration in the RIP (default screen). The dot size in the upper row (actual screen), on the other hand, have been changed by the calibration (linearised + calibrated). The first two measurement patches with 0% and 100% can be used for the calibration of the measurement device.



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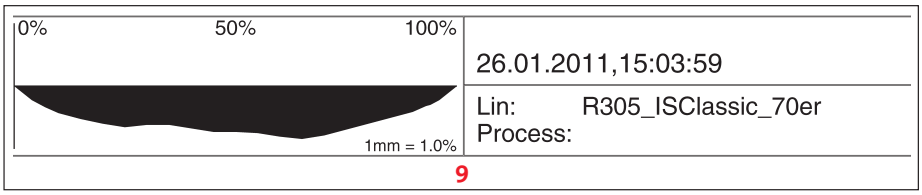
The highlight dots (1% - 3%) and the shadow dots (97% - 99%) are used to assess the finest halftone values on the plate. The 5% – 95% measurement patches enable step-by-step measurement and control over the total tone value range. The determined measurement values can be used to check or recalibrate a plate.

Screen information

The screen patch (8) shows information as regards the selected screening method.

Calibration

The last patch of the plate control strip (9) shows the linearization/calibration used and gives a graphic representation of the resulting calibration curve. This enables to check the use of correct process parameters fast and easily.



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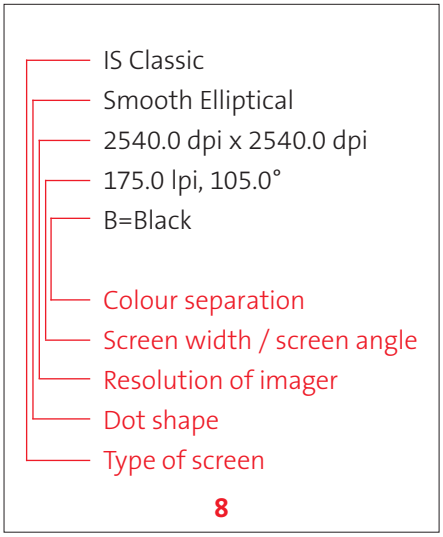
In production environments with many different calibrations and/or linearisations, this check is absolutely necessary in order to prevent faults due to a wrong selection of curves in printing.

To sum up

Printing plate control helps to keep the production process stable and to avoid expensive faults in printing. During recent years, above all differences between single plate batches have caused more and more problems.

It is true, investments in measuring device and wedge are required at the beginning, but they will be put into perspective with every fault that is prevented and costs dearly in printing. Unfortunately, prevented faults cannot be expressed in figures so that these investments are often used as a (wrong) reason against process control in plate production.



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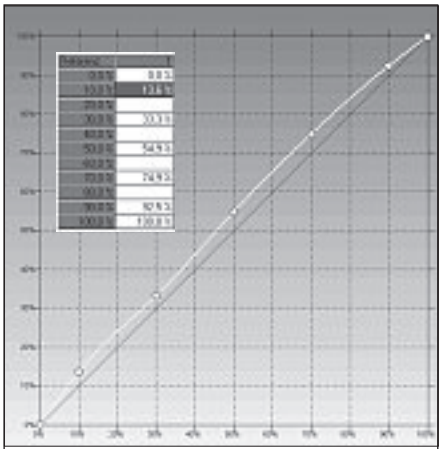

Measurement values and graphic evaluation of an unlinearised plate

No guarantee of the print quality achieved without control of the printing plate quality. While initially CtP plates were checked with densitometers designed for use on printed sheets, since there were no alternatives, devices based on microscopic image capture and image analysis are overwhelmingly used now.

Function principle

The measurement patch is illuminated evenly with a broad-band light source. The captured image is shown via an optical system on a matrix sensor and interpolated via a signal processor into dot size and/or coverage values which are very important for the user.

The devices of different manufacturers often render different measurement results so that it is advisable to calibrate the plate measurement devices. For this purpose, the FOGRA has developed the "Fogra Measuring Bar". This is a reference plate with AM and FM screens for a comparison with the basic setting of a plate measurement device. Nowadays, many manufacturers already provide FMB-based devices.