PROGRESSIVE BUILD TO GREY

Tim Quinn outlines the G7 method for calibrating and printing to Neutral Print Density in all printing processes

THE G7 METHOD FOR CALIBRATING AND printing to Neutral Print Density (NPD) is becoming more popular in all printing processes. As a means of control in 4-colour process printing, NPD provides a shared appearance in the same image printed across multiple platforms, and the ability to achieve and maintain colour within a production run, as well as from run to run, in the screen, digital, offset and flexo printing industries.

With properly controlled NPD an image can be reproduced by any print method desired, which is critical for screen printing to maintain its viability as a process. Moving towards this method of control requires recalibration of each screen press, which takes some time with multi-colour presses. Those with single colour presses, however, are at an additional disadvantage because press adjustments made during printing / calibrating cannot be assessed until the last colour is printed.

This article describes a process that develops grey balance for one-colour presses from linear plates. It involves deriving NPD curves and maintaining grey balance in production by predictably building up to grey as the print order proceeds.

STEPS TO NPD

To achieve NPD it is necessary to initially print linear films with press parameters set up to be as wide as possible. Printing is completed with press parameters adjusted to finely dial in the grey balance. If the NPD values cannot be achieved linearly, the films are curved appropriately and reprinted to gain proper NPD values. Once these process adjustments and film curves are set, results show colour is achieved in less time and maintained more consistently throughout the print run.

A key element of this process is to aim for grey balance from linear plates on the first run. This is a new concept and is often possible. Aiming for NPD on the initial linear run achieves at least four key benefits:

- Press operators learn to use grey balance as a function of press control
- The full impact of tonal change, by making on-press adjustments, is easily seen and understood
- Aiming for NPD brings consistency to the workflow; it is factored into the neutral print density curve (NPDC)
- The resultant press compensation curves are coherent and synchronised; they move up or down together.

USING THE HR POINT

The G7 / NDP process calls for three grey points to monitor grey balance: 25% HC (Highlight Contrast), 50% HR (Highlight Range) and 75% SC (Shadow Contrast). The 50% HR is the best target point for the first G7 run. Figure 1 shows graphically the impact on the tonal range, expressed in percentages of change, by density or press adjustments. According to this graph, the 25% HC is not a good control point due to the low impact of change.

	C	M	Y	Spread
CMY	.60	.60	.60	.00
CY	.53	–	.43	.10
MY	–	.46	.56	.10
CM	.60	.60	–	.00

Chart 1: Two colour accumulative density readings on the HR

Although it could be suggested that the 75% SC (Shadow Contrast), shown on the right in Figure 2, should be the ultimate aim point, tests show that using the HR 50% proves to be the most stable method, resulting in synchronised NPD curves.

PRESS SETTINGS

Ideal press settings establish the widest window of press adjustments (+ and -) that can be made to dial in the NPD. For example, calibrating a press when the squeegee pressure is at a maximum only allows for a reduction in pressure; there is little or no room for positive adjustment, so start with all press settings in the mid-range of acceptable results.

The charts provide actual results of printing linear film with press adjustments set to the mid-range values of 50 pounds of pressure with a squeegee speed of 6 and squeegee angle of 1 inch / 2.5 cm. Chart 1 shows the CMY press compensation curve results required to hit G7 NPD by adjusting press settings to achieve grey balance. The CMY compensation curves are nearly identical.

Chart 2 shows the CMY press compensation curve results required to hit G7 NPD using neutral press settings. Generally separate curves have to be used for each colour, with the benefit that the press remains neutral, maintaining its full adjustment range. The black curve remains unchanged in both examples because black is a non-chromatic colour, independent of grey.

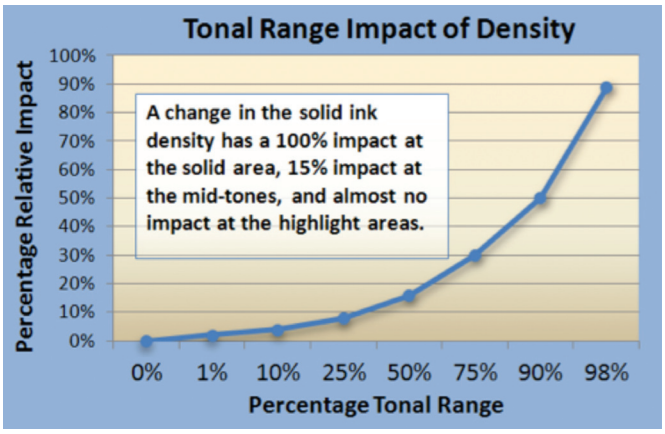

Figure 1

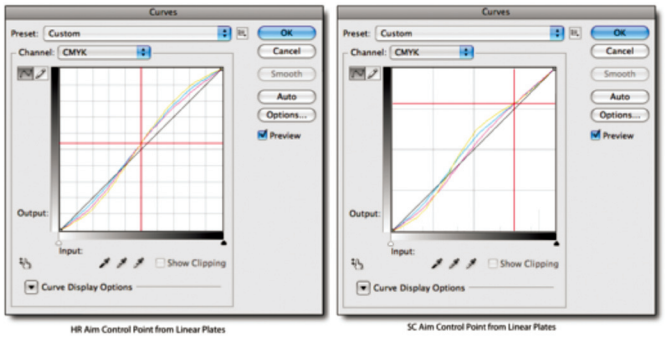

Figure 2

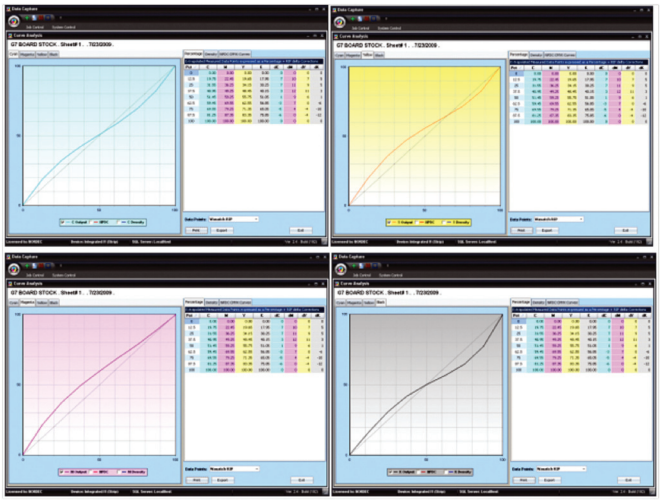

Figure 3

The press settings were then adjusted, per colour, to dial in the NPD:

C	40 lb pressure	8.5 speed	squeegee 1 inch / 2.5 cm
M	60 lb pressure	4.0 speed	squeegee 7/8 inches / 2.2 cm
Y	60 lb pressure	5.5 speed	squeegee 1 inch / 2.5 cm
K	50 lb pressure	10 speed	squeegee 7/8 inches / 2.2 cm

Chart 2

CMY data shows neutral results in the following curves. Notice that the CMY curves from Figures 3 and 4 are all noticeably different from each other, with the magenta and yellow showing the widest variance. The correction curves in Figure 4 exhibit consistency and smoothness while minimising unwanted compression to any image's dynamic range. The CMY correction curves are also all noticeably similar. The established press settings and curves provide a wide range of adjustability and consistency.

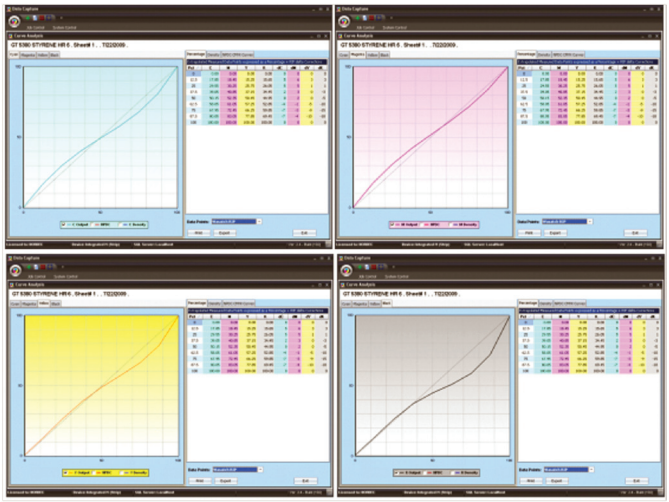

Figure 4

PRINT ORDER

A Design of Experiment (DOE) process was used to test and verify the optimum single colour print order and 'build to grey' weight values for the second colour down. When printing one colour at a time to NPD, the first and second colours down are the only variables that separate single colour printing from inline printing. For example, assuming the press is calibrated and the print order is C-M-Y-K, the third colour down gives a full grey scale for accumulative density readings and the fourth colour is independent of CMY.

Testing has proven that any print order can be used, but cyan is the easiest to implement. This is for two reasons: firstly the HR aim

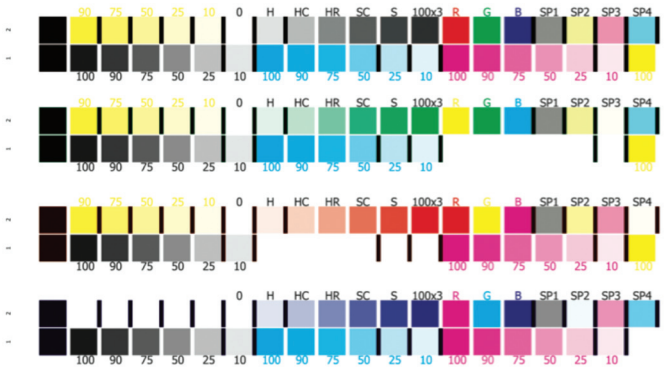

Figure 5

point is a build of 50% C and 40% YM. Cyan is the only colour that matches, in the grey ramp, the same values as the single colour bar, whereas M and Y ramp to a ratio of cyan, so it makes sense to have a control point aim that remains on the colour bar after the 'build to grey'. Secondly 50% cyan and 40% magenta are the only two colours that, when combined, equal the same accumulative density.

Using a control test, prints were measured from a compliant G7 digital proofer where the HR was calibrated to read C:60, Y:60, M:60. The test (see Figure 5) was designed to simulate all possible two-colour combinations: CY, MY, CM and their reciprocals. The results show the best print order to be CMY then K. The build to grey has no differential between C and M. Chart 1 shows that the other two options, MY and CY, are more difficult to print because of density differential.

CMY to grey, on a single colour press, is easy. After the test file is prepared, using the G7 layout modified to fit the press and imaged linear films / plates / screens, do the following:

- Print the cyan screen; on press after printing good clean dots, balanced all around the sheet with the press settings at neutral, read 50% cyan patch using a densitometer in density all mode.
- Print the magenta screen; switch to reading the G7 HR 50% grey patch, which is a build of 50% cyan and 40% magenta. Adjust press settings until the HR grey patch has equal cyan and magenta density readings – disregard yellow and black for now.
- Print the yellow screen; read the same G7 HR 50% grey patch. Adjust press settings until the HR grey patch has equal cyan, magenta and yellow density readings. With no compensation curve, the gain will be low but balanced and grey. As the black is independent of the grey, it can be printed using good clean dots and kept equal or close to where the cyan 50% patch started.

CONCLUSION

At this point the press is printing neutral and grey, which is the base line for all good printing. Previously this had been very difficult to produce, especially on single colour presses; a typical screen press would also have needed compensation for the highlights, mid-tones and shadows. The compensation curves can be built manually using a graph paper method or using software such as IDEALink Curve Software from IDEAlliance or Data Capture System (DCS) from Nazdar Consulting Services. After applying the necessary compensation curves, use the same 'build to grey' technique as previously described from the linear run. Many printers using this technique report significant time savings on press setup, approval and G7 proof matching. ■

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