WHAT IS G7?

G7 is an IDEAlliance specification that defines a universal appearance for B&W imagery (or a printed grayscale), as well as how to calibrate and control any printing or proofing system to achieve that appearance. It is also the basis of GRACoL and SWOP, and the new CGATS.21 suite of Reference Print Conditions (See Section 5.)

G7 uses the same CMYK calibration curves as traditional TVI-based calibration, but with much more valuable results. Unlike TVI calibration, which is unrelated to human vision, G7 is based on visual appearance, achieving the same pictorial qualities of tonality and gray balance across all print technologies. By controlling grays, color images also look as "pleasing" as possible without ICC profiles. For even more accuracy, and color-critical work, G7 should be combined with ICC color management.

In addition to being a specification, G7 also defines a simple method for calibrating CMYK printing devices. Part of the success of G7 is related to the ease of calibration. More than 1,500 printers worldwide have received G7 Master status by demonstrating their ability to print to G7.

G7 IN PICTURES

The illustration below shows what G7 can – and cannot – do. The top three images were produced without any calibration using three different printing technologies: dry-ink digital, inkjet and offset lithography.

The bottom images show that G7 calibration has corrected gray tones and improved colored areas. Saturated colors are still affected by ink differences (which G7 cannot adjust), but without a reference proof, all three bottom images are "pleasing" and it's hard to say which is "correct."

G7 BENEFITS

By focusing on visual appearance rather than mechanical variables like TVI, G7 offers many benefits.

- When used with ISO-standard ink and paper, G7 helps offset printers simulate a GRACoL or SWOP proof without a custom press profile.
- G7 brings some non-offset printing (e.g. dry-ink digital) close enough to GRACoL or SWOP for certain work. Higher accuracy can be achieved by adding ICC profiles.
- An ICC profile made after G7 calibration can have a longer life and achieve higher accuracy than one made without G7.
- All G7 printing systems have a "shared neutral appearance," meaning that files prepared for any G7 printer should look pleasing on any other. This has profoundly simplified and improved CMYK file exchange.

The above set of pictures shows how G7 calibration provides common appearance across multiple print processes.

BRINGING RGB BENEFITS TO CMYK

Exchanging RGB files has always been easier than exchanging CMYK files. Whether it's a TV signal, a web image or a video, an RGB image that looks good on one display (monitor or projector) usually looks pleasing (if not exactly the same) on any other. This is because all video display devices produce the color "gray" from equal RGB values, and typically share a common 2.2 gamma. So black-and-white images appear very similar, no matter where they are displayed.

G7 is the first "universal standard" for how to print gray in CMYK. Before G7, tonality (lightness and contrast) and gray balance varied widely on different presses and printing technologies. One perfectly good press might be very dark while another was very light. One might have a natural bluish cast while another had a natural reddish cast, etc. Every printing process needed its own custom CMYK files, and sharing files between printers often required extensive (and expensive) prepress corrections.

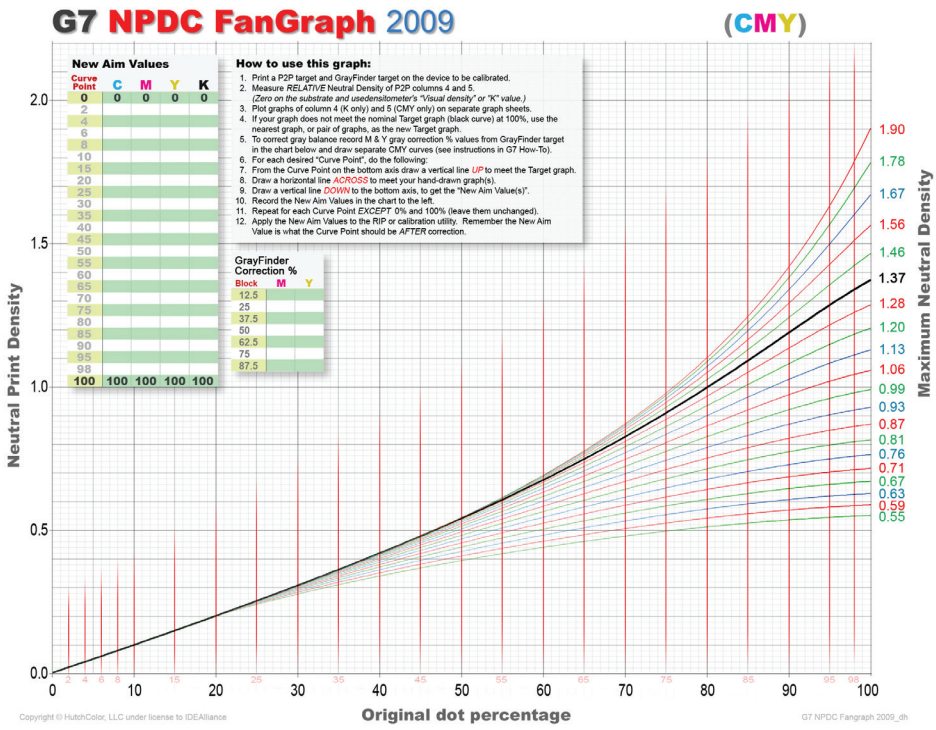
To address the differences between presses, G7 established a carefully researched definition of gray balance and neutral tonality, based on typical offset printing, and instituted a simple method of calibrating any printing system to match that definition.

G7 TONALITY (NPDC)

G7 tonality is the relationship between the dot percentage and printed neu-

tral density of two neutral gray scales, one printed in black only, the other printed with "balanced cmy" percentages.

The G7 neutral density values of these gray scales were determined by testing the natural performance of multiple offset presses using ISO-standard ink and paper. The results were averaged into a set of "neutral print density" curves (NPDC). A formula adapts the NPDC curve shape to any available maximum ink density, maintaining highlight contrast but compressing or expanding the curve in darker tones, as shown in the G7 NPDC FanGraph.



The G7 Fangraph shows how multiple devices can achieve common tonality and gray balance.

G7 GRAY BALANCE

G7 defines gray balance in two parts:

- a standardized scale of cmy percentages that should appear neutral to the eye, and
- the a* and b* values for each scale step.

The gray-scale cmy percentages were derived using a formula based on the traditional 50c, 40m, 40y gray balance ratio. Exact values appear in the "G7 How-To" booklet and in Column 5 of the P2P25 target.

The a* and b* values for any step of the gray scale vary according to paper color and can be calculated by these simple formulae:

a* = paper_a* x (1 - C/100)
b* = paper_b* x (1 - C/100)

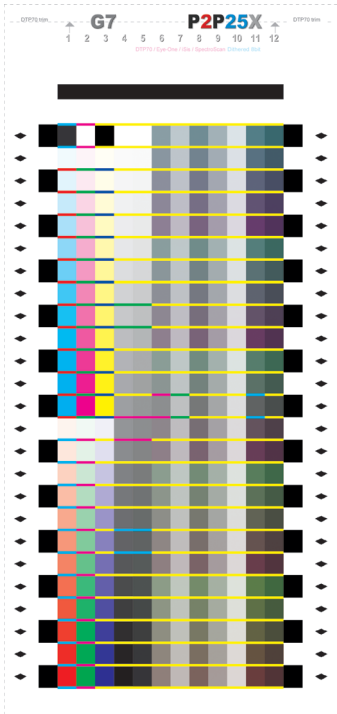
G7 gray balance is "paper-relative," meaning that images printed on different-colored substrates appear slightly different when viewed side by side. When viewed individually, however, each appears neutral to the eye, thanks to a process known as "visual adaptation," through which the eye uses the surrounding white paper as a neutral reference.

FLEXIBILITY

The key to G7's widespread adoption is that it works with any technology. Any stable, repeatable printing system can simulate G7, using either simple one-dimensional calibration LUTs or more sophisticated color management. The same rules apply to all printing processes, regardless of substrate (paper), colorants (inks), tone modulation (screening) or basic technology. G7 has been successfully applied to offset, flexography, gravure, electrophotography, inkjet, screen printing, RGB photographic paper, monochrome (black-and-white) and more.

LEARNING MORE

For more information, ask a G7 Expert, attend a G7 Expert / Professional training course or read the IDEAlliance "G7 How-To."



Most G7 calibrations include the P2P target.