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The Little “Secret” of Process Color at Press: Printing to Gray Balance

By [Patrick Henry](#) on May 22nd, 2007

Here’s a printing lesson we found so helpful that we’re posting it in full even though it’s a bit longer than usual for a blog entry. Entitled Printing to Gray Balance, it was written and submitted to PrintCEOBlog.com by Dan Remaley, Senior Technical Consultant in Process Controls for PIA/GATF. He invites anyone who would like further information to contact him at 412-259-1814 (o), 412-889-7643 (c), or dremaley@piagatf.org

Recently there has been a lot of discussion about “printing to gray balance.” The new [GRACoL G7](#) describes the methods to achieve gray balance at press.

What’s so important about gray balance at press?

The concept of gray balance is essential for excellent color reproduction in scanning, proofing, and in the pressroom. In scanning, images that are not in gray balance are considered casted. Images that are casted show a magenta, cyan, or yellow (or

combinations of M-C-Y) color appearance in the highlights, midtones, and/or shadows. Casted images require color correction to remove the unwanted colors. Images that are in gray balance only need to be adjusted for specific areas of color enhancement, e.g., greener grass or bluer skies.

Proofing systems must be able to reproduce neutral gray without any cast as well. If the file is correct and the proofer introduces a cast, then all the color is shifted away from gray balance. A proof that is casted will require the press to print away from neutral gray to match the proof.

The little secret of process color printing at press is that you can only print two ways on press in gray balance or casted that's it! You are either neutral throughout the tone scale, or you are casted in some way. If you're casted, color reproduction suffers.

The fact is that all press operators abide by this principle. Press operators look at a printed press sheet and notice casts of too much magenta, cyan, or yellow and reduce whichever color is creating the cast. The control for the press operator is more or less ink; however, the TVI (tone value increase), or dot area, is equally important. The press operator can't change the size of the dots on the plate, but he or she can change the gain by adding or subtracting ink.

The major problem in printing today is that the values on the plate are incorrect. The values on the plate need to be adjusted for all four colors. Each color, Y-M-C-K, needs its own plate curve to reproduce neutral gray at press. A lot of printers have only one plate curve for all colors! The other issue is weight: how dark or light is your midtone reproduction? Screen builds and Photoshop images are adjusted for around a 20% TVI, or midtone gain, meaning that a 50%

patch will print as a 70% value. Most linear plates (50% = 50%) gain around 14% to 16% on press and print too light for separations created in Photoshop.

The majority of printing plants I encounter have this platemaking problem. It is impossible for the pressroom to control gray balance and color with the wrong size dots on the plates. The procedure is to print a test form with complete tone scales at the required density.

Next, compare the scales against a standard and adjust the plate values accordingly. Every color bar should include a three-color gray patch represented by 50C-40M-40Y. This patch, when printed at the correct density and dot gain, will appear neutral without any casts. It can also be measured with a reflection densitometer. The densitometer needs to be set for all filter readings. Now the yellow, magenta, and cyan inks can be measured as a density. When all three filter readings are equal, the patch is neutral. A 0.03 density among all three filter readings is the tolerance for an acceptable neutral appearance.

20 Responses to “The Little “Secret” of Process Color at Press: Printing to Gray Balance”

By **Brian** on [May 23, 2007](#) | [Reply](#) Mr. Remaley hits the nail on the head here. After struggling for nearly a year adjusting our process and raw materials to get decent color, I attended Dan's Excellent “Process Controls Bootcamp” at the PIA/GATF Headquarters. Most of what I heard, I had learned the hard way

in the trenches, but the epiphany came when Dan discussed gray balance. I implemented what I learned there and our print has never looked better!

By **Bruce** on [May 23, 2007](#) | [Reply](#) Mr. Remaley, Thank You for your input. I find it interesting that companies will go out and sell their proofing and plate systems with a push to Gracol g7 and yet have No Clue how to make the system work. I could make a full time living just cleaning up and restoring plant standards after Fuji installs their systems. Don't get me wrong, I Love Fuji and recommend them highly over Approvals Any day of the week. At least you can go to press and match the proof after the system is established correctly. As far as Gracol g7 Call me Old School, But I just don't see what the hub-bub is. If a plant is finger printed and set up correctly, There is no need for this on a regular basis. I do understand the concept of printing to Grey balance and its value for consistence, However it just seems like a huge money pit to 98% of the printers. Its like the waterless or Stochastic Its a Fad and we will learn some things from it But long and short, Is the Market Place really willing to pay Extra for Gracol 7 ? Maybe some young buck out of print collage who has No Grey hair might spend the extra until their boss sees a 14% increase in print costs! Att Printers who have gone to Gracol g7, Please let me know if this sounds familiar? Customer refuses to sign off at press as the back ground is way off, You have prep make a new plate with 6% less is Cyan 1/4 tone and 3% gain in Mag 3/4 tone pull back up and customer refuses to sign. You the add 4% Black mid tone and pull 3% cyan 3/4 tone out pull back up and HA! finally have Background close but Flesh tones look like the person just

survived an episode of 24 with Jack Bauer!!!Before you know it Your down 17 plates, 11 extra hours of press time and your sending material handling for more paper and you see your supervisor telling the customer... ” I know its an Apple, But lets face it There are a lot of Orange Apples in this world today !!!Question Is It Worth It ?

By **John Henry** on [May 23, 2007](#) | [Reply](#)Yes Dan has trying to get printers to use this method for years. I have and it works. The problem I belive is most printers call the “prepress guys” when trying to get color to match.The “prepress guys” then want to sell a “new” color software/hardware solution that does not in away address the real issues of calibrated plates/dotgain to press.None of this is new, printers have known of this since the 70’s, few have done it. Much simpler to blame it on the press or press operator

By **Ray** on [May 23, 2007](#) | [Reply](#)Gray balance should be set in prepress and not at the press. Press testing and fingerprinting of a press every six months is desired. If this is done many problems will not occur.Control of a press run is not as simple as running to gray balance during the run. Many factors influence gray balance: density, fit, register, slur, doubling, backtrapping, trap, dot gain, wavy paper, paper coating issues. The simplest way to run is to set gray in prepress and control ink film thickness via density during the run. If gray varies it can be due to one of the other factors. Fix the factor and do not change denisty.Keep in mind that if there is an issue on press that controlling the press run by controlling gray balance can and will lead to greater color variation on both web and sheetfed presses.

By **Robear** on [May 24, 2007](#) | [Reply](#)I have taken Dan Remaley’s

“Process Control” boot camp, and have come away with Gray Balance being the foundation to a properly implemented color management program which I use today in setting up printing plants as part of a Process Control program. Where most companies come up short in their quest for consistent color in the pressroom, with poor to non-existence process controls, they believe for some odd reason that if they implement G7 as a pressroom standard, that they will be able to match color like never before. It is not long afterwards that the excitement wears off as the printing plant can no longer match previously printed work, and they revert back to just running the ink densities to please the customer with no real process control in place. I guess to them, it is easier that way and as Bruce has pointed out, some companies believe that 17 plates and 11 hours of makeready just to get a customer OK (which is all based on a visual assessment) is a color managed program. I am sure Dan will agree that before Gray Balance can be used successfully in the pressroom, the printing plant must be able to print consistently to the “Numbers” of SWOP / GRACoL / SNAP. Maybe we can call this the “Dirty Gray” secret of Color management.

By **vinod r navwab** on [May 24, 2007](#) | [Reply](#) I agree Grey balance should be corrected at Pre-Press and somehow the LPI/DPI ratio also plays a big role in balancing. Those who use poor washing chemicals in regular use and improper pressure settings between rollers and cylinder hardly have control at Press to balance it.

By **Dan Remaley** on [May 24, 2007](#) | [Reply](#) For those of you who don't believe in gray balance for color control, please visit and Quad Graphics who use, and sell System Brunner. Ifra, ISO, G7

and the Newspaper industry all use gray balance for run control. It's interesting that the Newspaper industry has very little room for color control targets, so of all measurements, what do they measure GRAY BALANCE, the 3/color bar is on every color page.

By **Ray** on [May 24, 2007](#) | [Reply](#) Additional comments: Very few firms use System Brunner and many of those who do control color during the run by density and watch gray balance as an indicator of press issues. The control is density up or density down. ISO does not recommend control of a production run by control of gray balance. G7 in the drafts was controlling by gray balance alone during the run but in later versions states that you may go either way. Control of a pressrun by gray balance control will work in a perfect world — I have not found that world. Newspaper are another story.

By **Greg Imhoff** on [May 24, 2007](#) | [Reply](#) Use your Gray Matter. Dan is correct and John Henry reinforces that which I know for certain printing to a natural (neutral) gray midtones (+) not only “works,” adding by using G7 this actually helps printers. Rhetorical question: Name one major SIC manufacturing industry today, without standard production requirements. TT BOMK Printing is the one large industry which operates daily without standard production requirements with each company, of course producing jobs to self standards. One may argue since each work is in itself a custom production this is just. Another may state regardless in manufacturing production efficiencies (The World is Flat), with quality and throughput at a PRICE, to client needs profitably, is the (real) goal. Enter GRACoL for US. The truth is GRACoL and G7 works. I know this from being at various G7 test runs and know the

good people involved at all levels for many years. One reason this works to “take the cake” using Pats analogy is Gray Balance, by definition is simply based upon solid science aka Spectral (plus TVI etc.) values which considering each job as custom challenging colors and with normal shifting stock colorants, logical. If we keep the concept of manufacturing to standards specifications simple, as a production principle we then keep it accurate and efficient. That is to say to keep things “neutral” is to match the proof and to then more efficiently satisfy the client, for more profits. Then on to the next job more profits, etc. To me the better question to ask may be: How do we simplify GRACoL 7 so press operators do not defeat a system which helps their companies to grow, both today and tomorrow? Gray Matters. G7 works across all print media. Greg Imhoff President, GRIPdigital, inc.<http://www.gripdigital.com>(708)588-1150

By **Robear** on **May 24, 2007** | **Reply**Hi Dan, did you expect such a lively response to your little secret? You got the full gamut from running a press using density only, let prepress correct pressroom issues, throw more color management software at the problem, G7 being endorsed by the Flat World Society, companies who are more successful running no standard with maybe 1 plate curve, and of course my personal favorite...turning your pressroom into a bakery!Are you thinking what I am thinking, that most of these print shops don't see alot of repeat work so they can invest the time to perform color management out in the pressroom until they get close to meeting customers expectations no matter how costly this method may be.All kidding aside, it requires a culture change for any plant who is not used to keeping tight

process controls over their operation to even consider a color management program using Gray Balance as a key indicator for quality printing. The sad part of all this is most print shops printing 4-color process still use only solid ink densities patches on their color bar to control their work. It is almost as if they never heard that there are books available like "Basic Principles of Quality Control" by Heidelberg, a quick and easy fold-out brochure by BETA Industries, and of course the many many books by GATF to keep everyone informed and educated. Work Smarter Not Harder....naagh, I am not buying it. Sounds to much like work :-0

By **Tom Coker** on [May 25, 2007](#) | [Reply](#) Grey balance-Gracol-G7It seems strange to me that there is so much hoop-la about printing to Grey balance. When Learning to operate a Hell Scanner back in the late 70's, Grey balance was the golden Rule. With out it, you produced casted separations that then had to be etched to bring the sep. into balance. Then as a Scitex operator, doing re-touching. Everything revolved around Grey balance. Now working in the printing industry we must continue the process. However, now instead of films making the plates, the CTP devices must produce plates that will print a Grey through out the entire tonal range, and this is accomplished by separate plate curves for each process color. At our facility, we are fortunate to require only 3 of the typical 4 curves. Our presses will produce a Grey balance when the plates are correct, and the other influencing factors such as water, chemistry, and overall conditions of the press are correct. This requires close monitoring, but is very managable. Typicall a press make ready has the pressman coming up to our established standards for the type of paper he is using,

then he looks at the 3 color grey bar that we print along with the standard color spots. When this is in balance, and the readings with the spectrophotometer are within spec. then and only then he brings out the proof, if there is one, and guess what, if he has grey balance, he matches the proof 99 % of the time.

By **John** on [May 26, 2007](#) | [Reply](#)DanCan you please point out the differences between System Brunner and G7 ?I see them both as good calibration systems and I do not see where G7 lacks anything compared to Brunner.BruceNo it doesnt sound familiar at all, I have been using G7 for months and have not seen what you are describing.Tints and 4/C match, better than anything I have done in the past....sorry I dont get your point.For coated Sheetfed and Web, G7 works period.Obviously there is a process control issue or it wasnt set up properly in the first place.Were you trained in G7 ?Bottom line Process control is Key, and both System Brunner and G7 can get you where you want to be.JR

By **Dan Remaley** on [May 29, 2007](#) | [Reply](#)“Can you please the point out the differences between System Brunner and G7 ?I see them both as good calibration systems and I do not see where G7 lacks anything compared to Brunner.”System Brunner is an ink control system, measuring and controlling ink flow based on, primarily gray balance but also density. Go to <http://www.systembrunner.ch> to learn more.The G7 methods are for establishing the plate curves to print gray balance at press based on the colormetric data

By **Hal Stratton** on [Jun 4, 2007](#) | [Reply](#)There’s a need for clarification . . . There is difference between G7 and System Brunner.G7 is a calibration process initially used to help proof

match press more accurately — based on gray balance. G7 has no tool for monitoring or evaluating gray balance on press during production, or offer to the press operators how to improve gray balance. Currently there is a move to have a visual comparison between the CMY 50/40/40 overprint, printed next to a 50% black patch so the press operator can “see” if their gray balance not “neutral.” A very “subjective” method of gray balance evaluation. System Brunner is not a calibration process, it is a tool for press operators during makeready and production. System Brunner has a close-loop color control system called Instrument Flight for gray balance measurement, evaluation, and in some cases control. Instrument Flight that is OEM'd to QuadTech for web presses on their color measuring system, and on sheetfed presses it is available in closed-loop for MAN Roland 300, 500, 700, and 900 series presses. It also comes in a stand-alone version. Since 1998, many MAN Roland presses are already equipped for gray balance measurement and evaluation with System Brunner PrintConsult, and as an option since 2006 with System Brunner okBalance. Both of these softwares measure and evaluate gray balance of the current production job directly from the colorbar, with gray balance measurement in every ink key. The softwares provide the press operators with an easy to understand view of the current print conditions based on measurements of SID, TVI (50%) and gray balance overprints (CMY solid and CMY tint). System Brunner provides the press operator an excellent objective look at gray balance across the entire press sheet in every single ink zone. If gray balance is not neutral, the press operators can see why, and the software offers recommendations for improving gray

balance. In the case of okBalance, the software will monitor and control color based on an “OK” sheet to maintain gray balance throughout print production of the job. MAN Roland has participated with the GRACoL committee on one test of the GRACoL G7 process (overseen by the “lead” GRACoL expert) and one GRACoL expert training (also done by the “lead” GRACoL expert) at the MAN Roland facility in Chicago. Prior to the GRACoL run, we used the SID/TVI method many are using as a proven method for evaluating gray balance (as Dan Remaley described above). During both of the GRACoL runs, we came up to our standard SID and our TVIs for CMY were in alignment. System Brunner PrintConsult provided us feedback that which showed that our gray balance both solid and tint CMY overprints were very close neutral and print parameters for SID and TVI were with specifications. The G7 method was used to evaluate our print and a very, very minor change was made to the yellow curve — no noticeable change to the gray balance was seen. For those wanting to use the G7 calibration method, it works — SID/TVI calibration method also can work. The overall goal of both is to have print production with gray balance. System Brunner is the tool monitoring gray balance after the calibration to aid the press operators in maintaining it throughout a production run.

By **John** on [Jun 6, 2007](#) | [Reply](#) Hal Thank you for clarification of System Brunner and G7, certainly if they were incorporated together it would make for some positive changes in the industry. Using the G7 Calibration method with system brunner monitoring and adjusting the press would be an ideal situation for everyone. Sorry if I added to the confusion but from reading some of the first few entries it seemed more of a G7 Bashing

than any type of constructive discussion about Brunner and G7. Dan, have you adopted the G7 method into your boot camp training, certainly Gray Balance is important through out the entire Print range. I believe if you are using SWOP aim points you are only targeting the 25, 50, and 75% for TVI Based Gray balance ? John

By **Tony Fetter** on [Jun 11, 2007](#) | [Reply](#) I too had the privilege of taken the “Process Control Boot Camp” with Dan. I learned a lot, especially the importance of gray balance. We incorporated this knowledge into our printing process. Here is how we created our process: 1. Fingerprinted the Press by installing linear plates (no curve). 2. Made sure blankets were fairly new (no older than 2 weeks). 3. Fresh fountain solution. 4. Ran to SWOP densities (dry – 1.60, 1.30, 1.40, & 1.00). 5. Pull 10–20 sheets, at density, measure the Dot Gains at the 25/50/75 and average out. 6. Create plate curve according to Dot Gains realized on Press vs. SWOP standard. 7. After implementing the plate curves, monitored Dot Gains on Press. We needed to fine-tune the curve slightly. 8. We did take gray balance a step further by controlling the 25% & 75%. We curved the 25%, 50%, and the 75%. We now have gray balance through the entire tonal scale. We print on No. 1 & 2 Coated sheets and still use the SWOP guidelines. We do not use GRACoL guidelines. With the diminishing press counts and quick turn times (sometimes 8 hours), the use of GRACoL’s ink densities would lead to severe offsetting.

By **Louis Dery** on [Jul 17, 2007](#) | [Reply](#) About gray balance and TVI curves realworld story: we have many clients who are using our curve calculator called PerfX Press Curves™ to validate and/or calculate TVI and GrayBalance when doing press

fingerprint. As an example, we have a client (book printing) who is now running with gray balance bar only! Pressmen just have to measure reference Black and CMY (GB) densities, in order to get color OK and match proofs (color managed with press profile). It is sure that SID color bar is required, but for this particular client, that is the way they now work and now they save a lot of money (make ready, etc.) and are able to fix color problem at the right place (prepress vs press). Gray balance is not “new”. It’s been there since many years. But now, clients request standard print conditions and ask printing shops to show them what they (the printing press) are targeting in order to establish Color QC. Gray balance is a supplemental way to validate, as well as SID, TVI, etc. The curves tool is used to bring the press to a standard printing condition, in order to avoid “color tweaking” at the press. It is cheaper to “fix” plate curves than let the pressmen spend time, ink and paper to get color right, and this, from job to job! PerfX Press Curves is also used to cross match different TVI, screens, print processes, etc.