Idealliance ECG Calibration Guidelines

Idealliance ECG Program Overview

The Idealliance ECG committee is working to create an industry standard test chart, methods and procedures for calibrating, and a sample target characterization data set for ECG (Expanded Color Gamut) printing.

Benefits of Participating in the ECG Program

The ECG test program will provide a number of benefits for the industry:

- A common ECG target for use with a wide range of software
- A common calibration methodology
- Common printing aims and characterization data

Idealliance will recognize test form contributors as part of the ECG team with a formal letter acknowledging the participant's place in the creation of the ECG deliverables. Participants will also gain knowledge on global leading practices for ECG calibration ahead of the rest of the industry, leading to both tremendous efficiencies and cost reduction.

Program Scope

The objective is to create a standard characterization data set for use with a set white point using CMYKOGV printing inks. This is not limited to a specific print technology, but we are certain and looking to capture data from offset, flexo, inkjet, gravure, and other seven-color capable print technology in order to create standard characterization data set(s) representative of all print technologies as well. This is just the first step/phase in the program, which will then lead to other substrates, substrate data collection and the ability to adapt data for various substrates. ECG (CMYKOGV) is an opportunity for all print markets, and collection of data representative of all print technology is welcome.

Program Status

The test target and control strip have been published and Idealliance members are currently conducting test runs for the ECG project using 7-color CMYKOGV printing.

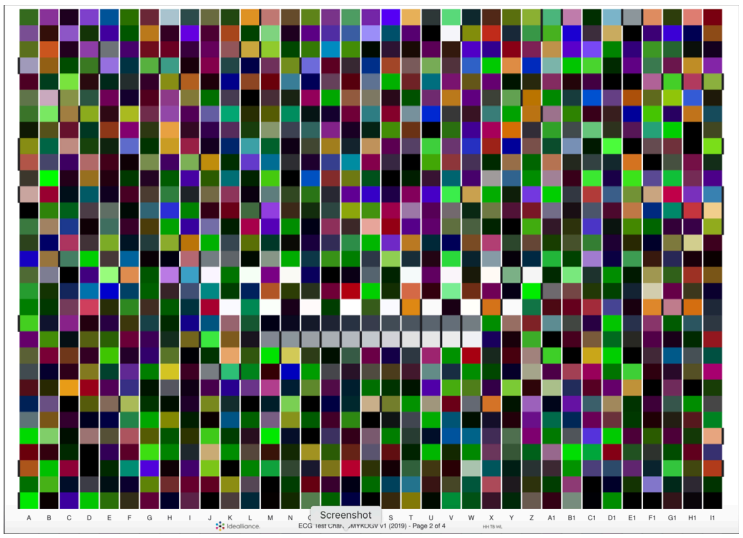
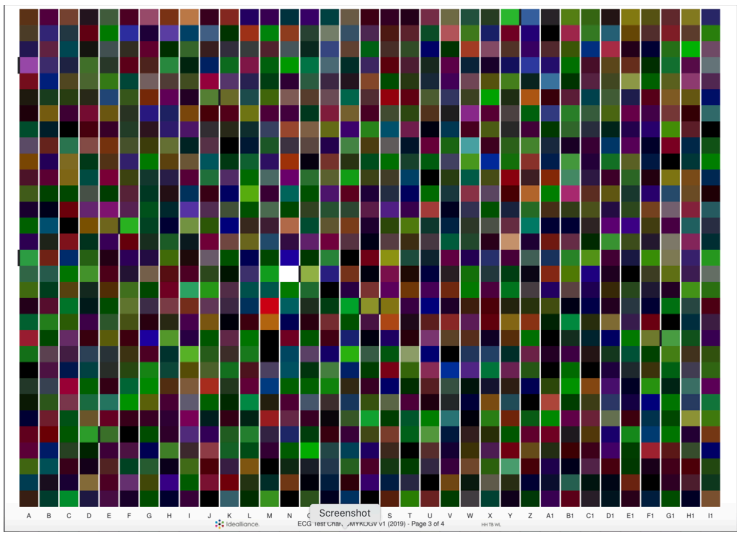
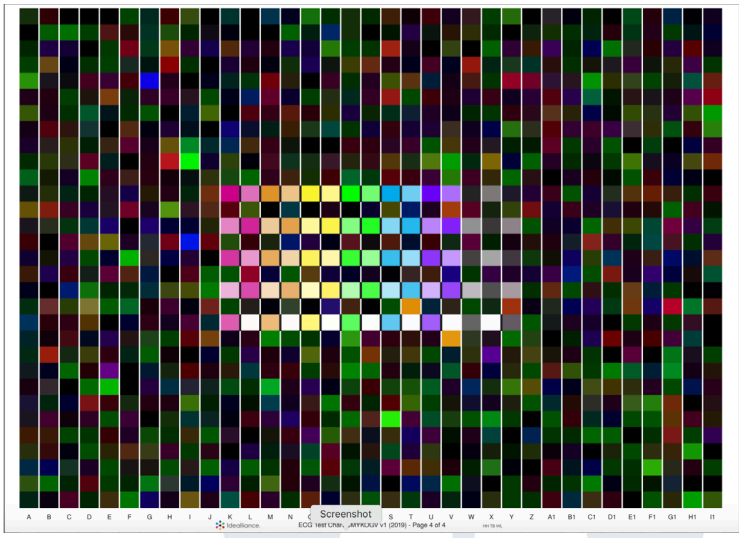
Document purpose

This document describes the requirements for conducting an ECG test run.

About the ECG Test Form

The current test form is designed for use with offset printing; however, it can be adapted for other print technology segments. The form consists of 1-4 test charts that can be used to calibrate and characterize an ECG test run. While using more test charts provides more information, the charts are designed so that in many cases 1 or even 2 charts can be used, and in some cases even (1) chart can be used to achieve an effective characterization. The full set of all 4 charts and reference files can be downloaded from the Idealliance website: www.gracol.org.

The ECG test form can be downloaded from www.gracol.org

Example: ECG Test Chart, pages 1-4

Test Run Requirements

Paper/Substrate

To achieve the best result in terms of color gamut and fidelity, a high-quality substrate with a near-neutral white point (similar to SBS paperboard) should be used with a high quality and stable print technology.

Target white point:	95 L*, 0 a*, 1 b*.
Tolerance:	< 2.0 dE00

Note: The ECG process can be applied to other applications that are not currently in scope. Other applications may include flexible packaging, labels, fine-art, or photo book printing. For these applications, differences in substrate white point (brightness, color and OBA), ink absorption may result in decreased correlation to the standard target characterization data set that is being developed at this time. In that case, additional research and/or target characterization development may be required.

Screening

Printers may user either AM or FM screening to produce the test form, however FM or Ring AM is suggested for two reasons;

1. FM and Ring AM screening can help solve screen angle conflicts such as moire which result from using conventional AM screening.

2. FM and Ring AM screening, or any other non-traditional screening that uses very small ink-receptive sites (e.g 20 micron) can help expand color gamut in quarter-to mid-tone tinted areas on most offset and flexo presses.

If using conventional AM screening, screen rulings (lines per inch or cycles per cm) and angles should be optimized to minimize the appearance of moiré. For AM screen systems where the screen rulings are similar to one another, placing the OGV colors at the same angles as their complementary colors with Orange at the Cyan angle, Green at the Magenta angle, and Violet at the Black angle. This can lead to moiré issues between these two colors depending on the graphics, therefore, it is recommended to use. It is recommended to use FM or Ring AM screening when running Violet rather than attempting to run Violet at the Black angle.

The rationale is that it is rare to have color overprint combinations including significant combinations of complementary colors, so it is somewhat safe to use the same screen angles and hence the same screen patterns for these complements. Violet is chosen to screen at the same angle as Black because there are no other good choices available for the overprint. Generally, in offset printing, this will result in V/K at 45°, O/C at 15° or 75°, and G/M at 75° or 15° (different than O/C). Y can be screened at 0° because Yellow is a light color, the resulting moiré is usually not very noticeable. In other printing processes such as flexo, 7.5° rotated versions of these same constellations of screen systems are also possible, following the same basic principle of screening complementary chromatic colors with the same screen angle.

Stochastic or FM screening of OGV or all units also may be used to prevent moiré. FM screening all 7 units makes it possible to use 7 independent screen patterns, which prevents moiré altogether.

However, depending on the smoothness of the substrate, FM screening can lead to print mottle where flat screens do not appear smooth and uniform. The best way to deal with this is to use AM screening for all but Violet, then print Violet with FM screening. AM screening does much better with rougher substrates.

> *Note: When characterizing FM, it is usually recommended to apply a pre-emptive cut back curve to reduce the increased dot gain/TVI that is typical of FM printing. Doing so results in a printed characterization chart which has greater separation between the measured values for the different patches comprising the chart particularly in the shadows, and thus gives better results. Note that the need for an arbitrary cut back curve is largely eliminated by proper G7® and SCTV calibration, however a pre-emptive cut back curve applied to the first calibration run can reduce the number of iterations required to achieve accurate G7® or SCTV calibration.*

Recommended screening options:

- FM/CMYKOGV
- AM/CMYKOG + FM/V
- AM/CMYK + FM/OGV

Other screening configurations may be used. However, note that some alternative screening configurations may introduce moiré and other artifacts. In addition, note that mixing screening types may cause different print characteristics on differently screened units.

> *Note: The FTA Hue Angles, derived in 2013 when many companies were just starting to print expanded gamut, have proven to be amazingly accurate. Since that time, experience has shown the Green angle of 181° should remain at 181° while a 2° Hue change for Orange (54° to 56°) and Violet (307° to 309°) puts these aims closer to the center of the variation window for both flexo and offset inks.*

Inks

CMYK Inks

ECG is compatible with any ISO 12647-2 CMYK compatible ink set currently used for commercial (e.g. GRACoL®) printing. High-chroma inks may help improve gamut at lower ink film but are not recommended for this test.

Recommended Color Pigment and Hue Angle - CMYK

Ink Color	Recommended Pigment	Hue Angle
Cyan	Pigment Blue 15:3	233.5°
Magenta	Pigment Red 57:1	356.9°
Yellow	Pigment 14	92.5°
Black	Pigment Black 7	0°

OGV Inks

Standard Orange, Green and Violet inks should be used for the OGV inks using the hue angles below.

Recommended Color Pigment and Hue Angle - OGV

Ink Color	Recommended Pigment	Recommended Values			Derived from LAB	
		L	A	B	C	H
Orange	Orange 16 or 64	70.0	55.0	82.0	98.7	56.1°
Green	Green 7	66.0	-73.0	-1.0	73.0	180.8°
Violet	Pigment 23	24.0	46.0	-57.0	73.2	308.9°

Print Rotation

The test chart should be printed with the recommended print sequence of KCMYVGO. Alternative rotations are permitted, if justified, but may conflict with characterization data from other test runs, and from the standard data set produced by this research program. Overprints are directly impacted by the ink rotation selection.

Calibration

Before working with ECG, the CMYK plates must be calibrated to G7 using the consumables and settings suggested below.

Run the press to the above aims for inks, using 12647-2:2013 for CMYK and the table above for OGV. Once ink is within 3.5 delta E/2° Hue of above perform the following calibrations:

- For CMYK perform a G7 calibration
- For OGV perform a linear SCTV calibration

Both the G7 and SCTV calibrations should be as accurate as possible but note that small deviations will be corrected later in software as part of this project.

Confirmation Run

Perform a confirmation run with the new plates at the same ink levels determined in the first run. Run enough sheets/impressions to reach press stability and pull 20 sheets/impressions from last set.

XCMYK+OGV Test Run

Run one last set of sheets/impressions with CMYK inks increased to XCMYK levels and pull last set. Re-calibration to compensate for the impact of higher XCMYK ink levels on G7 is optional, but not essential. Post re-calibration will be applied to the measured data later, if needed. This run is being used to evaluate whether XCMYK combined with OGV yields significant gamut expansion.

Ink Color	Recommended Values		
	L	A	B
Cyan	49.0	-31.0	-59.0
Magenta	45.0	79.0	9.0
Yellow	90.0	-5.0	103.0
Black	10.0	0.0	0.0
Red	45.0	74.0	55.0
Green	42.0	-73.0	24.0
Blue	16.0	21.0	-45.0

The following densities may be used as rough ink level indicators.

Ink Color	Status T- Density (Approximate)
Cyan	1.85
Magenta	1.85
Yellow	1.20
Black	2.00

Partial versus Complete Calibration

If for some reason the second run does not exactly meet the calibration targets for G7 and SCTV, sheets/impressions may still have value, as long as they meet the correct target ink aims and are relatively even across the print area. In some cases, measurement data from these samples may be realigned to the target characterization data using mathematical functions. In these cases, data from these samples is usable and valuable for this project. The recommendation is to pull 20 sheets/impressions, with the closest ink aims, from the entire press run set.

Test Sheet Preparation and Shipping

Test samples should be carefully packaged to eliminate scuffing and damage and shipped to Ron Ellis. Please contact Ron Ellis at ppc@idealliance.org for questions regarding testing.

For shipping information contact Idealliance at ppc@idealliance.org.

About Idealliance

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