G7 System Certification Application Data Sheet

The IDEAlliance Print Properties Working Group has established a certification process for G7 Systems. In accordance with this process The G7 System Certification Program is designed to evaluate the ability of a candidate system to calibrate a printing device to meet the G7 greyscale definition using four 1-D Curves within the tolerances outlined in this document. All evaluations are based on the parameters of the G7 Specification (draft 2008). The following information is intended to assist producers and consumers in the use of the vendor system as specified for creating the four 1-D Curves.

Manufacturer

Curve2 is a joint production of;

HutchColor, LLC
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Washington, NJ 07882
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www.hutchcolor.com
and
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CERTIFIED BY G7 SYSTEM IDEALLIANCE

Certified Dec 6, 2010

Product

Curve2

Testing Instructions

Printing the test target(s)

Print at least one sample P2P target (version 25 or higher) on the device to be calibrated. The P2P target can be downloaded as a package containing digital images and all necessary reference files from www.idealliance.org and/or www.hutchcolor.com. If the optional VPR (Virtual Press Run) module will be used, a suitable characterization target such as the IT8.7/4 must be printed at the same time and with the same printer settings as the P2P target. For G7 calibration to be effective, the printing device must be able to produce multiple successive prints with virtually identical characteristics print-to-print and with uniform characteristics across the whole image area. Prints used for calibration or verification should be free from blemishes or other artifacts and should have had sufficient time to dry or stabilize prior to measuring. *(See **Curve2 User Guide** for more detailed target printing instructions.)*

Measuring the target(s)

Measure the printed P2P target with a spectrophotometer such as X-Rite i1Pro, X-Rite i1 iSis, or equivalent, in software such as X-Rite MeasureTool, X-Rite ColorPort, or equivalent, according to the instructions included in the P2P target package. Save the measured data in CGATS format, with spectral values in the 0-1 range. If VPR will also be used, measure the characterization target at the same time with the same instrument and software. *(See **Curve2 User Guide** for more detailed target measuring instructions.)*

Loading measurement files into Curve2

Launch the Curve2 application. In the ***Setup*** tab, make sure ***Method:*** is set to ***G7*** and the ***"Measured"*** box is empty (not checked).
In the ***Calibration Runs*** list click on ***Run 1 – Calibration*** then either drag the P2P measurement file into the ***Measurements*** list, or click on the + (Plus symbol) below the list and browse for the files.

Adjusting gray balance parameters

Click on the ***Create Curves*** tab. Open the ***Gray Balance Options*** panel and set the desired ***Gray correction threshold***. For maximum gray balance accuracy on a stable and repeatable printing system, set the threshold to 100. For printing systems with unstable shadow characteristics (for example due to

variations in ink trapping) or with non-uniform gray balance errors in dark shadow tones, a lower threshold number such as 50 may produce more acceptable results overall, even if gray balance is not fully corrected in darker areas. Set the ***Gray Aimpoint*** to ***Paper White*** and click ***OK*** to close the Gray Balance Options panel.

Choosing Control Points

In the ***Control Points*** list select the desired number and curve point values. On real printing devices, fewer points are generally safer, but for maximum theoretical accuracy and/or system certification purposes, select ***highlight and shadow weighted (P2P)***.

Applying Control Point values to the printing system

Type the Curve2 Control Point correction values into the printing system RIP or user interface. If the RIP accepts digital files directly from Curve2, select the RIP name in the ***Export - Text File:*** list, click ***Export*** and import the resulting file into the RIP. *(See **Curve2 User Guide - Section 10 Applying Control Point Values** for more detailed instructions.)*

Saving the Curve2 session

It is recommended that each successful Curve2 session be saved so it can be used again to iterate or fine-tune an existing calibration. Saved sessions also allow the VPR module to be used later to test a calibration *(see **Appendix C: Verification Instructions (via VPR module)**.*

Verification By Physical Print Testing

Printing a "Verification" target

Print the P2P target again on the same printing system using the same media and system settings used to print the original test target, but through the new RIP curves calculated in the previous section.

Measuring the Verification target

Measure the verification P2P target in exactly the same way as the original test target. Save the data file in CGATS format.

Analyzing Results

1. Launch the appropriate Curve2 session.
2. Click the + (Plus symbol) at the bottom of the ***Calibration Runs*** list to create a new run, which will be called by default ***Run 2 - Verification***. If desired, double-click on the run name to re-name it.

3. Either drag and drop the P2P Verification measurement file (created by physical print testing or by the VPR module) into the ***Measurements*** list, or click on the + (Plus symbol) below the ***Measurements*** list and browse for the file.
4. Select the ***Analyze*** tab and then select the ***G7*** sub-tab.
5. In the ***Analyze – G7*** window the ***Results*** table shows the average and maximum Delta L* (ΔL*) values for the K-only and CMY gray scales (P2P columns 4 and 5). Also shown are the Delta F* (ΔF*) (also known as Delta-ab (Δab)) for the CMY gray scale (P2P column 5). These values can be compared to the ΔL* and ΔF* tolerances shown in the chart below.

*Note: The metric name "**Delta F***" or "**ΔF***" used in early versions of Curve2 may instead appear as "**Delta-ab**" or "**Δab**". The names are interchangeable for the purposes of this document.*

Curve2 Tolerances

Using the 2010 G7 System Certification sample test files and the Analysis Instructions (see above) or the IDEAlliance Validation Process (see below), Curve2 will achieve tolerances equal to or lower than the following.

Metric	Average	Maximum
ΔF* (CMY only)	≤1.0	≤2
ΔL* (CMY & K)	≤1.0	≤2

Table 1: Curve2 tolerances for 2010 sample test files

Note: Because the current G7 System Certification method uses a simulation process that eliminates print-to-print variation, and because the sample data provided by IDEAlliance for G7 System Certification is highly uniform, Curve2 can produce extremely low delta errors with those specific data files. Higher errors should be expected when calibrating live printing devices, depending on the characteristics and variability of each printing system.

IDEAlliance Validation Process

To validate that the G7 calibration process has been successful, a target consisting of two gray scales having the CMYK patch values listed in ***Appendix A:*** shall be printed through the calculated correction curves using the same print settings in use when the calibration was calculated.

Validating NPDC (CMY and K scales)

To validate NPDC correction, both the K-only scale and the CMY-only scale shall be measured with a densitometer or spectrophotometer and the relative neutral density (ND) values (measured in the "K" or "Visual" channel) shall be recorded for each patch. To obtain relative ND values, either the measuring device shall be zeroed on the substrate, or the white patch neutral density value shall be subtracted from itself and all other patches.
The (relative) ND values shall be converted to (relative) L* by the standard CIE formula in ***Appendix B:***
The Delta L* (ΔL*) error shall be computed for each patch compared to target values on file with IDEAlliance by the formula in ***Appendix B:***
The average and maximum ΔL* must not exceed the IDEAlliance Tolerance values in **Table 2**, below.

Validating Gray Balance (CMY scale only)

To validate gray balance correction, the CMY-only scale shall be measured with a spectrophotometer and the a* and b* values recorded for each patch.
The Delta F* (ΔF*) error shall be computed for each patch compared to target values on file with IDEAlliance by the formula in ***Appendix B:***
The average and maximum ΔF* must not exceed the IDEAlliance Tolerance values in **Table 2**, below.

IDEAlliance Tolerances

Metric	Average	Maximum
ΔF* (CMY only)	≤1.5	≤3
ΔL* (CMY & K)	≤1.5	≤3

Table 2: IDEAlliance required tolerances

Appendix A:

P2P patch values

Column 4 (K only)

C%	M%	Y%	K%
0	0	0	0
0	0	0	1.96
0	0	0	3.92
0	0	0	5.88
0	0	0	7.84
0	0	0	10.2
0	0	0	14.9
0	0	0	20
0	0	0	25.1
0	0	0	30.2
0	0	0	34.9
0	0	0	40
0	0	0	45.1
0	0	0	49.8
0	0	0	54.9
0	0	0	60
0	0	0	65.1
0	0	0	69.8
0	0	0	74.9
0	0	0	80
0	0	0	85.1
0	0	0	89.8
0	0	0	94.9
0	0	0	98.04
0	0	0	100

Table 3: CMYK percentage values in column 4 of the P2P target

P2P patch values

Column 5 (CMY only)

C%	M%	Y%	K%
0	0	0	0
1.96	1.18	1.18	0
3.92	2.77	2.77	0
5.88	4.15	4.15	0
7.84	5.61	5.61	0
10.2	7.41	7.41	0
14.9	11	11	0
20	14.9	14.9	0
25.1	18.8	18.8	0
30.2	22.91	22.91	0
34.9	26.78	26.78	0
40	30.98	30.98	0
45.1	35.48	35.48	0
49.8	39.82	39.89	0
54.9	44.71	44.71	0
60	49.8	49.8	0
65.1	54.9	54.9	0
69.8	60.16	60.16	0
74.9	66.07	66.07	0
80	71.77	71.77	0
85.1	78.06	78.06	0
89.8	84.61	84.61	0
94.9	92.2	92.2	0
98.04	96.86	96.86	0
100	100	100	0

Table 4: CMYK percentage values in column 5 of the P2P target

Appendix B:

Formulae

Converting ND to L*

$Y = 1/10^{ND}$

If: $Y > (6/29)3$

$L^* = 116 \times Y^{1/3} - 16$

Else:

$L^* = 116 \times (841/108 \times Y + 4/29) - 16$

Calculating Delta L* (ΔL*)

$\Delta L^* = (L^*_{sample} - L^*_{target})$

Calculating Delta F* (ΔF*) – also known as Delta-ab

$\Delta F^* = ((a^*_{sample} - a^*_{target})^2 + (b^*_{sample} - b^*_{target})^2)^{1/2}$

Appendix C:

Verification Instructions (using VPR module)

The optional VPR module allows adjustments calculated by Curve2 to be tested without making a second physical print. For this a characterization target (e.g. IT8.7/4) must have been printed and measured at the same time as the P2P, ideally on the same sheet of material.

NOTE: Results determined by the VPR process may differ slightly from results obtained by physical print testing, due to printing and measuring variations between the first and second prints, or variations between the characterization target and the P2P target.

1. In the same Curve2 session used to create the curves being verified, click ***Virtual Print Run*** to launch the VPR module.
2. In the ***Run (curves to be applied)*** tab select the calibration run used to create the calibration curves. (Note that all variables in the ***Create Curves*** window - such as number of control points, ***Gray Balance Options***, etc., must not have changed.)
3. In the ***Target data to be curved:*** list, select the same P2P target data file used to create the curves.
4. In the ***Training Target (Optional):*** list, select the measurement file from the characterization target (e.g. IT8.7/4) printed at the same time as the P2P target. *(When applying VPR to a P2P target, the training target is NOT OPTIONAL).*
5. In the ***Curving Method*** area, select ***Curve Lab values (retains CMYK values and target type)***.
6. Set the ***Precise / Smooth*** slider to ***Precise***.
7. Click ***Curve & Export…*** and save the VPR-adjusted P2P data.
8. Click the + (Plus symbol) at the bottom of the ***Calibration Runs*** list to create a new run (called by default ***Run 2 – Verification***).
9. Either drag the VPR-adjusted P2P data into the ***Measurements*** list, or click on the + (Plus symbol) below the list and browse for the file.
10. Select the ***Analyze*** tab and then select the ***G7*** sub-tab.
11. In the ***Analyze – G7*** window the ***Results*** table shows the average and maximum Delta L* (ΔL*) values for the K-only and CMY gray scales (P2P columns 4 and 5). Also shown are the Delta F* (ΔF*) (also known as Delta-ab (Δab)) for the CMY gray scale (P2P column 5). These values can be compared to the ΔL* and ΔF* tolerances shown in the chart in ***Analyzing Results***.