G7 Calibration and Color Management for Flexo

Jay Sperry
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Background

- Grew out of GRACoL group – 7th Edition
- G = Gray 7 = CMYKRGB
- Introduces NPDC – Neutral Print Density Curve
- Uses existing ISO ink standards
- Managed by IDEAlliance
Background

- **G7 Masters**
  - Certified to calibrate a CMYK device to the NPDC
  - Certified by a G7 Expert
  - Yearly fee to IDEAlliance

- **G7 Expert**
  - Training on G7 Methodology
  - Responsible for the security of specification
- **G7 as a standard**
  - Standardize ink colors
    - Ink vendors provide ISO certification
  - Standardize print curves
    - Printers calibrate press and system to G7
Why G7?

- CMYK simplification
- Color management throughout supply chain
- Management of customer expectations
- Alignment of multiple print processes and substrates
What is G7?

- Press and proofer calibration method
- Based on “Near Neutral Calibration”
- Calibrates CMY curves to a standard density curve (Dot Gain Curves)
- Maintains gray balance throughout tone range

- Certification dependant on ISO spec inks
What are ISO inks?

- ISO 2846 defines process color printing inks
- 2846-5 describes flexographic inks
- Defines color, transparency, and testing specs
**What are ISO inks?**

- Color is defined as CIE LABCH \((D50, 2^\circ)\)
- Tolerancing is defined as Delta E \((\Delta E_{1976})\)

### Table 1 — Colorimetric values for 0/45 and 45/0 geometry, illuminant D50, 2° observer

<table>
<thead>
<tr>
<th>Ink</th>
<th>CIELAB values</th>
<th>Tolerances</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(L^*)</td>
<td>(a^*)</td>
</tr>
<tr>
<td>Yellow</td>
<td>91,0</td>
<td>-5,0</td>
</tr>
<tr>
<td>Magenta</td>
<td>52,0</td>
<td>71,0</td>
</tr>
<tr>
<td>Cyan</td>
<td>58,0</td>
<td>-38,0</td>
</tr>
<tr>
<td>Black</td>
<td>&lt; 18,0</td>
<td>0,5</td>
</tr>
</tbody>
</table>

\(\Delta L^*\) This means that for black there is no symmetrical tolerance for \(L^*\) but an upper limit.
What is the aimpoint for CMYK?

- A meter is a meter
- Cut with chainsaw, laser, axe
- Different degrees of accuracy, same aimpoint
What is the G7 standard curve?
- Target gray balance values (substrate dependant)
- Target Dot Gain Values for:
  - CMY triplets (combined CMY i.e. 50c, 40m, 40y)
  - Black

<table>
<thead>
<tr>
<th>C%*</th>
<th>M%</th>
<th>Y%</th>
<th>a*</th>
<th>b*</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0</td>
<td>-2</td>
</tr>
<tr>
<td>12.5</td>
<td>9.0</td>
<td>9.0</td>
<td>0</td>
<td>-1.7</td>
</tr>
<tr>
<td>25.1</td>
<td>18.8</td>
<td>18.8</td>
<td>0</td>
<td>-1.5</td>
</tr>
<tr>
<td>37.3</td>
<td>29.0</td>
<td>29.0</td>
<td>0</td>
<td>-1.2</td>
</tr>
<tr>
<td>49.8</td>
<td>40.0</td>
<td>40.0</td>
<td>0</td>
<td>-1</td>
</tr>
<tr>
<td>62.7</td>
<td>52.9</td>
<td>52.9</td>
<td>0</td>
<td>-0.70</td>
</tr>
<tr>
<td>75.3</td>
<td>66.3</td>
<td>66.3</td>
<td>0</td>
<td>-0.5</td>
</tr>
<tr>
<td>87.5</td>
<td>81.2</td>
<td>81.2</td>
<td>0</td>
<td>-0.2</td>
</tr>
<tr>
<td>100</td>
<td>100</td>
<td>100</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
How do you calibrate to G7?
- Optimize CMYK printing system
- Run P2P test-chart to determine CMYK Dot Gain Curves
- Apply curves to workflow
- Run IT8 7/4 Color Management Chart
- Define color profile for device
Near Neutral Calibration

- Press substrates with certified ink sets
- Run P2P chart (seen top)
- Measure color
- Use software to generate curves
Near Neutral Calibration

IDEAlink Curve

Output Curves

Output Curve Set

Gray Tone Alims

Paper Included | Paper Excluded
---|---
<p>| | |
| ||</p>
<table>
<thead>
<tr>
<th>%</th>
<th>CMY</th>
<th>K</th>
<th>CMY</th>
<th>K</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>0.32</td>
<td>0.29</td>
<td>0.25</td>
<td>0.22</td>
</tr>
<tr>
<td>50</td>
<td>0.61</td>
<td>0.56</td>
<td>0.54</td>
<td>0.49</td>
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<tr>
<td>75</td>
<td>0.99</td>
<td>0.94</td>
<td>0.92</td>
<td>0.87</td>
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Near Neutral Calibration

Output Curve Set

<table>
<thead>
<tr>
<th>Entry</th>
<th>C</th>
<th>M</th>
<th>Y</th>
<th>K</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
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<td>10.0</td>
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<td>-3.55</td>
<td>-3.97</td>
<td>-2.37</td>
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<tr>
<td>20.0</td>
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<td>-6.20</td>
<td>-7.87</td>
<td>-3.42</td>
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<tr>
<td>30.0</td>
<td>-7.99</td>
<td>-8.56</td>
<td>-11.34</td>
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<td>40.0</td>
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<td>-8.26</td>
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<tr>
<td>50.0</td>
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<td>-12.50</td>
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<tr>
<td>60.0</td>
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<td>-3.95</td>
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<tr>
<td>70.0</td>
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<td>-7.35</td>
<td>-11.66</td>
<td>-2.13</td>
</tr>
<tr>
<td>80.0</td>
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<td>-5.13</td>
<td>-8.46</td>
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<td>90.0</td>
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<td>100.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
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</table>

Gray Tone Aims

<table>
<thead>
<tr>
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<th>Paper Excluded</th>
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<tbody>
<tr>
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<tr>
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<td>0.99</td>
<td>0.94</td>
</tr>
</tbody>
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Near Neutral Calibration
Standard methods for CMYK printing allow:
- Common File Handling / Color Separation
- Universal quality process control
- Print buyers understanding of output
- Less proofing headaches
Method Summary

- Analyze and Certify Ink Set – ISO Report
- Optimize flexographic plates, plate package, press system
- Optimize Solid CMYK printed values
- Calibrate prepress to hit NPDC
- Verify NPDC, Capture ICC press profile
- Analyze color space, calibrate proofer
- Create color management workflow
Color Management

- Agency / Design / Creative
  - CMYK Imagery
  - Monitor based color adjustment
  - Comp Proofs

- Standard CMYK Profile
  - GRACoL 2006, SWOP 2006
Color Management

- **Prepress / Brand Management**
  - CMYK Engineering
  - Monitor based color retouching
  - Contract Proofs

- **Press CMYK Profile**
  - Based on G7
  - GRACoL 2006, SWOP 2006
Color Management

- Pressroom / Printing
  - CMYK Process Control
  - Based on G7 Calibration
  - Gray Balance Control
  - Press CMYK Profile
    - G7 Specified control
    - 25, 50, 75 CMY / K Balance
    - Substrate dependant
Color Management Workflow

Original Image Separated to GRACoL 2006 Coated1
Color Management Workflow

GRACoL 2006 Coated1 Separations

RIPPED through…
Custom DGC Curves
Created for Gray Balance
and overall density

Dependant on substrate, ink set, trapping, dot gain, etc.
Color Management Workflow

- Run on press with process control back to calibrated condition
- Optimized separations and printing
- Predictable results with GRACoL

Printer Specific Separations for Production
Summary and Conclusions

KCMY LABCH Color Targets
ISO 2846-5

Certify Ink Using Proofing, Measuring, and Analysis based on ISO 2846-5
- Standardized Backing
- Press Ready Inks

Communication to Ink Vendor

\[
\begin{array}{|c|c|c|c|c|c|}
\hline
 & L & A & B & C & H \\
\hline
\text{Cyan} & 54 & -36 & -49 & 61 & 234 \\
\text{Magenta} & 46 & 72 & -5 & 72 & 356 \\
\text{Yellow} & 87 & -6 & 90 & 90 & 94 \\
\text{Black} & 16 & 0 & 0 & 0 & 0 \\
\hline
\end{array}
\]

Delta E(\text{ab})
- Cyan<6
- Magenta<6
- Yellow<5
- Black - L<18
Optimize Printing System
• Anilox Rollers and Ink Strength
• Plate Package
• Run Sequence and Drying
• Substrate Range

Optimize CMYK Color Reproduction
• Establish solid color definitions
• Create and apply DGC curves to achieve neutral print density

Tolerances
Hue Angle +/- 3º
Maximum Chroma at Hue
Summary and Conclusions

Characterize Printing System
• Calibrated Conditions
• IT8 7/4
• Sample, Measure, Average
• Build Custom ICC Profile

Color Space and Process Control
• Compare color to GRACoL 2006 Coated1
• Develop color management workflow
• Publish target colors and tolerances, measurement protocol, and reporting for production
Thank You! Questions?

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