

http://farbe.li.tu-berlin.de/AEA0/AEA0L0NA.TXT /.PS; vector graphic (VG); start output
N: no 3D-linearization (OL) in file (F) or PS-startup (S), page 1/1

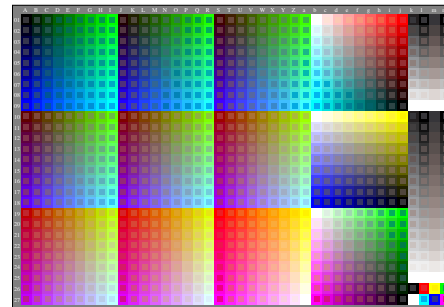
see similar files: <http://farbe.li.tu-berlin.de/AEA0/AEA0L0NA.TXT>
technical information: <http://farbe.li.tu-berlin.de> or <http://130.149.60.45/~farbmetrik>

TUB registration: 20200201-AEA0/AEA0L0NA.TXT /.PS TUB material: code=rh4ta
application for evaluation and measurement of display or print output

PostScript-Colour Parameters and 1-Minus-Relation (IMR) of *rgb* and *cmYk*

```
01 Colour parameters setgray, setrgbcolor, and setcmykcolor in PostScript.
02
03 k setgray with 0 <= k <= 1 defines colours in the space DeviceGray.
04 For k=0 the colour is black, for k=1 the colour is white.
05 For 0 < k <= 1 a grey colour is defined between black and white.
06
07 r g b setrgbcolor with 0 <= r,g,b <= 1 defines colors in the space DeviceRGB.
08 For r=g=b=0 the colour is black, for r=g=b=1 the colour is white.
09 For 0 < r,g,b <= 1 many colours including greys are defined.
10
11 c m y k setcmykcolor mit 0 <= cmyk <= 1 defines colors in the space DeviceCMYK.
12 If k=0 and c=m=y=1 the colour is black, for c=m=y=0 the colour is white.
13 If c=m=y=0 and k=1 the colour is black, for k=0 the colour is white.
14 For 0 < c,m,y <= 1 and k=0 many colours including greys are defined.
15
16 For 0 < c,m,y <= 1 and k=0 the minimum of [c, m, y] can be changed by k.
17 In this case the new parameters of setcmykcolor are [c-k, m-k, y-k, k].
18 Lines 16 and 17 define the 1-Minus-Relation for the cmYk values.
19 The 1-Minus-Relation for values of rgb and cmYk is r=1-c, g=1-m, b=1-y.
20
21 Lines 03 to 14: parameters of setgray, setrgbcolor, and setcmykcolor.
22 Lines 16 to 19: 1-Minus-Relation between [cmyk], [cmyk], [cmyk], and [r,g,b].
```

AEA00-1S



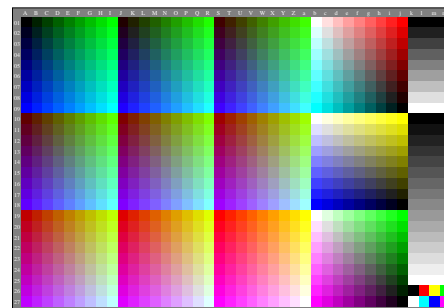
AEA00-20, Input file: <http://farbe.li.tu-berlin.de/AEA0/AEA00-2N.PDF>; no change of output colour data.

Frame File PostScript Code for 1-Minus-Relation (IMR) to *setrgbcolor*

```
01 %!PS-Adobe-3.0 EPSF-3.0, 1MR for change to setrgbcolor
02 /PPM_setrgbcolor {setrgbcolor} bind def
03 /IMR-0000 {IMR procedure 1MR-0000
04 %IMR-Transform of setgray and setcmykcolor to PPM_setrgbcolor
05
06 /setgray {IMR procedure setgray to setrgbcolor
07 dup dup PPM_setrgbcolor
08 } def %END procedure setgray to setrgbcolor
09
10 /setcmykcolor {IMR procedure setcmykcolor to setrgbcolor
11 /PPM_k exch def /PPM_y exch def /PPM_c exch def /PPM_m exch def
12 PPM_k 0 eq {1 PPM_c sub 1 PPM_y sub 1 PPM_m sub 1 PPM_m sub PPM_setrgbcolor}
13 {1 PPM_k sub dup dup PPM_setrgbcolor} ifelse
14 } def %END procedure setcmykcolor to setrgbcolor
15
16 } def %END procedure 1MR-0000
17 %%Trailer %END 1-Minus-Relation (IMR) to setrgbcolor
```

Remarks:
line 02: necessary for the revised definition of *rgb* *setrgbcolor*.
The FF_PS file shall include line 02 before the use of 1MR-0000.
line 06 to 08: change of *w* *setgray* to *rgb* *setrgbcolor*.
line 10 to 14: change of *cmYk* *setcmykcolor* to *rgb* *setrgbcolor*.

AEA00-1S



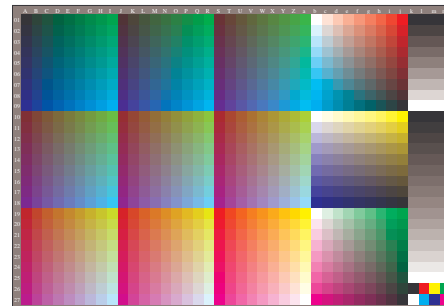
AEA00-20, Input file: <http://farbe.li.tu-berlin.de/AEA0/AEA00-2N.PDF>; 1MR-change to *rgb* *setrgbcolor*

Frame File PostScript-code for 1-Minus-Relation (IMR) to *cmYk* *setcmykcolor*

```
01 %!PS-Adobe-3.0 EPSF-3.0, 1MR-0002 for change to cmYk setcmykcolor
02 /PPM_setcmykcolor {setcmykcolor} bind def
03 /IMR-0002 {IMR procedure 1MR-0002 to cmYk setcmykcolor
04 %IMR-Transform of setgray, setrgbcolor, cmYk setcmykcolor to cmYk setcmykcolor
05 /setgray {IMR procedure setgray to cmYk setcmykcolor
06 /IMR exch def /IMR sub dup dup 0 PPM_setcmykcolor
07 } def %END procedure setgray to cmYk setcmykcolor
08 /setrgbcolor {IMR procedure setrgbcolor to cmYk setcmykcolor
09 /IMR exch def /IMR sub dup /IMR exch def /IMR sub dup
10 /IMR 0 ne {IMR add IMR add IMR add IMR add 0}
11 {IMR 0 ne {IMR add IMR add IMR add IMR add 0} ifelse PPM_setcmykcolor
12 } def %END procedure setrgbcolor to cmYk setcmykcolor
13
14 /setcmykcolor {IMR procedure cmYk to cmYk setcmykcolor
15 /IMR exch def /IMR sub dup /IMR exch def /IMR sub dup
16 /IMR 0 ne {IMR add IMR add IMR add IMR add 0}
17 {IMR 0 ne {IMR add IMR add IMR add IMR add 0} ifelse PPM_setcmykcolor
18 } def %END procedure cmYk to cmYk setcmykcolor
19
20 %%Trailer %END procedure 1MR-0002 to cmYk setcmykcolor
```

Remarks:
line 02: necessary for the revised definition of *cmYk* *setcmykcolor*.
The FF_PS file shall include line 02 before the use of 1MR-0002.
line 05 to 07: change of *setgray* to *cmYk* *setcmykcolor*.
line 08 to 16: change of *setrgbcolor* & *setcmykcolor* to *cmYk* *setcmykcolor*.

AEA00-1S



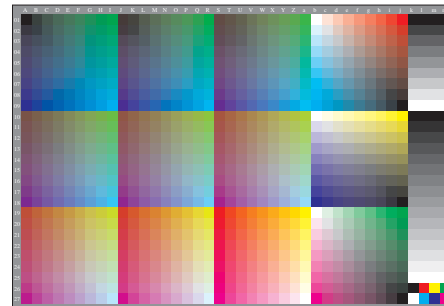
AEA00-20, Input file: <http://farbe.li.tu-berlin.de/AEA0/AEA00-2N.PDF>; 1MR-change to *cmYk* *setcmykcolor*

Frame File PostScript-code for 1-Minus-Relation (IMR) to *cmYk* *setcmykcolor*

```
01 %!PS-Adobe-3.0 EPSF-3.0, 1MR-0003 for change to cmYk setcmykcolor
02 /PPM_setcmykcolor {setcmykcolor} bind def
03 /IMR-0003 {IMR procedure 1MR-0003 to cmYk setcmykcolor
04 %IMR-Transform of setgray, setrgbcolor, cmYk setcmykcolor to cmYk setcmykcolor
05 /setgray {IMR procedure setgray to cmYk setcmykcolor
06 /IMR exch def /IMR sub dup dup 0 PPM_setcmykcolor
07 } def %END procedure setgray to cmYk setcmykcolor
08 /setrgbcolor {IMR procedure setrgbcolor to cmYk setcmykcolor
09 /IMR exch def /IMR sub dup /IMR exch def /IMR sub dup
10 /IMR 0 ne {IMR add IMR add IMR add IMR add 0}
11 {IMR 0 ne {IMR add IMR add IMR add IMR add 0} ifelse PPM_setcmykcolor
12 } def %END procedure setrgbcolor to cmYk setcmykcolor
13
14 /setcmykcolor {IMR procedure cmYk to cmYk setcmykcolor
15 /IMR exch def /IMR sub dup /IMR exch def /IMR sub dup
16 /IMR 0 ne {IMR add IMR add IMR add IMR add 0}
17 {IMR 0 ne {IMR add IMR add IMR add IMR add 0} ifelse PPM_setcmykcolor
18 } def %END procedure cmYk to cmYk setcmykcolor
19
20 %%Trailer %END procedure 1MR-0003 to cmYk setcmykcolor
```

Remarks:
line 02: necessary for the revised definition of *cmYk* *setcmykcolor*.
The FF_PS file shall include line 02 before the use of 1MR-0003.
line 08 to 20: change of *setgray*, *setrgbcolor*, *setcmykcolor* to *cmYk* *setcmykcolor*.

AEA00-1S



AEA00-20, Input file: <http://farbe.li.tu-berlin.de/AEA0/AEA00-2N.PDF>; 1MR-change to *cmYk* *setcmykcolor*

CIE LAB measurement of output colours on an LCD display

At work places the ambient room light produces reflections on any display.
Figure AEA01-3N shows 2.5% reflection compared to White W (100%).
Figure AEA01-4N shows 20% reflection compared to White W (100%).

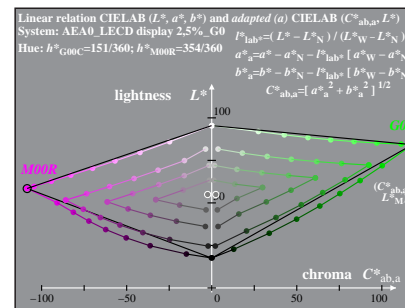
Result
The scaling of the grey scale remains not approximately equally spaced.
In Figure AEA01-4N many dark grey steps can not be distinguished.

Requirement
Apply display-output linearization to get the output equally spaced.

Scientific result
In many cases a reduction of the display *gamma* helps.

Test and application
ISO 9241-306:2018 defines 15 steps of *gamma* γ_{sp} .
In many cases an ISO file shows solutions of the problem, see
<http://standards.iso.org/iso/9241/306/ed-2/AE49/AE49F0P0.PDF>
<http://standards.iso.org/iso/9241/306/ed-2/AE49/AE49F0N0.PDF>
See many other files with output questions in english, french, and german
<http://standards.iso.org/iso/9241/306/ed-2/index.html>

AEA01-1N



AEA01-3N

CIE LAB measurement of output colours in offset print

The output colours depend of the colour separation method.
Figure AEA01-5N applies the separation method of Figure AEA00-5N.

Result
Many dark and chromatic steps are missing in the print.

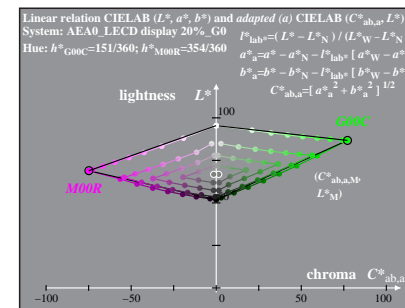
Scientific result
Figure AEA01-7N shows the continuous overprint of Rd and Cd with black.
Pure black is not possible because the presence of Rd or Cd produces a chromatic tint.

Solution
Increase the overprint of black from 0 to 100%,
and reduce appropriate Rd or Cd from 100% to 0%.

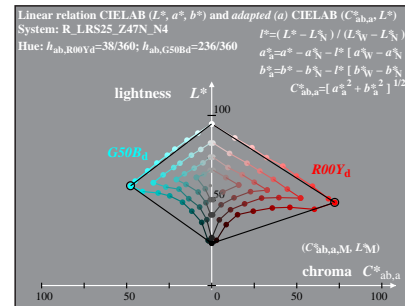
Application result
Figure AEA01-6N shows the continuous overprint of Rd and Cd with black,
and at the same time an appropriate reduction of Rd and Cd.

Output-linearization based on the above application result
Figure AEA01-8N shows the intended equally spaced grey and chromatic steps.
Figure AEA01-8N produces 100% Under Colour Removal (UCR),
the grey series is only printed by the black colorant.

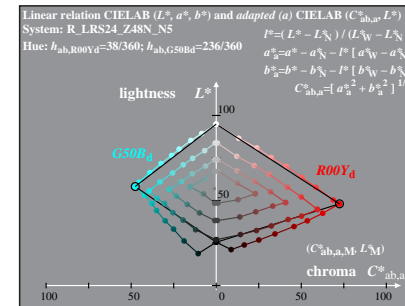
AEA01-2N



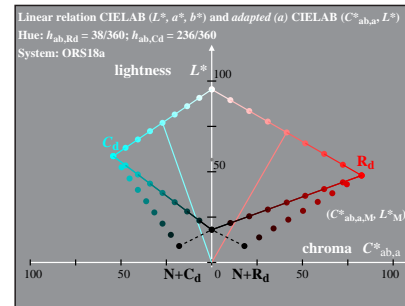
AEA01-4N



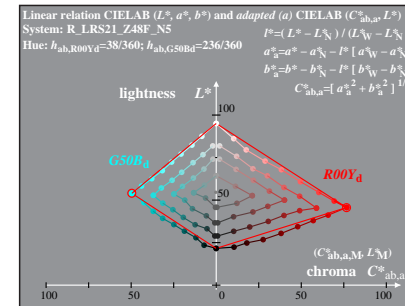
AEA01-5N



AEA01-6N



AEA01-7N



AEA01-8N

TUB-test chart AEA0; Application of 1-Minus-Relation
Output and steering of test chart AE49 of ISO 9241-306

input: *w/rgb/cmyk* -> *w/rgb/cmyk*
output: *all[2],rgb[4],cmyk[6,8],cmyk[10]*