TUB material: code=rha4a

TUB material: 20200801-AS87/AS87L0N1.TXT /.PS
aplicación para la medida de display output

## CIELAB 1976 $L^*a^*b^*$–color space definition and reversal

$L^* = 116 \ (Y/Y_n)^{1/3} - 16$

$a^* = 500 \ [ \ (X/X_n)^{1/3} - (Y/Y_n)^{1/3} \ ]$

$b^* = 200 \ [ \ (Y/Y_n)^{1/3} - (Z/Z_n)^{1/3} \ ]$

$X = X_n \ [ \ (L^* + 16) \ / \ 116 + a^*/500 \ ]^3$

$Y = Y_n \ [ \ (L^* + 16) \ / \ 116 ]^3$

$Z = Z_n \ [ \ (L^* + 16) \ / \ 116 - b^*/200 \ ]^3$
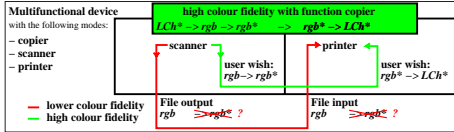
AS87–1N

### $Q$-function changes; transition from light- to color metrics

scaling function of **light metrics:**

$Q \ [k(x - u] = Q[k(\log L - \log L_u)]$

$\log L - > \log P$ **for color metrics:**

$Q[k(\log P - \log L_u)]$

$= Q[k(\log L - \log L_u + \log P - \log L)]$

with saturation $p = \log P - \log L$
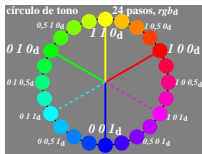
**for color metrics:** $Q \ [k( \ x - u + p)]$

AS87–2N

### Agreement (Y/N) of CIELAB $h_{ab}$ with IEC 61966-2-1 and CIE R1-47

| | reference: device colours | | | | NOTES |
|---|---|---|---|---|---|
| | $R_{d,sRGB}$ | $Y_{d,sRGB}$ | $G_{d,sRGB}$ | $B_{d,sRGB}$ | visual standard deviation $v_{SD}$ |
| **definition for display output in IEC 61966-2-1** | 40 +/− 4 <br> 40 +/− 8 | 103 +/− 4 <br> 103 +/− 8 | 136 +/− 4 <br> 136 +/− 8 | 306 +/− 8 <br> 306 +/− 16 | 1 x $v_{SD}$ <br> 1 x $v_{SD}$ <br> data see [1], Tab. B.2 |
| **measurement of printer output** *rgb* **in file** | 34 $N$(−2) <br> 34 $Y$ | 100 $Y$ <br> 100 $Y$ | 146 $N$(+1) <br> 146 $N$(+2) | 264 $N$(−34) <br> 264 $N$(−26) | 1 x $v_{SD}$; 1 x $Y$ <br> 2 x $v_{SD}$; 2 x $Y$ <br> data see [1], Fig. 32 |
| **measurement of printer output** *cmy0* **in file** | 34 $N$(−2) <br> 34 $Y$ | 100 $Y$ <br> 100 $Y$ | 153 $N$(+15) <br> 153 $N$(+9) | 300 $Y$ <br> 300 $Y$ | 1 x $v_{SD}$; 2 x $Y$ <br> 2 x $v_{SD}$; 3 x $Y$ <br> data see [1], Fig. 33 |
| | reference: elementary colours | | | | NOTES |
| | $R_e$ | $Y_e$ | $G_e$ | $B_e$ | visual standard deviation $v_{SD}$ |
| **definition for any output in CIE R1-47** | 26 +/− 4 <br> 26 +/− 8 | 92 +/− 4 <br> 92 +/− 8 | 162 +/− 4 <br> 162 +/− 8 | 272 +/− 8 <br> 272 +/− 16 | 1 x $v_{SD}$ <br> 2 x $v_{SD}$ <br> data see CIE R1-47 |
| **measurement of printer output** *rgb* **in file** | 34 $N$(+4) <br> 34 $Y$ | 100 $N$(+4) <br> 100 $Y$ | 146 $N$(−2) <br> 146 $N$(−8) | 264 $N$(−4) <br> 264 $Y$ | 1 x $v_{SD}$; 0 x $Y$ <br> 2 x $v_{SD}$; 3 x $Y$ <br> data see [1], Fig. 32 |
| **measurement of printer output** *cmy0* **in file** | 34 $N$(+4) <br> 34 $Y$ | 100 $N$(+4) <br> 100 $Y$ | 153 $N$(−5) <br> 153 $N$(−1) | 300 $N$(+20) <br> 300 $N$(+12) | 1 x $v_{SD}$; 0 x $Y$ <br> 2 x $v_{SD}$; 2 x $Y$ <br> data see [1], Fig. 33 |

AS871–3N

### Multifunctional device

with the following modes:
– copier
– scanner
– printer

**high colour fidelity with function copier**

$LCh^* -> rgb -> rgb^* \quad -> \quad rgb^* -> LCh^*$

scanner ——— printer

user wish: $rgb -> rgb^*$

user wish: $rgb^* -> LCh^*$

— lower colour fidelity
— high colour fidelity

File output
$rgb \Rightarrow rgb^*$ ?

File input
$rgb \Rightarrow rgb^*$ ?

AS870–3N



círculo de tono — 24 pasos, $rgb_d$



círculo de tono — 24 pasos, $rgb_d$
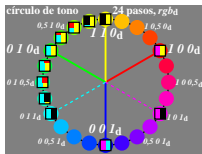
AS870–5N · AS870–6N

### Offset $rgb^*$ input data and LCh* output data

| Color | $rgb^*$ | LCh* |
|---|---|---|
| $R_e$ elementary red | 1 0 0 | 47, 74, 26 |
| $Y_e$ elementary yellow | 1 1 0 | 86, 88, 92 |
| $G_e$ elementary green | 0 1 0 | 53, 57, 164 |
| $B_e$ elementary blue | 0 0 1 | 42, 45, 271 |
| $N$ black | 0 0 0 | 18, 0, 0 |
| $W$ white | 1 1 1 | 95, 0, 0 |

*Data according to test chart DIN 33872-2, p.9-12*
http://farbe.li.tu-berlin.de/A/33872E.html
*Elementary-hue angles of CIE R1-47, see*
http://web.archive.org/web/20160304130704/http://files.cie.co.at/526.pdf

### 9 step offset colours in CIELAB colour space

*ICC encoding space*

For white $W$: $rgb^*_W = 95, 0, 0$
$rgb^*_W = 1, 1, 1$

$(C^*_{ab}, L^*)$
$= (142, 100)$

CIELAB lightness $L^*$
White $W$ — 100

$I^* = 75$ — 9 steps

9 steps — red $R_e$
$LCh^*_R = 47, 74, 26$

Black $N$ — 9 steps
$LCh^*_N = 18, 0, 0$
$rgb^*_N = 0, 0, 0$

$C^*_{ab} = 37$ — CIELAB chroma $C^*_{ab}$

$h_{ab} = 26$

$C^*_{ab} = 0.75, 0.25, 0$ — black $N$, 0, 0, 0
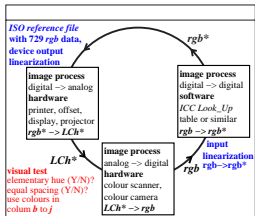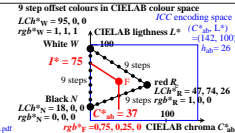
AS870–7N

gráfico TUB-AS87; Examples of colour metric
User coordinates and device calibration

### ISO reference file

with 729 *rgb* data,
device output
linearization

$rgb^*$

image process
digital –> analog
**hardware**
printer, offset,
display, projector
$rgb^* -> rgb^*$

image process
digital –> digital
**software**
ICC Look_Up
table or similar
$rgb -> rgb^*$

$-> LCh^*$

**visual test**
elementary hue (Y/N)?
equal spacing (Y/N)?
use colours in
colum $b$ to $j$

image process
analog –> digital
**hardware**
colour scanner,
colour camera
$LCh^* -> rgb$

**input**
linearization
$rgb -> rgb^*$

entrada: $w/rgb/cmyk -> w/rgb/cmyk$
salida: ningún cambio

AS871–7N