

- color space

$$\begin{aligned} L^* &= 116 (Y/Y_n)^{1/3} - 16 \\ a^* &= 500 [(X/X_n)^{1/3} - (Y/Y_n)^{1/3}] \\ b^* &= 200 [(Y/Y_n)^{1/3} - (Z/Z_n)^{1/3}] \\ X &= X_n [(L^* + 16) / 116 + a^*/500]^3 \\ Y &= Y_n [(L^* + 16) / 116]^3 \\ Z &= Z_n [(L^* + 16) / 116 - b^*/200]^3 \end{aligned}$$

**$Q$ -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  $L \rightarrow$  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**:  $Q[k(x - u + p)]$

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

	reference: device colours				NOTES visual standard deviation $v_{SD}$
	$R_{d,sRGB}$	$Y_{d,sRGB}$	$G_{d,sRGB}$	$B_{d,sRGB}$	
definition for display output in IEC 61966-2-1	40 +/- 4 40 +/- 8	103 +/- 4 103 +/- 8	136 +/- 4 136 +/- 8	306 +/- 8 306 +/- 16	1 x $v_{SD}$ 2 x $v_{SD}$ data see [1], Tab. B.2
measurement of printer output <i>rgb</i> in file	34 $N(-2)$ 34 $Y$	100 $Y$ 100 $Y$	146 $N(+8)$ 146 $N(+2)$	264 $N(-34)$ 264 $N(-26)$	1 x $v_{SD}$ ; 1 x $Y$ 2 x $v_{SD}$ ; 2 x $Y$ data see [1], Fig. 32
measurement of printer output <i>cmY0</i> in file	34 $N(-2)$ 34 $Y$	100 $Y$ 100 $Y$	153 $N(+15)$ 153 $N(+9)$	300 $Y$ 300 $Y$	1 x $v_{SD}$ ; 2 x $Y$ 2 x $v_{SD}$ ; 3 x $Y$ data see [1], Fig. 33
	reference: elementary colours				NOTES visual standard deviation $v_{SD}$
	$R_e$	$Y_e$	$G_e$	$B_e$	
definition for any output in CIE R1-47	26 +/- 4 26 +/- 8	92 +/- 4 92 +/- 8	162 +/- 4 162 +/- 8	272 +/- 8 272 +/- 16	1 x $v_{SD}$ 2 x $v_{SD}$ data see CIE R1-47
measurement of printer output <i>rgb</i> in file	34 $N(+4)$ 34 $Y$	100 $N(+4)$ 100 $Y$	146 $N(-12)$ 146 $N(-8)$	264 $N(-4)$ 264 $Y$	1 x $v_{SD}$ ; 0 x $Y$ 2 x $v_{SD}$ ; 3 x $Y$ data see [1], Fig. 32
measurement of printer output <i>cmY0</i> in file	34 $N(+4)$ 34 $Y$	100 $N(+4)$ 100 $Y$	153 $N(-5)$ 153 $N(-1)$	300 $N(+20)$ 300 $N(+12)$	1 x $v_{SD}$ ; 0 x $Y$ 2 x $v_{SD}$ ; 2 x $Y$ data see [1], Fig. 33

### Multifunctional device

with the following modes:

- copier
- scanner
- printer

**high colour fidelity in copier mode**

$$LCh^* \rightarrow rgh \rightarrow rgh^* \rightarrow rgh^* \rightarrow L$$

100

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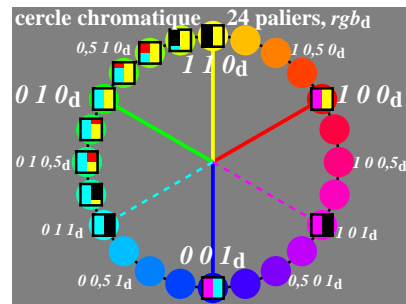
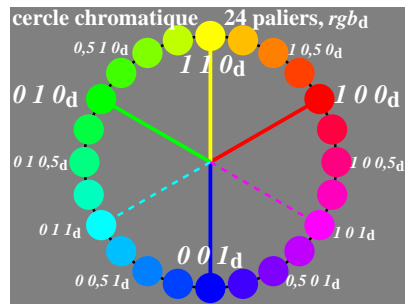
→ **Winter**

100



## File output

## File input



Offset *rgb\** input data and *LCh\** output data

Color	<i>rgb</i> *	<i>LCh</i> *
<i>R</i> <sub>e</sub> elementary red	<b>1 0 0</b>	47, 74, <b>26</b>
<i>Y</i> <sub>e</sub> elementary yellow	<b>1 1 0</b>	86, 88, <b>92</b>
<i>G</i> <sub>e</sub> elementary green	<b>0 1 0</b>	53, 57, <b>164</b>
<i>B</i> <sub>e</sub> elementary blue	<b>0 0 1</b>	42, 45, <b>271</b>
<i>N</i> black	<b>0 0 0</b>	18, <b>0, 0</b>
<i>W</i> white	<b>1 1 1</b>	95, <b>0, 0</b>

(data according to test chart DIN 33872-2, p. 9-12,  
(CIELAB hue angles according to CIE R1-47)

**9 step offset colours in CIELAB colour space**

$LCh^*_W = 95, 0, 0$   
 $rgb^*_W = 1, 1, 1$   
White W

**ICC encoding space**  
 $(C^*_ab, L^*_ab) = (142, 100)$   
 $h_{ab} = 26$

**CIELAB lightness  $L^*$**

$I^* = 75$

9 steps

9 steps

9 steps

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

red R  
 $LCh^*_R = 47, 74, 26$   
 $rgb^*_R = 1, 0, 0$

$C^*_ab = 37$

$rgb^*_F = 0.75, 0.25, 0$

**CIELAB chroma  $C^*_ab$**

AS790-7B

**Output – Input – Output: A loop for relative colour fidelity**

**ISO reference file  
with 729 rgb data  
device output  
linearization**

**image processing**  
digital → analog  
**hardware**  
printer, offset  
display, projector  
*rgb\** → *LCh*

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

 $rgb^*$ 

**image process**  
digital -> digital  
**software**  
*ICC Look\_Up*  
table or similar  
*rgb -> rgb\**

input  
linearization  
 $rgb \rightarrow rgb^*$

entrée: w/rgb/cmyk → w/rgb/cmyk  
sortie: aucun changement

TUB-test graphique AS79; Examples of colour metric  
User coordinates and device calibration