

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

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

UE19-1N

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

scaling function of **light metrics**:

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

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

UE190-2N

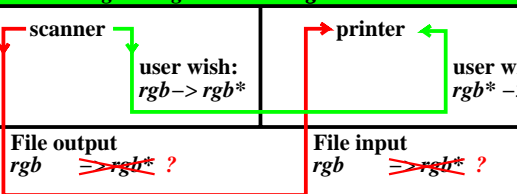
### Multifunctional device

with the following modes:

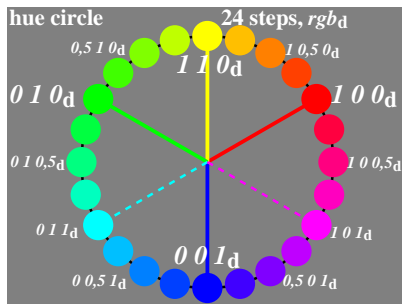
- copier
- scanner
- printer

### high colour fidelity with function copier

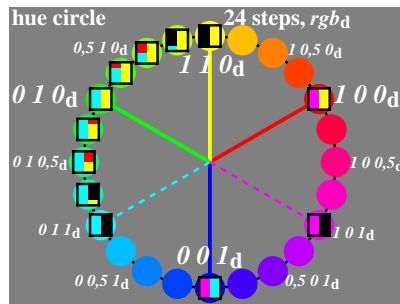
$LCh^* \rightarrow rgb \rightarrow rgb^* \rightarrow LCh^*$



UE190-3N



UE190-5N



UE190-6N

### 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

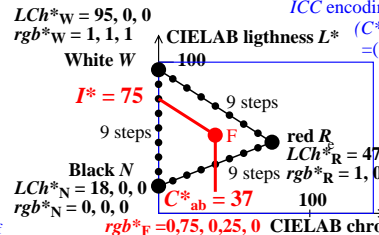
<http://farbe.li-tu-berlin.de/A/33872E.html>

Elementary-hue angles of CIE R1-47, see

<http://web.archive.org/web/20160304130704/http://files.cie.co.at/526.pdf>

UE190-7N

### 9 step offset colours in CIELAB colour space



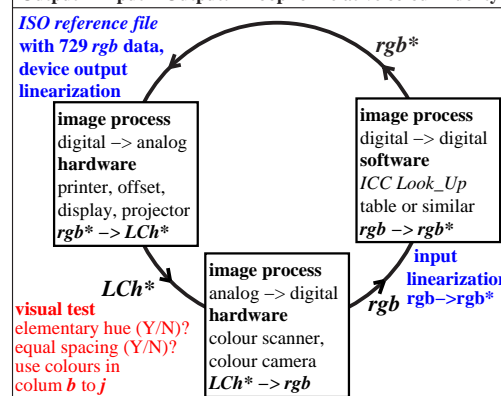
TUB-test chart UE19; Examples of colour metric  
User coordinates and device calibration

### 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 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 $rgb$ 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 $cmY0$ 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
	$R_e$	$Y_e$	$G_e$	$B_e$	visual standard deviation $v_{SD}$
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 $rgb$ 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 $cmY0$ 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

UE191-3N

### Output - Input - Output: A loop for relative colour fidelity



UE191-7N

input: w/rgb/cmyk  $\rightarrow$  w/rgb/cmyk  
output: no change