

see similar files of the whole serie: <http://farbe.li.tu-berlin.de/feo9.htm>  
<http://farbe.li.tu-berlin.de> or <http://color.li.tu-berlin.de>

**Colourimetric scaling of achromatic colours between peak white and black.  
 Relations between tristimulus value Y, luminance L, and lightness L\* of ISO-standards**

Colour (light or paper)	tristimulus values	IECsRGB <sub>W</sub> lightness	relative luminance		CIELAB <sub>W</sub> lightness	TUBLOG <sub>U</sub> lightness
			L <sub>rU</sub> = L/L <sub>U</sub>	L <sub>rW</sub> = L/L <sub>W</sub>		
<b>Contrast W:N (25:1=100:4)</b>	<b>Y</b> (5 <sup>0.5</sup> =2,24)	<b>L*</b> <sub>IECsRGB<sub>W</sub></sub> = s <sub>W</sub> L <sub>rW</sub> <sup>1/2,4</sup>	L <sub>rU</sub>	L <sub>rW</sub>	<b>L*</b> <sub>CIELAB<sub>W</sub></sub> = c <sub>W</sub> L <sub>rW</sub> <sup>1/3-16</sup>	<b>L*</b> <sub>TUBLOG<sub>U</sub></sub> = t <sub>U</sub> log(L <sub>rU</sub> )+50
White P2 (light)	500 =20*25	195=50+145 =s(5,00) <sup>1/2,4</sup>	25	5,00	182=50+132 =c(5,00) <sup>1/3-16</sup>	150=50+102 =t log(25,00)+50
White W (fluorescent paper)	100 =20*5	100=50+50 =s(1,00) <sup>1/2,4</sup>	5	1,00	100=50+50 =c(1,00) <sup>1/3-16</sup>	100=50+52 =t log(5,00)+50
light Grey H (paper)	44,8 =20*2,24	71=50+21 =s(0,45) <sup>1/2,4</sup>	2,24	0,45	72=50+22 =c(0,45) <sup>1/3-16</sup>	75=50+27 =t log(2,24)+50
Grey U (paper)	20	51=50+1 =s(0,20) <sup>1/2,4</sup>	1	0,20	51=50+1 =c(0,20) <sup>1/3-16</sup>	50=50+2 =t log(1,00)+50
dark Grey D (paper)	8,9 =20/2,24	36=50-13 =s(0,09) <sup>1/2,4</sup>	0,45	0,09	35=50-14 =c(0,09) <sup>1/3-16</sup>	24=50-23 =t log(0,45)+50
Black N (paper)	4 =20/5	26=50-23 =s(0,04) <sup>1/2,4</sup>	0,20	0,04	23=50-26 =c(0,04) <sup>1/3-16</sup>	0=50-48 =t log(0,20)+50
Black P2 (glossy paper)	1,9 =20/11,2	18=50-31 =s(0,02) <sup>1/2,4</sup>	0,09	0,022	14=50-35 =c(0,02) <sup>1/3-16</sup>	-24=50-72 =t log(0,09)+50

It is valid: CIELAB<sub>W</sub>: c<sub>W</sub>=c=116, IECsRGB<sub>W</sub>: s<sub>W</sub>=s=100, TUBLOG<sub>U</sub>: t<sub>U</sub>=t=50/log(5)=72

feo90-3n

**Colourimetric scaling of achromatic colours between peak white and black.  
 Relations between tristimulus value Y, luminance L, and lightness L\* of ISO-standards**

Colour (light or paper)	tristimulus values	HDR display luminance	relative luminance		CIELAB <sub>W</sub> lightness	TUBLOG <sub>U</sub> lightness
			L <sub>rU</sub> = L/L <sub>U</sub>	L <sub>rW</sub> = L/L <sub>W</sub>		
<b>Contrast W:N (25:1=100:4)</b>	<b>Y</b> (5 <sup>0.5</sup> =2,24)	<b>L</b> [cd/m <sup>2</sup> ]	L <sub>rU</sub>	L <sub>rW</sub>	<b>L*</b> <sub>CIELAB<sub>W</sub></sub> = c <sub>W</sub> L <sub>rW</sub> <sup>1/3-16</sup>	<b>L*</b> <sub>TUBLOG<sub>U</sub></sub> = t <sub>U</sub> log(L <sub>rU</sub> )+50
White P2 (light)	500 =20*25	1000 =40*25	25	5,00	182=50+132 =c(5,00) <sup>1/3-16</sup>	150=50+102 =t log(25,00)+50
White W (fluorescent paper)	100 =20*5	200 =40*5	5	1,00	100=50+50 =c(1,00) <sup>1/3-16</sup>	100=50+52 =t log(5,00)+50
light Grey H (paper)	44,8 =20*2,24	89,6 =40*2,24	2,24	0,45	72=50+22 =c(0,45) <sup>1/3-16</sup>	75=50+27 =t log(2,24)+50
Grey U (paper)	20	40 40*1	1	0,20	51=50+1 =c(0,20) <sup>1/3-16</sup>	50=50+2 =t log(1,00)+50
dark Grey D (paper)	8,9 =20/2,24	17,8 40/2,24	0,45	0,09	35=50-14 =c(0,09) <sup>1/3-16</sup>	24=50-23 =t log(0,45)+50
Black N (paper)	4 =20/5	8 40/5	0,20	0,04	23=50-26 =c(0,04) <sup>1/3-16</sup>	0=50-48 =t log(0,20)+50
Black P2 (glossy paper)	1,9 =20/11,2	3,6 40/11,2	0,09	0,022	14=50-35 =c(0,02) <sup>1/3-16</sup>	-24=50-72 =t log(0,09)+50

It is valid: CIELAB<sub>W</sub>: c<sub>W</sub>=c=116, TUBLOG<sub>U</sub>: t<sub>U</sub>=t=50/log(5)=72

feo90-7n

TUB-test chart feo9; Colourimetric scaling of achromatic colours between white and black.  
 Contrast W:N=100:4, P2:p2=1000:3,6; L<sub>rW</sub>, L<sub>rU</sub>. See ISO 22028-5, ITU-R BT.2390-10, sec. 5.31

**Colourimetric scaling of achromatic colours between peak white and black.  
 Relations between tristimulus value Y, luminance L, and lightness L\* of ISO-standards**

Colour (light or paper)	tristimulus values	HDR display luminance	relative luminance		CIELAB <sub>U</sub> lightness	TUBLOG <sub>U</sub> lightness
			L <sub>rU</sub> = L/L <sub>U</sub>	L <sub>rW</sub> = L/L <sub>W</sub>		
<b>Contrast W:N (25:1=100:4)</b>	<b>Y</b> (5 <sup>0.5</sup> =2,24)	<b>L</b> [cd/m <sup>2</sup> ]	L <sub>rU</sub>	L <sub>rW</sub>	<b>L*</b> <sub>CIELAB<sub>U</sub></sub> = d <sub>U</sub> L <sub>rU</sub> <sup>1/3-16</sup>	<b>L*</b> <sub>TUBLOG<sub>U</sub></sub> = t <sub>U</sub> log(L <sub>rU</sub> )+50
White P2 (light)	500 =20*25	1000 =40*25	25	5,00	182=50+132 =c(25,00) <sup>1/3-16</sup>	150=50+102 =t log(25,00)+50
White W (fluorescent paper)	100 =20*5	200 =40*5	5	1,00	100=50+50 =c(5,00) <sup>1/3-16</sup>	100=50+52 =t log(5,00)+50
light Grey H (paper)	44,8 =20*2,24	89,6 =40*2,24	2,24	0,45	72=50+22 =c(2,24) <sup>1/3-16</sup>	75=50+27 =t log(2,24)+50
Grey U (paper)	20	40 40*1	1	0,20	51=50+1 =c(1,00) <sup>1/3-16</sup>	50=50+2 =t log(1,00)+50
dark Grey D (paper)	8,9 =20/2,24	17,8 40/2,24	0,45	0,09	35=50-14 =c(0,45) <sup>1/3-16</sup>	24=50-23 =t log(0,45)+50
Black N (paper)	4 =20/5	8 40/5	0,20	0,04	23=50-26 =c(0,20) <sup>1/3-16</sup>	0=50-48 =t log(0,20)+50
Black P2 (glossy paper)	1,9 =20/11,2	3,6 40/11,2	0,09	0,022	14=50-35 =c(0,09) <sup>1/3-16</sup>	-24=50-72 =t log(0,09)+50

It is valid: CIELAB<sub>U</sub>: d<sub>U</sub>=d=66, TUBLOG<sub>U</sub>: t<sub>U</sub>=t=50/log(5)=72

feo91-3n

**Colourimetric scaling of achromatic colours between peak white and black.  
 Relations between tristimulus value Y, luminance L, and lightness L\* of ISO-standards**

Colour (light or paper)	tristimulus values	HDR display luminance	relative luminance		ITU <sub>s</sub> RGB <sub>P2</sub> lightness	TUBLOG <sub>U</sub> lightness
			L <sub>rU</sub> = L/L <sub>U</sub>	L <sub>rW</sub> = L/L <sub>W</sub>		
<b>Contrast W:N (25:1=100:4)</b>	<b>Y</b> (5 <sup>0.5</sup> =2,24)	<b>L</b> [cd/m <sup>2</sup> ]	L <sub>rU</sub>	L <sub>rW</sub>	<b>L*</b> <sub>ITU<sub>s</sub>RGB<sub>P2</sub></sub> = j <sub>W</sub> L <sub>rW</sub> <sup>0,45-10</sup>	<b>L*</b> <sub>TUBLOG<sub>U</sub></sub> = t <sub>U</sub> log(L <sub>rU</sub> )+50
White P2 (light)	500 =20*25	1000 =40*25	25	5,00	161=50+111 =j(1,00) <sup>0,45-10</sup>	150=50+102 =t log(25,00)+50
White W (fluorescent paper)	100 =20*5	200 =40*5	5	1,00	73=50+23 =j(0,20) <sup>0,45-10</sup>	100=50+52 =t log(5,00)+50
light Grey H (paper)	44,8 =20*2,24	89,6 =40*2,24	2,24	0,45	48=50-1 =j(0,09) <sup>0,45-10</sup>	75=50+27 =t log(2,24)+50
Grey U (paper)	20	40 40*1	1	0,20	30=50-19 =j(0,04) <sup>0,45-10</sup>	50=50+2 =t log(1,00)+50
dark Grey D (paper)	8,9 =20/2,24	17,8 40/2,24	0,45	0,09	18=50-31 =j(0,02) <sup>0,45-10</sup>	24=50-23 =t log(0,45)+50
Black N (paper)	4 =20/5	8 40/5	0,20	0,04	9=50-40 =j(0,01) <sup>0,45-10</sup>	0=50-48 =t log(0,20)+50
Black P2 (glossy paper)	1,9 =20/11,2	3,6 40/11,2	0,09	0,022	4=50-45 =j(0,00) <sup>0,45-10</sup>	-24=50-72 =t log(0,09)+50

It is valid: ITUsRGB<sub>W</sub>: j<sub>W</sub>=j=110, TUBLOG<sub>U</sub>: t<sub>U</sub>=t=50/log(5)=72

feo91-7n

TUB registration: 20240201-feo9/feo910np.pdf / .ps  
 application for evaluation and measurement of display or print output

TUB material: code=rhata4