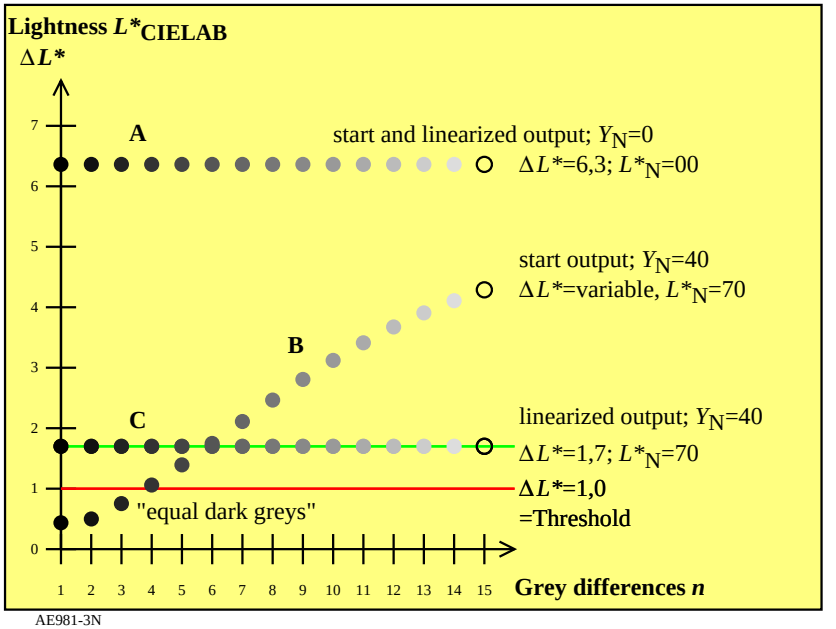
Contrast step C_{Yi} (i=1 to 8), CIE tristimulus value Y_N, grey steps according to ISO 9241-306[1)]

Contrast step C_{Yi} and Y -ratio (i=1 .. 8)	CIE tristimulus value Y_N and CIE lightness L^*_N of black	total viewing display illuminance E_{P+R} [lux][3)]	measured projector (P) display illuminance E_P [lux][3)]	room light (R) display illuminance E_R [lux][3)]	grey steps without output linearisation ΔL^*=1 amount a_n[2)]	grey steps with output linearisation ΔL^*=1 amount a_l[2)]
C_{Y8} **288:1**	0,31 / 1	80000+64000	143500	500	47 (max)	94 (max)
C_{Y7} **144:1**	0,62 / 6	40000+32000	61500	500	44	88
C_{Y6} **72:1**	1,25 / 11	20000+16000	35500	500	42	84
C_{Y5} **36:1**	**2,5 / 18**	**10000+8000**	**17500**	**500**	**38**	**77**
C_{Y4} **18:1**	5,0 / 27	5000+4000	8500	500	34	68
C_{Y3} **9:1**	10 / 38	2500+2000	4000	500	28	57
C_{Y2} **4,5:1**	20 / 52	1250+1000	1750	500	21	43
C_{Y1} **2,25:1**	40 / 70	625+500	625	500	12	25

1) The example is intended for data projectors (P). The standard contrast step (bold) C_{Y5} = 36:1 is hard to reach.
2) For the amount of discriminable colour steps use the equations: $c_n = a_n^3$ or $c_l = a_l^3$, for example c_n = 4096 for a_n = 16.
3) For the contrast C_Y=2:1 the viewing luminances of both the black in the projection and the white standard offset paper are equal (!). Visual fatigue caused by the adaptation luminance ratio 36:1 of the black at the screen and the black at the paper shall be reduced. If for example a grey screen with the CIE tristimulus value Y_Z = 22,2 (=0,25*88.9) is used the contrast step C_{Yi} remains constant. Then the luminance ratio of all colours at the screen and the paper has reduced to 9:1. This reduces visual fatigue.

AE980-3N



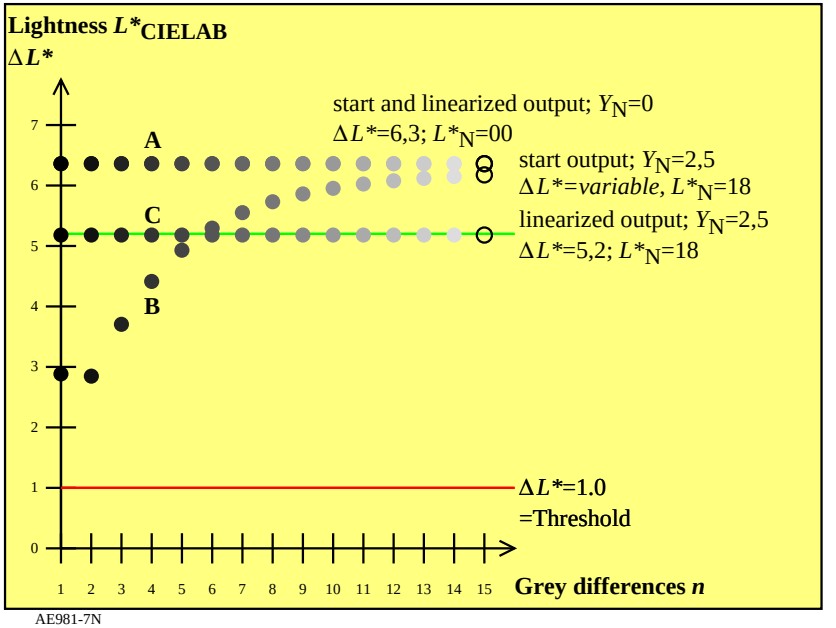
AE981-3N

Contrast step C_{Yi} (i=1 to 8) and absolute and relative Gamma according to ISO 9241-306[1)]

Contrast step C_{Yi} and Y -ratio (i=1 .. 8)	CIE tristimulus value; ratio $Y_W : Y_N$ White W and Black N	CIE tristimulus value; range Y_{N1} ... Y_{N2}	absolute Gamma G_{Pk}(k=0 to 7) for display (P) with G_{P0}=2,4[2)] G_{Pk}=2,4-0,18k	relative Gamma g_{Pk}(k=0 to 7) for display (P) with G_{P0}=2,4[2)] g_{Pk}=G_{Pk}/2,4	application and colour mode at work place; illuminance on display 500 lux or 250/125/62 lux
C_{Y8} **288:1**	88,9 : 0,31	0,00 ... <0,46	G_{P0} = 2,40	g_{P0} = 1,000	display, only 062 lux
C_{Y7} **144:1**	88,9 : 0,62	0,46 ... <0,93	G_{P1} = 2,22	g_{P1} = 0,925	display, only 125 lux
C_{Y6} **72:1**	88,9 : 1,25	0,93 ... <1,87	G_{P2} = 2,04	g_{P2} = 0,850	display, only 250 lux
C_{Y5} **36:1**	**88,9 : 2,50**	**1,87 ... <3,75**	**G_{P3} = 1,86**	**g_{P3} = 0,775**	**display and surface**
C_{Y4} **18:1**	88,9 : 5,00	3,75 ... <7,50	G_{P4} = 1,68	g_{P4} = 0,700	display and surface
C_{Y3} **9:1**	88,9 : 10,0	7,50 ... <15,0	G_{P5} = 1,50	g_{P5} = 0,625	display and surface
C_{Y2} **4,5:1**	88,9 : 20,0	15,0 ... <30,0	G_{P6} = 1,32	g_{P6} = 0,550	display and surface
C_{Y1} **2,25:1**[3)]	88,9 : 40,0	30,0 ... <60,0	G_{P7} = 1,14	g_{P7} = 0,475	display and surface

1) The example is intended for data projectors (P) with G_{P0}=2,4. compare IEC 61966-2-1: G_{P0}=2,4.
2) The computer operating system *Apple* has used the value 1,8 until 2010. The change to 2,4 *(= Windows)* is in the wrong direction.
3) For the contrast C_Y=2:1 the viewing luminances of both the black in the projection and the white standard offset paper are equal (!). Visual fatigue caused by the adaptation luminance ratio 36:1 of the black at the screen and the black at the paper shall be reduced. If for example a grey screen with the CIE tristimulus value Y_Z = 22,2 (=0,25*88.9) is used the contrast step C_{Yi} remains constant. Then the luminance ratio of all colours at the screen and the paper has reduced to 9:1. This reduces visual fatigue.

AE980-7N



AE981-7N

see similar files: http://farbe.li.tu-berlin.de/AE98/AE98.HTM
technical information: http://farbe.li.tu-berlin.de/ or http://130.149.60.45/~farbmetrik/

TUB registration: 20181001-AE98/AE98L0NP.PDF /.PS
application for measurement or viewing of display output
TUB material: code=rha4ta