Contrast steps 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 values; Ratio $Y_W : Y_N$ of White W and Black N	CIE tristimulus values; 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 & surface**
C_{Y4} **18:1**	88,9 : 5,00	3,75 ... <7,50	G_{P4} = 1,68	g_{P4} = 0,700	display & surface
C_{Y3} **9:1**	88,9 : 10,0	7,50 ... <15,0	G_{P5} = 1,50	g_{P5} = 0,625	display & surface
C_{Y2} **4,5:1**	88,9 : 20,0	15,0 ... <30,0	G_{P6} = 1,32	g_{P6} = 0,550	display & surface
C_{Y1} **2,25:1**[3)]	88,9 : 40,0	30,0 ... <60,0	G_{P7} = 1,14	g_{P7} = 0,475	display & 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_{Y1} =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_S = 22,2 (=0,25*88.9) is used the contrast step C_{Y5} remains constant.
Then the luminance ratio of all colours at the screen and the paper has reduced to 9:1. This reduces visual fatigue.

PN050−3N

Contrast steps 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 values; Ratio $Y_W : Y_N$ of White W and Black N	CIE tristimulus values; Range Y_{N1} ... Y_{N2}	absolute Gamma G_{Pk}(k=−3 to 4) for display (P) with G_{P0}=1,86[2)] G_{Pk}=1,86−0,18k	relative Gamma g_{Pk}(k=−3 to 4) for display (P) with G_{P0}=1,86[2)] g_{Pk}=G_{Pk}/1,86	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_{P-3} = 2,40	g_{P-3} = 1,29	display, only 062 lux
C_{Y7} **144:1**	88,9 : 0,62	0,46 ... <0,93	G_{P-2} = 2,22	g_{P-2} = 1,20	display, only 125 lux
C_{Y6} **72:1**	88,9 : 1,25	0,93 ... <1,87	G_{P-1} = 2,04	g_{P-1} = 1,10	display, only 250 lux
C_{Y5} **36:1**	**88,9 : 2,50**	**1,87 ... <3,75**	G_{P0} = **1,86**	g_{P0} = **1,00**	**display & surface**
C_{Y4} **18:1**	88,9 : 5,00	3,75 ... <7,50	G_{P1} = 1,68	g_{P1} = 0,90	display & surface
C_{Y3} **9:1**	88,9 : 10,0	7,50 ... <15,0	G_{P2} = 1,50	g_{P2} = 0,81	display & surface
C_{Y2} **4,5:1**	88,9 : 20,0	15,0 ... <30,0	G_{P3} = 1,32	g_{P3} = 0,71	display & surface
C_{Y1} **2,25:1**[3)]	88,9 : 40,0	30,0 ... <60,0	G_{P4} = 1,14	g_{P4} = 0,61	display & surface

1) The example is intended for data projectors (P) with G_{P0}=1,86. Compare NTSC television: G_{P0}=1,8.
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_{Y1} =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_S = 22,2 (=0,25*88.9) is used the contrast step C_{Y5} remains constant.
Then the luminance ratio of all colours at the screen and the paper has reduced to 9:1. This reduces visual fatigue.

PN050−7N

Contrast steps C_{Yi} (i=1 to 8), CIE tristimulus values Y_W and Y_N according to ISO 9241−306[1)]

Contrast step C_{Yi} and Y-ratio (i=1 .. 8)	CIE tristimulus values; Ratio $Y_W : Y_N$ of White W and Black N	CIE tristimulus values; Range Y_{N1} ... Y_{N2}	Paper (S) luminance[2)]; Ratio [cd/m²] $L_{WS} : L_{NS}$	Display (P) luminance[2)]; Ratio [cd/m²] $L_{WP} : L_{NP}$	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	142 : 142/288	142*36 : 018	display, only 062 lux
C_{Y7} **144:1**	88,9 : 0,62	0,46 ... <0,93	142 : 142/144	142*36 : 035	display, only 125 lux
C_{Y6} **72:1**	88,9 : 1,25	0,93 ... <1,87	142 : 142/72	142*36 : 071	display, only 250 lux
C_{Y5} **36:1**	**88,9 : 2,50**	**1,87 ... <3,75**	**142 : 142/36**	**142*36 : 142**	**display & surface**
C_{Y4} **18:1**	88,9 : 5,00	3,75 ... <7,50	142 : 142/18	142*18 : 142	display & surface
C_{Y3} **9:1**	88,9 : 10,0	7,50 ... <15,0	142 : 142/09	142*09 : 142	display & surface
C_{Y2} **4,5:1**	88,9 : 20,0	15,0 ... <30,0	142 : 142/4,5	142*4,5 : 142	display & surface
C_{Y1} **2,25:1**[3)]	88,9 : 40,0	30,0 ... <60,0	142 : 142/2,25	142*2,25 : 142	display & surface

1) The example is intended for data projectors (P). The standard contrast step (bold) with L_{WP}=142*36 cd/m² is hard to reach.
2) 500 lux corresponds to the viewing luminance L_S=142 cd/m² for a standard white paper with the tristimulus value Y_W=88,9.
3) For the contrast C_{Y1} =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_S = 22,2 (=0,25*88.9) is used the contrast step C_{Y5} remains constant.
Then the luminance ratio of all colours at the screen and the paper has reduced to 9:1. This reduces visual fatigue.

PN051−3N

Contrast steps C_{Yi} (i=1 to 8), CIE tristimulus values Y_W and Y_N according to ISO 9241−306[1)]

Contrast step C_{Yi} and Y-ratio (i=1 .. 8)	CIE tristimulus values; Ratio $Y_W : Y_N$ of White W and Black N	CIE tristimulus values; Range Y_{N1} ... Y_{N2}	Paper (S) luminance[2)]; Ratio [cd/m²] $L_{WS} : L_{NS}$	Display (P) luminance[2)]; Ratio [cd/m²] $L_{WP} : L_{NP}$	application and colour mode at work place; illuminance on display 125 lux or 62/31/15 lux
C_{Y8} **288:1**	88,9 : 0,31	0,00 ... <0,46	142 : 142/288	36*36 : 4,5	display, only 15 lux
C_{Y7} **144:1**	88,9 : 0,62	0,46 ... <0,93	142 : 142/144	36*36 : 09	display, only 31 lux
C_{Y6} **72:1**	88,9 : 1,25	0,93 ... <1,87	142 : 142/72	36*36 : 18	display, only 62 lux
C_{Y5} **36:1**	**88,9 : 2,50**	**1,87 ... <3,75**	**142 : 142/36**	**36*36 : 36**	**display & surface**
C_{Y4} **18:1**	88,9 : 5,00	3,75 ... <7,50	142 : 142/18	36*18 : 36	display & surface
C_{Y3} **9:1**	88,9 : 10,0	7,50 ... <15,0	142 : 142/09	36*09 : 36	display & surface
C_{Y2} **4,5:1**	88,9 : 20,0	15,0 ... <30,0	142 : 142/4,5	36*4,5 : 36	display & surface
C_{Y1} **2,25:1**[3)]	88,9 : 40,0	30,0 ... <60,0	142 : 142/2,25	36*2,25 : 36	display & surface

1) The example is intended for data projectors (P). The standard contrast step (bold) with L_{WP}=36*36 cd/m² is hard to reach.
2) 125 lux corresponds to the viewing luminance L_S=36 cd/m² for a standard white paper with the tristimulus value Y_W=88,9.
3) For the contrast C_{Y1} =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_S = 22,2 (=0,25*88.9) is used the contrast step C_{Y5} remains constant.
Then the luminance ratio of all colours at the screen and the paper has reduced to 9:1. This reduces visual fatigue.

PN051−7N

test chart PN05; Contrast steps of emittive displays
Eight contrast steps, and illuminances of displays for 500 lux

input: *w/rgb/cmyk −> rgb_*
output: no change compared