

Contrast step C_{Y_i} (i=1 to 8), CIE tristimulus value Y_N , grey steps according to ISO 9241-306¹⁾

Contrast step C_{Y_i} 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 delta $L^*=1$ amount a_n ²⁾	grey steps with output linearisation delta $L^*=1$ amount a_l ²⁾
C_{Y_8} 288:1	0,31 / 1	80000+64000	143500	500	47 (max)	94 (max)
C_{Y_7} 144:1	0,62 / 6	40000+32000	61500	500	44	88
C_{Y_6} 72:1	1,25 / 11	20000+16000	35500	500	42	84
C_{Y_5} 36:1	2,5 / 18	10000+8000	17500	500	38	77
C_{Y_4} 18:1	5,0 / 27	5000+4000	8500	500	34	68
C_{Y_3} 9:1	10 / 38	2500+2000	4000	500	28	57
C_{Y_2} 4,5:1	20 / 52	1250+1000	1750	500	21	43
C_{Y_1} 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) $C_{Y_5} = 36:1$ 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 $Y_Z = 22,2$ ($=0,25 \cdot 88,9$) is used the contrast step C_{Y_1} remains constant.
Then the luminance ratio of all colours at the screen and the paper has reduced to 9:1. This reduces visual fatigue.