

**Contrast step  $C_{Y_i}$  ( $i=1$  to 8), CIE tristimulus value  $Y_N$ , grey steps according to ISO 9241-306<sup>1)</sup>**

Contrast step $C_{Y_i}$ and $Y$ -ratio ( $i=1 \dots 8$ )	CIE tristimulus value $Y_N$ and CIE lightness $L_N^*$ of black	total viewing display illuminance $E_{P+R}$ [lux] <sup>2)</sup>	measured projector (P) display illuminance $E_P$ [lux] <sup>2)</sup>	room light (R) display illuminance $E_R$ [lux] <sup>2)</sup>	grey steps without output linearisation delta $L^*=1$ amount $a_n$ <sup>2)</sup>	grey steps with output linearisation delta $L^*=1$ amount $a_1$ <sup>2)</sup>
$C_{Y_8}$ <b>288:1</b>	0,31 / 1	19200+16000	35075	125	47 (max)	94 (max)
$C_{Y_7}$ <b>144:1</b>	0,62 / 6	9600+8000	17475	125	44	88
$C_{Y_6}$ <b>72:1</b>	1,25 / 11	4800+4000	8675	125	42	84
$C_{Y_5}$ <b>36:1</b>	<b>2,5 / 18</b>	<b>2400+2000</b>	<b>4275</b>	<b>125</b>	<b>38</b>	<b>77</b>
$C_{Y_4}$ <b>18:1</b>	5,0 / 27	1200+1000	2075	125	34	68
$C_{Y_3}$ <b>9:1</b>	10 / 38	600+500	975	125	28	57
$C_{Y_2}$ <b>4,5:1</b>	20 / 52	300+250	425	125	21	43
$C_{Y_1}$ <b>2,25:1</b>	40 / 70	150+125	150	125	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  $c_1 = a_1^3$ , 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  $C_{Y_i}$  remains constant. Then the luminance ratio of all colours at the screen and the paper has reduced to 9:1. This reduces visual fatigue.