

| Contrast step $C_{Yi}$ ( $i=1$ to 8), CIE tristimulus value $Y_N$ , grey steps according to ISO 9241-306 <sup>1)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                      |                                                                    |                                                                         |                                                                 |                                                                                      |                                                                                   |
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| Contrast step<br>$C_{Yi}$ and $Y$ -ratio<br>( $i=1 \dots 8$ )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | CIE tristimulus value<br>$Y_N$ and CIE lightness<br>$L^*_N$ of black | total viewing display illuminance<br>$E_{P+R}$ [lux] <sup>3)</sup> | measured projector (P) display illuminance<br>$E_P$ [lux] <sup>3)</sup> | room light (R) display illuminance<br>$E_R$ [lux] <sup>3)</sup> | grey steps without output linearisation<br>$\Delta L^*=1$ amount $a_n$ <sup>2)</sup> | grey steps with output linearisation<br>$\Delta L^*=1$ amount $a_l$ <sup>2)</sup> |
| $C_{Y8}$ 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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>2,5 / 18</b>                                                      | <b>10000+8000</b>                                                  | <b>17500</b>                                                            | <b>500</b>                                                      | <b>38</b>                                                                            | <b>77</b>                                                                         |
| $C_{Y4}$ 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                                                                                |
| <p>1) The example is intended for data projectors (P). The standard contrast step (bold) <math>C_{Y5} = 36:1</math> is hard to reach.</p> <p>2) For the amount of discriminable colour steps use the equations: <math>c_n = a_n^3</math> or <math>c_l = a_l^3</math>, for example <math>c_n = 4096</math> for <math>a_n = 16</math>.</p> <p>3) For the contrast <math>C_Y=2:1</math> 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 <math>Y_Z = 22,2</math> (<math>=0,25 \cdot 88,9</math>) is used the contrast step <math>C_{Yi}</math> remains constant. Then the luminance ratio of all colours at the screen and the paper has reduced to 9:1. This reduces visual fatigue.</p> |                                                                      |                                                                    |                                                                         |                                                                 |                                                                                      |                                                                                   |