

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

| 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 delta $L^*=1$ amount a_n ²⁾ | grey steps with output linearisation delta $L^*=1$ amount a_1 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 $c_1 = a_1^3$, 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 $Y_2 = 22,2$ ($=0,25 \cdot 88,9$) is used the contrast step C_{Y1} remains constant. Then the luminance ratio of all colours at the screen and the paper has reduced to 9:1. This reduces visual fatigue.

PS040-3N

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

| 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] ²⁾ | measured projector (P) display illuminance E_P [lux] ²⁾ | room light (R) display illuminance E_R [lux] ²⁾ | grey steps without output linearisation delta $L^*=1$ amount a_n ³⁾ | grey steps with output linearisation delta $L^*=1$ amount a_1 ³⁾ |
|---|--|---|--|--|--|---|
| 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 |

The following example assumes that a projector produces the contrast step C_{Y3} for the illuminances measured for 5 times the horizontal A4 direction (149 cm):

| | | | | | | |
|------------------------|---------|-----------|------|-----|----|----|
| 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 |

The illuminances E_P are by the factor 4 less for 10 times the A4-direction (298 cm):

| | | | | | | |
|-------------------------------------|---------|----------|------|-----|----|----|
| C_{Yx1} 3:1⁴⁾ | 30 / 61 | 1000+500 | 1000 | 500 | 17 | 34 |
| C_{Yx2} 1,9:1⁵⁾ | 45 / 74 | 438+500 | 438 | 500 | 10 | 21 |

- 1) The example is intended for data projectors (P). The standard contrast step (bold) $C_{Y5} = 36:1$ is not reached.
- 2) 500 lux corresponds to the viewing luminance $L_v = 142$ cd/m² for a standard white paper with the tristimulus value $Y_w = 88,9$.
- 3) 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 $a_n = 16$.
- 4) The viewing contrast $C_{Yx1} = 1500:500 = 3:1$ is larger compared to the contrast $C_{Y1} = 2,25:1$. The contrast step is $C_{Y1} = 2,25:1$.
- 5) The viewing contrast $C_{Yx2} = 938:500 = 1,9:1$ is smaller compared to the contrast $C_{Y1} = 2,25:1$. A contrast step is not defined.

PS040-7N

gráfico PS04; Contrast steps of data projectors
 Eight contrast steps, and illuminances of displays for 500 lux

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

| 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] ²⁾ | measured projector (P) display illuminance E_P [lux] ²⁾ | room light (R) display illuminance E_R [lux] ²⁾ | grey steps without output linearisation delta $L^*=1$ amount a_n ²⁾ | grey steps with output linearisation delta $L^*=1$ amount a_1 ²⁾ |
|---|--|---|--|--|--|---|
| C_{Y8} 288:1 | 0,31 / 1 | 19200+16000 | 35075 | 125 | 47 (max) | 94 (max) |
| C_{Y7} 144:1 | 0,62 / 6 | 9600+8000 | 17475 | 125 | 44 | 88 |
| C_{Y6} 72:1 | 1,25 / 11 | 4800+4000 | 8675 | 125 | 42 | 84 |
| C_{Y5} 36:1 | 2,5 / 18 | 2400+2000 | 4275 | 125 | 38 | 77 |
| C_{Y4} 18:1 | 5,0 / 27 | 1200+1000 | 2075 | 125 | 34 | 68 |
| C_{Y3} 9:1 | 10 / 38 | 600+500 | 975 | 125 | 28 | 57 |
| C_{Y2} 4,5:1 | 20 / 52 | 300+250 | 425 | 125 | 21 | 43 |
| C_{Y1} 2,25:1 | 40 / 70 | 150+125 | 150 | 125 | 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 $c_1 = a_1^3$, 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 $Y_2 = 22,2$ ($=0,25 \cdot 88,9$) is used the contrast step C_{Y1} remains constant. Then the luminance ratio of all colours at the screen and the paper has reduced to 9:1. This reduces visual fatigue.

PS041-3N

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

| 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] ²⁾ | measured projector (P) display illuminance E_P [lux] ²⁾ | room light (R) display illuminance E_R [lux] ²⁾ | grey steps without output linearisation delta $L^*=1$ amount a_n ³⁾ | grey steps with output linearisation delta $L^*=1$ amount a_1 ³⁾ |
|---|--|---|--|--|--|---|
| C_{Y4} 36:1 | 10 / 38 | 2400+2000 | 4275 | 125 | 38 | 77 |
| C_{Y3} 9:1 | 20 / 52 | 1200+1000 | 2075 | 125 | 34 | 68 |
| C_{Y2} 4,5:1 | 40 / 70 | 600+500 | 975 | 125 | 28 | 57 |

The following example assumes that a projector produces the contrast step C_{Y3} for the illuminances measured for 5 times the horizontal A4 direction (149 cm):

| | | | | | | |
|-----------------------|---------|-----------|------|-----|----|----|
| C_{Y4} 36:1 | 10 / 38 | 2400+2000 | 4275 | 125 | 38 | 77 |
| C_{Y3} 9:1 | 20 / 52 | 1200+1000 | 2075 | 125 | 34 | 68 |
| C_{Y2} 4,5:1 | 40 / 70 | 600+500 | 975 | 125 | 28 | 57 |

The illuminances E_P are by the factor 4 less for 10 times the A4-direction (298 cm):

| | | | | | | |
|-----------------------------------|---------|----------|------|-----|----|----|
| C_{Yx1} 4:1⁴⁾ | 30 / 61 | 1069+125 | 1069 | 125 | 34 | 34 |
| C_{Yx2} 2:1⁵⁾ | 45 / 74 | 518+125 | 518 | 125 | 21 | 21 |

- 1) The example is intended for data projectors (P). The standard contrast step (bold) $C_{Y5} = 36:1$ is not reached.
- 2) 125 lux corresponds to the viewing luminance $L_v = 35$ cd/m² for a standard white paper with the tristimulus value $Y_w = 88,9$.
- 3) 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 $a_n = 16$.
- 4) The viewing contrast $C_{Yx1} = 1194:125 = 8,5:1$ is larger compared to the contrast $C_{Y2} = 4,5:1$. The contrast step is $C_{Y2} = 4,5:1$.
- 5) The viewing contrast $C_{Yx2} = 643:125 = 5,1:1$ is larger compared to the contrast $C_{Y2} = 4,5:1$. The contrast step is $C_{Y2} = 4,5:1$.

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entrada: w/rgb/cmyk -> rgb-
 salida: ningún cambio

vea archivos semejantes: http://130.149.60.45/~farbmetrik/PS04/PS04.HTM
 información técnica: http://www.ps.bam.de o http://130.149.60.45/~farbmetrik

TUB matrícula: 20130201-PS04/PS04L0NA.TXT / PS
 aplicación para la medida de display output

TUB material: code=rh4ta