

# Light Measurement Report

Print date: 14-8-2025

Measurement date and time: 14-8-2025 10:06:31 – Measurement no. VFR-250814-2544-MS

Measurement tracking No. and Link: [VT250814-005571](#)

Operator:



## Laboratory and Equipment

Laboratory Owner and Location  
Goniospectrometer System and Type  
Sensor Name, Calibr. Date and Serial No.  
Spectrometer Manufacturer and Model

Viso Systems, Copenhagen V, Denmark  
LabSpion – Type C, horizontal  
LabSensor Model2 – 11-1-2024 – 3130191315  
Ibsen Photonics, Denmark – Freedom VIS (Custom Viso)

## Measurement Conditions

Number of C-planes and Resolution  
 $\gamma$  (gamma)-Resolution  
Test Distance  
Input Power, Power and Displ. Factors  
Input RMS Voltage and Current  
Frequency of Input Power  
Warm-up Time and Variation

20 planes – 18°  
5°  
2,00 m  
15,2 W – PF 0,95 – DPF 0,96  
230 V – 0,069 A  
50 Hz  
Lamp stabilized in 15 min 1 sec – 2,0%

## Tested Light Source

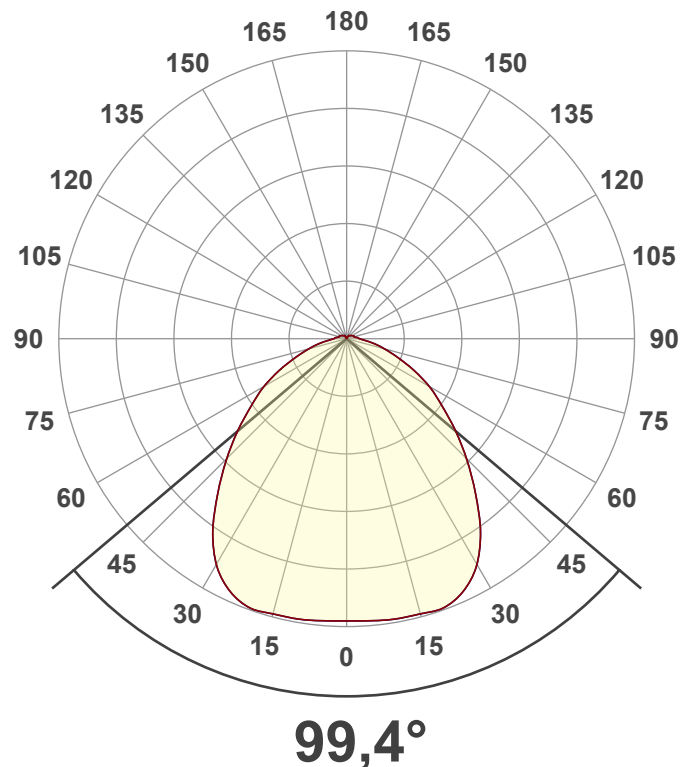
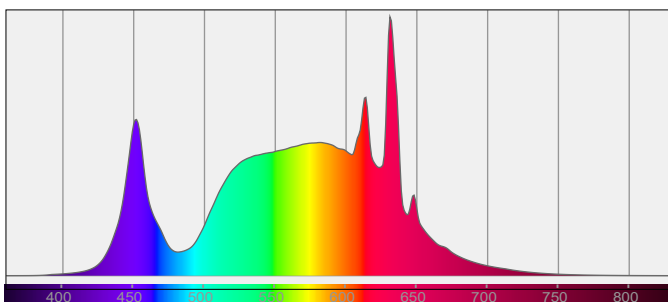
Product Name  
Item No. and Manufacturer  
Product Description (line 1)  
ZWART | CCT SWITCH

812959-4000K-16W  
812959-4000K-16W – Dutchfulfillment  
3-FASE RAILARMATUUR | TARVOS | 60CM | 12W/16W/20W/24W |

## Main Light Measurement Results

Output – Total Lumen (Up% / Down%)  
Efficiency  
Peak Intensity and Beam Angle  
Correlated Color Temperature, Target/Measured  
Color Rendering Index  
Color Rendering TM30-18  
Color Shift, CIE duv and MacAdam Steps  
Flicker

1818 lm – 4,78% / 95,22%  
120 lm/W  
659 cd – 99,4°  
CCT = 4000 K / 3790 K  
CRI 84,1  
 $R_f$  84,3 –  $R_g$  98,6  
Duv 0,0043 – SDCM 6,7  
SVM 0 – PstLM 0,01



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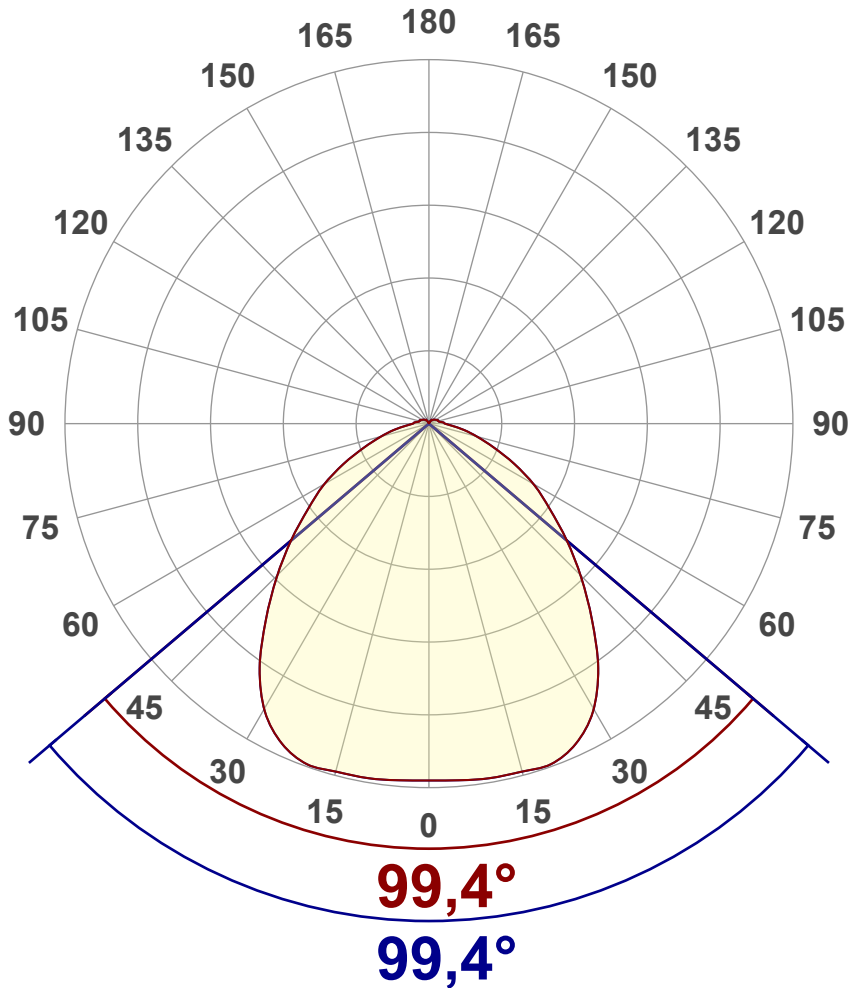
Measurement tracking No. and Link: [VT250814-005571](#)

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## Luminous Intensity diagram

Unit: 0-100% of peak intensity



## Main Values

Output (total Lumen)	1818 lm
Lumen Up% / Down%	4,78% / 95,22%
Peak Intensity	659 cd
Beam Angle (50%)	99,4°
Beam Angle (90%)	99,4°
Beam Angle (10%)	99,4°

## Cut-off Angle

Average 2,5%	225,9°
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## Field Angle

Average 10%	159,1°
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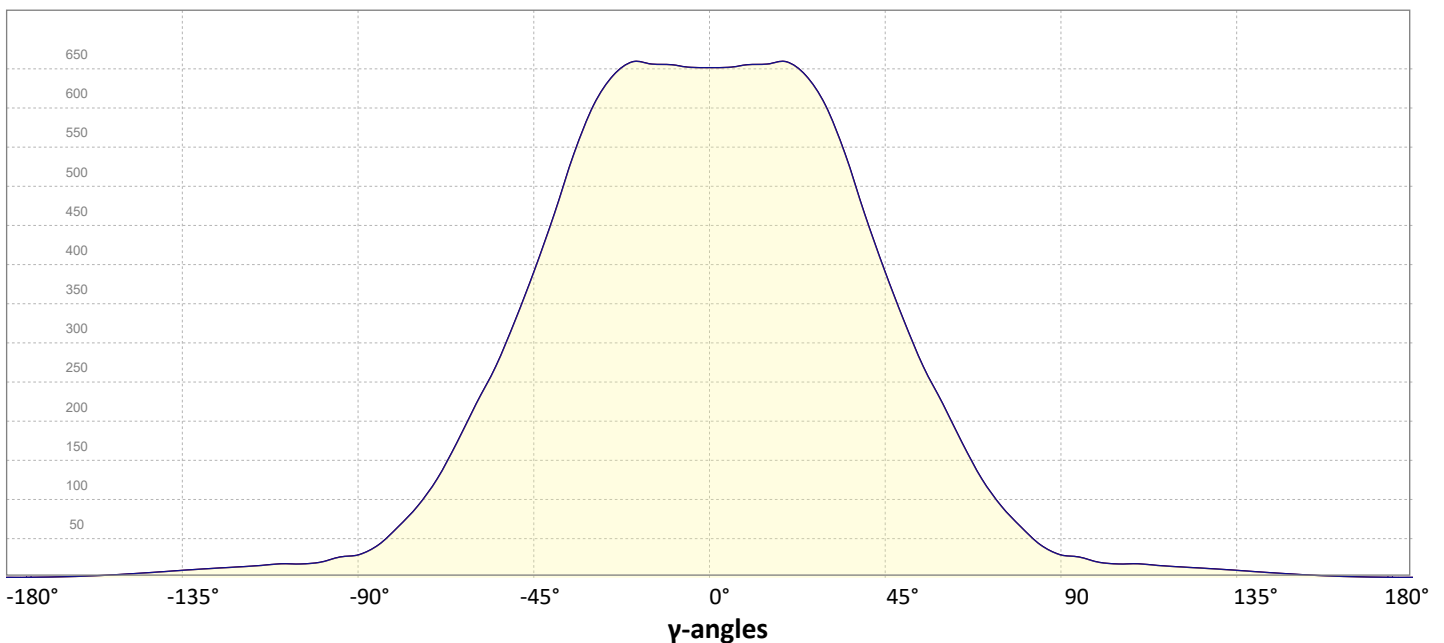
## Intensity Ratio

In 120° cone	78,0%
In 90° cone	56,8%

**C000-C180**

**C090-C270**

## Linear distribution diagram - Intensity (candela) vs $\gamma$ -angle



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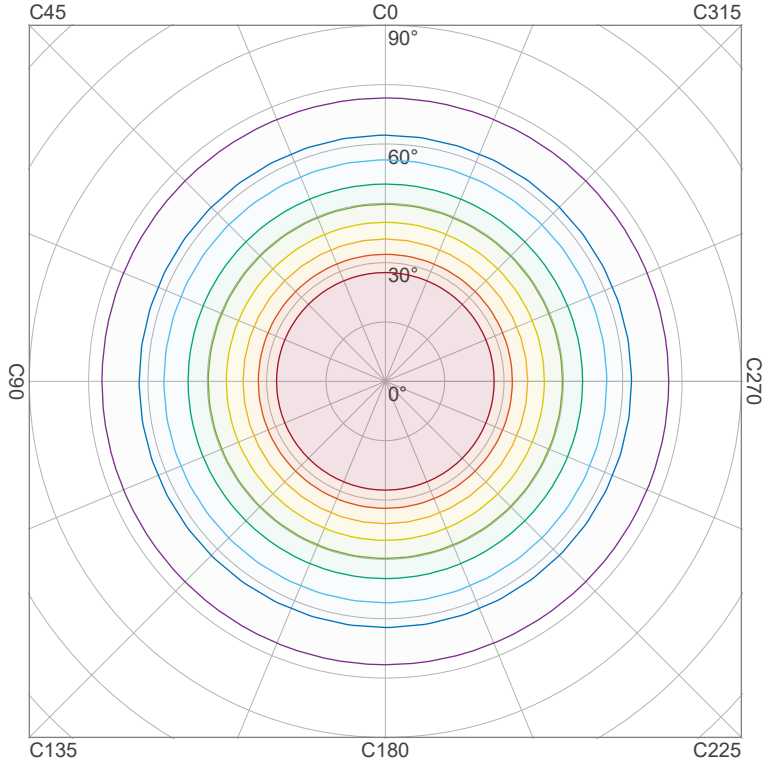
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## Iso-intensity Diagram (Iso-candela)

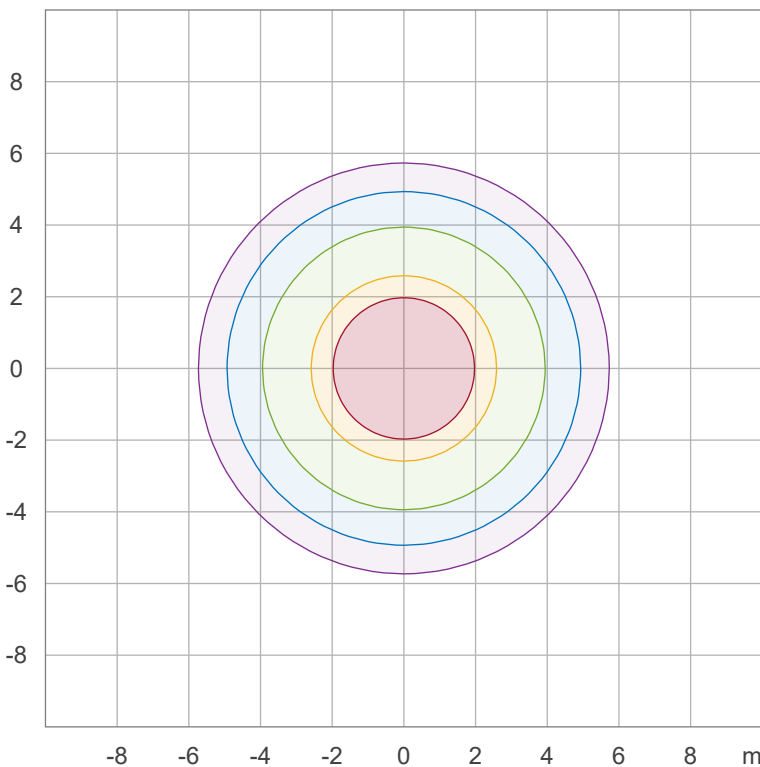


90 %	592,7 cd
80 %	526,8 cd
70 %	461,0 cd
60 %	395,1 cd
50 %	329,3 cd
40 %	263,4 cd
30 %	197,6 cd
20 %	131,7 cd
10 %	65,9 cd

Peak intensity: 658,6 cd

Number of c-planes: 20

## Iso-illuminance Diagram (Iso-lux)



50,0 %	36,2 lx
30,0 %	21,7 lx
10,0 %	7,2 lx
5,0 %	3,6 lx
3,0 %	2,2 lx

Peak illuminance: 72,4 lx

Mounting height: 3,0 m

Number of c-planes: 20

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## Color details

Correlated Color Temperature, Target CCT = 4000 K  
 Correlated Color Temperature, Measured CCT = 3790 K  
 Color Rendering Index CRI 84,1  
 Color Rendering Index, R9 (red component) R9 = 33,8  
 Color Rendering TM30-18 R<sub>f</sub> 84,3 – R<sub>g</sub> 98,6  
 Color Quality Scale CQS = 84,4

MacAdam Steps SDCM = 6,7  
 Color coordinates CIE 1931 (x;y) = (0,381;0,377)  
 Color coordinate CIEs 1960 (u;v) = (0,225;0,334)  
 Color deviation from BBL Duv = 0,0043  
 Color coordinate CIEs 1976 (CIELUV) (u';v') = (0,225;0,502)

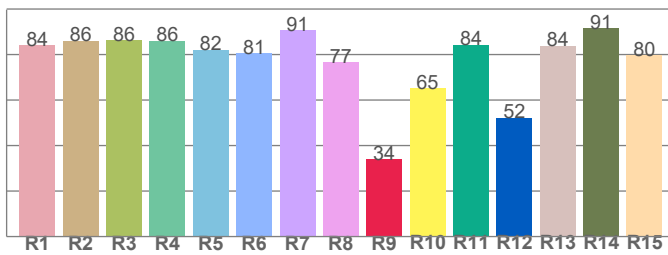
### CIE 1931



### CIE 1931 – zoomed on Planckian locus



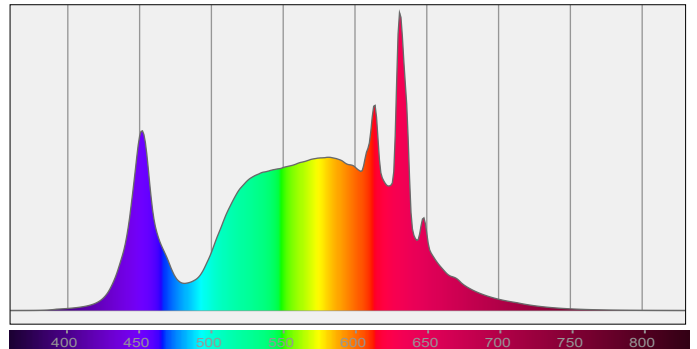
### Color Rendering Index per reference color (CIE 1995)



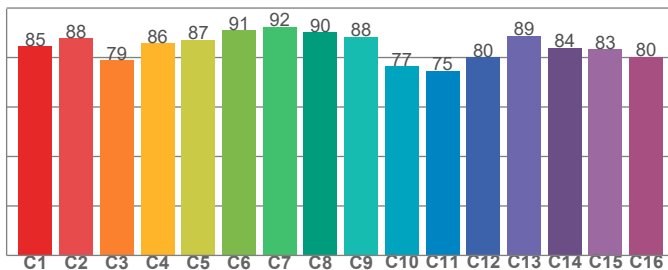
CRI R values, only R1-R8 are used to calculate final CRI value

R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
84,2	86,0	86,3	86,0	82,1	80,6	90,7	76,6	33,8	65,2	84,3	52,2	83,9	91,5	79,7

### Spectral power distribution (SPD) / W/nm – 0-100%



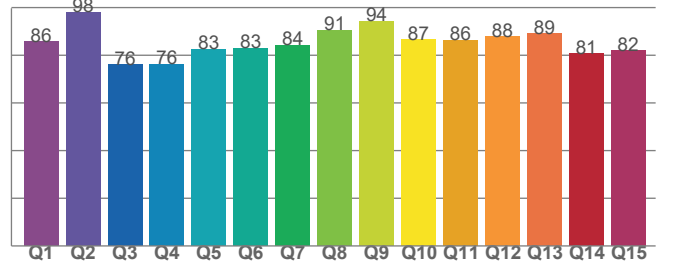
### TM30-18 R<sub>f</sub>-values per hue bin



TM30 C values, 16 binned values out of total of 99 C values

C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16
84,5	87,7	79,0	85,7	87,2	91,1	92,5	90,1	88,4	76,6	74,6	80,0	88,7	83,9	83,3	80,3

### Color Quality Scale by reference color



CQS Q values

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15
85,6	98,0	76,1	76,2	82,5	83,0	84,1	90,6	94,4	86,5	86,4	87,8	89,0	80,6	81,8

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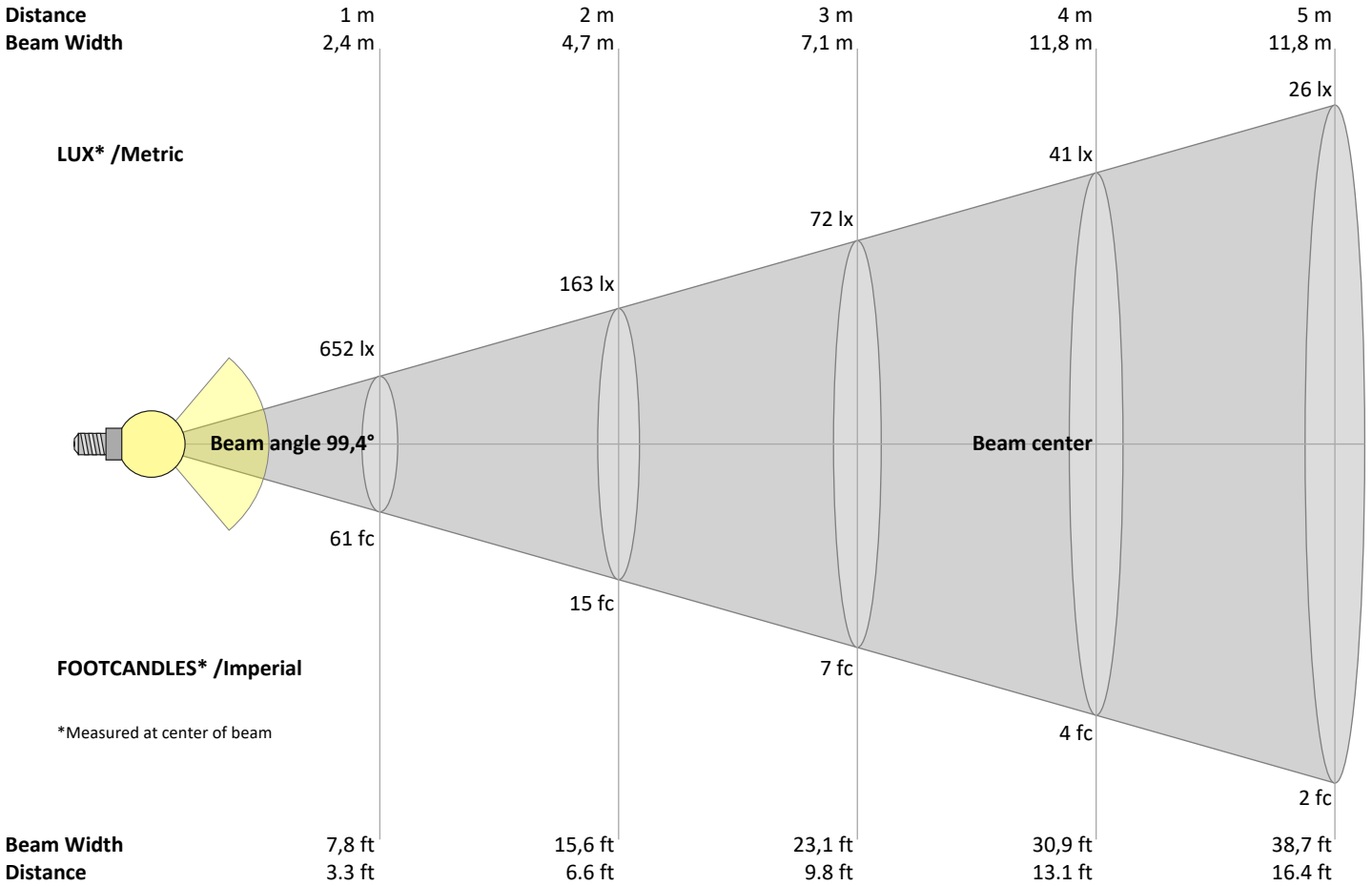
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## Beam Details



### Beam intensities from 1 – 20 m

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	m
3,3	6,6	9,8	13,1	16,4	19,7	23	26,2	29,5	32,8	36,1	39,4	42,7	45,9	49,2	52,5	55,8	59,1	62,3	65,6	ft
652	163	72	41	26	18	13	10	8	7	5	5	4	3	3	3	2	2	2	2	lux
60,6	15,1	6,7	3,8	2,4	1,7	1,2	0,9	0,7	0,6	0,5	0,4	0,4	0,3	0,3	0,2	0,2	0,2	0,2	0,2	fc

### Intensities in 0° c-plane

0°	5°	10°	15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	65°	70°	75°	80°	85°	90°	95°	γ
652	652	655	656	658	639	600	537	461	390	326	267	220	170	124	90	64	41	29	26	cd
100%	100%	101%	101%	101%	98%	92%	82%	71%	60%	50%	41%	34%	26%	19%	14%	10%	6%	5%	4%	of 0°val

### Intensities in 90° c-plane

0°	5°	10°	15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	65°	70°	75°	80°	85°	90°	95°	γ
652	652	655	656	658	639	600	537	461	390	326	267	220	170	124	90	64	41	29	26	cd
100%	100%	101%	101%	101%	98%	92%	82%	71%	60%	50%	41%	34%	26%	19%	14%	10%	6%	5%	4%	of 0°val

### Intensities in 180° c-plane

0°	5°	10°	15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	65°	70°	75°	80°	85°	90°	95°	γ
652	652	655	656	658	639	600	537	461	390	326	267	220	170	124	90	64	41	29	26	cd
100%	100%	101%	101%	101%	98%	92%	82%	71%	60%	50%	41%	34%	26%	19%	14%	10%	6%	5%	4%	of 0°val

### Intensities in 270° c-plane

0°	5°	10°	15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	65°	70°	75°	80°	85°	90°	95°	γ
652	652	655	656	658	639	600	537	461	390	326	267	220	170	124	90	64	41	29	26	cd
100%	100%	101%	101%	101%	98%	92%	82%	71%	60%	50%	41%	34%	26%	19%	14%	10%	6%	5%	4%	of 0°val

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## Light Planning – UGR table

Uncorrected, comprehensive UGR table according to 117-1995

Reflectances		70	70	50	50	30	70	70	50	50	30
	ρ Ceiling	70	70	50	50	30	70	70	50	50	30
	ρ Walls	50	30	50	30	30	50	30	50	30	30
	ρ Floor	20	20	20	20	20	20	20	20	20	20
Room size		Viewed Crosswise					Viewed Endwise				
H = mounting height above eye level		(Viewing direction orthogonal to lamp length axis)					(Viewing direction parallel to lamp length axis)				
X	Y										
2H	2H	21,9	23,0	22,2	23,4	23,7	22,2	23,4	22,5	23,7	24,0
	3H	22,9	24,1	23,4	24,4	24,7	23,4	24,5	23,8	24,9	25,2
	4H	23,4	24,5	23,8	24,8	25,2	23,9	25,0	24,4	25,3	25,7
	6H	23,8	24,7	24,2	25,1	25,6	24,4	25,4	24,8	25,8	26,2
	8H	23,9	24,9	24,3	25,3	25,8	24,7	25,6	25,1	26,0	26,5
	12H	24,1	25,0	24,5	25,4	25,9	24,9	25,8	25,3	26,2	26,7
4H	2H	22,4	23,5	22,8	23,8	24,2	22,6	23,7	23,1	24,1	24,4
	3H	23,7	24,6	24,1	25,0	25,5	24,1	25,0	24,5	25,4	25,9
	4H	24,2	25,1	24,7	25,5	26,1	24,6	25,5	25,1	26,0	26,6
	6H	24,7	25,5	25,2	25,9	26,4	25,2	26,1	25,8	26,5	26,9
	8H	24,9	25,6	25,4	26,0	26,5	25,5	26,3	26,1	26,7	27,2
	12H	25,1	25,7	25,6	26,2	26,7	25,8	26,4	26,4	26,9	27,5
8H	4H	24,4	25,1	25,0	25,6	26,0	24,8	25,5	25,4	26,0	26,5
	6H	25,1	25,6	25,6	26,2	26,8	25,6	26,2	26,2	26,7	27,3
	8H	25,4	25,9	26,0	26,5	27,2	26,0	26,5	26,6	27,1	27,8
	12H	25,7	26,1	26,3	26,7	27,3	26,5	26,9	27,1	27,4	28,1
12H	4H	24,4	25,0	25,0	25,5	26,1	24,8	25,4	25,4	25,9	26,5
	6H	25,2	25,6	25,7	26,2	26,9	25,7	26,2	26,3	26,8	27,5
	8H	25,5	25,9	26,2	26,5	27,2	26,1	26,5	26,8	27,1	27,8

### Variations with the observer position for the luminaire spacings, S:

S = 1.0H	0,1 / -0,2	0,1 / -0,1
S = 1.5H	0,2 / -0,4	0,2 / -0,3
S = 2.0H	0,5 / -0,7	0,5 / -0,6

## Coefficients of Utilization

Ceiling reflectance	80			70			50			30			10			0		
Wall reflectance	70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10	0
Floor reflectance	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	0
RCR	(RCR: Room Cavity Ratio)																	
	Room Values are expressed as percentage of Lumen delivered to the task surface																	
0	118	118	118	118	115	115	115	115	108	108	108	103	103	103	98	98	98	95
1	108	103	99	95	105	101	97	93	95	92	90	91	88	86	86	84	83	80
2	99	91	84	79	96	89	83	77	84	79	75	80	76	73	77	73	70	68
3	90	80	73	66	88	78	71	65	75	69	64	71	66	62	68	64	60	58
4	83	72	63	57	81	70	62	56	67	60	55	64	58	54	61	57	52	50
5	77	64	56	49	74	63	55	49	60	53	48	58	52	47	56	50	46	44
6	71	58	50	43	69	57	49	43	55	48	42	53	46	42	51	45	41	39
7	66	53	44	39	64	52	44	38	50	43	38	48	42	37	46	41	36	34
8	62	48	40	35	60	48	40	34	46	39	34	44	38	33	43	37	33	31
9	58	45	37	31	56	44	36	31	42	35	31	41	35	30	40	34	30	28
10	54	41	33	28	52	40	33	28	39	32	28	38	32	27	37	31	27	25

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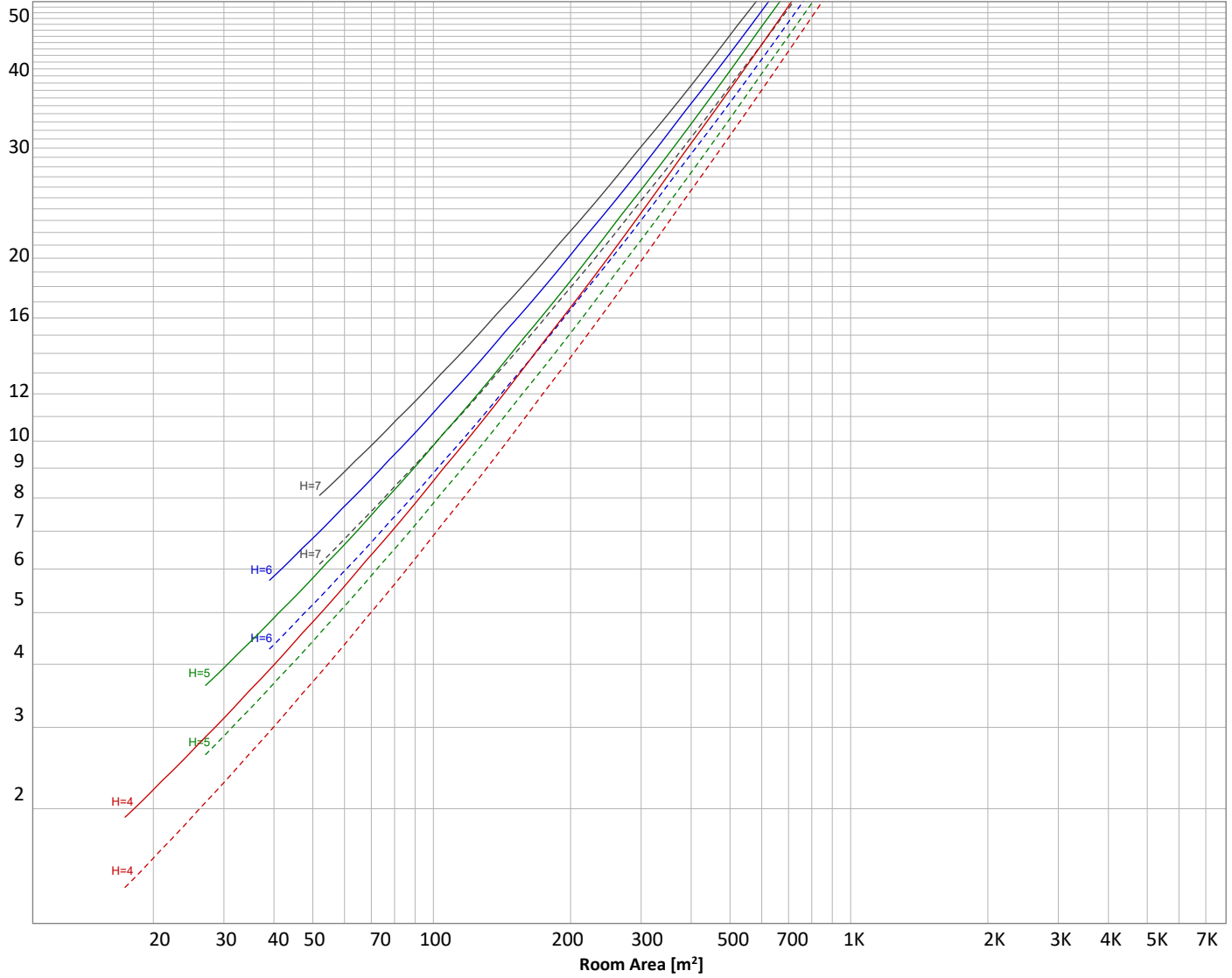
Operator:



## Luminaire budgetary diagram

Uncorrected, comprehensive UGR table according to 117-1995

LAMPS (number of lamps)



### Conditions

H = Room height	Flux = 1818 lm				
H <sub>down</sub> = Lamp distance from ceiling =	0.00 m	Line type	Ceiling reflectance	ρ(%) Wall reflectance	Floor reflectance
H <sub>work</sub> = Work area height from floor =	0.00 m	-----	70	50	30
E <sub>work</sub> = Average lux on work area =	100 lx	_____	50	30	20

### Zonal Lumen Summary

0°-10°	10°-20°	20°-30°	30°-40°	40°-50°	50°-60°	60°-70°	70°-80°	80°-90°
62,4 lm	186 lm	293 lm	333 lm	302 lm	241 lm	169 lm	97,0 lm	47,7 lm
90°-100°	100°-110°	110°-120°	120°-130°	130°-140°	140°-150°	150°-160°	160°-170°	170°-180°
27,6 lm	19,2 lm	15,6 lm	11,3 lm	7,36 lm	3,86 lm	1,52 lm	0,403 lm	0,061 lm

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## Outdoor Light Planning

### Lumen per Zone

Zone (γ)	Lumen	% Total
0-10°	62 lm	3,4%
10-20°	186 lm	10,2%
20-30°	293 lm	16,1%
30-40°	333 lm	18,3%
40-50°	302 lm	16,6%
50-60°	241 lm	13,3%
60-70°	169 lm	9,3%
70-80°	97 lm	5,3%
80-90°	48 lm	2,6%
90-100°	28 lm	1,5%
100-110°	19 lm	1,1%
110-120°	16 lm	0,9%
120-130°	11 lm	0,6%
130-140°	7 lm	0,4%
140-150°	4 lm	0,2%
150-160°	2 lm	0,1%
160-170°	0 lm	0,0%
170-180°	0 lm	0,0%
<b>Total</b>	<b>1818 lm</b>	<b>100,0%</b>

### Intensity peaks

Max intensity	659 cd
Intensity, 90°	29 cd
Intensity, 0°	652 cd

### Zonal Lumen summary

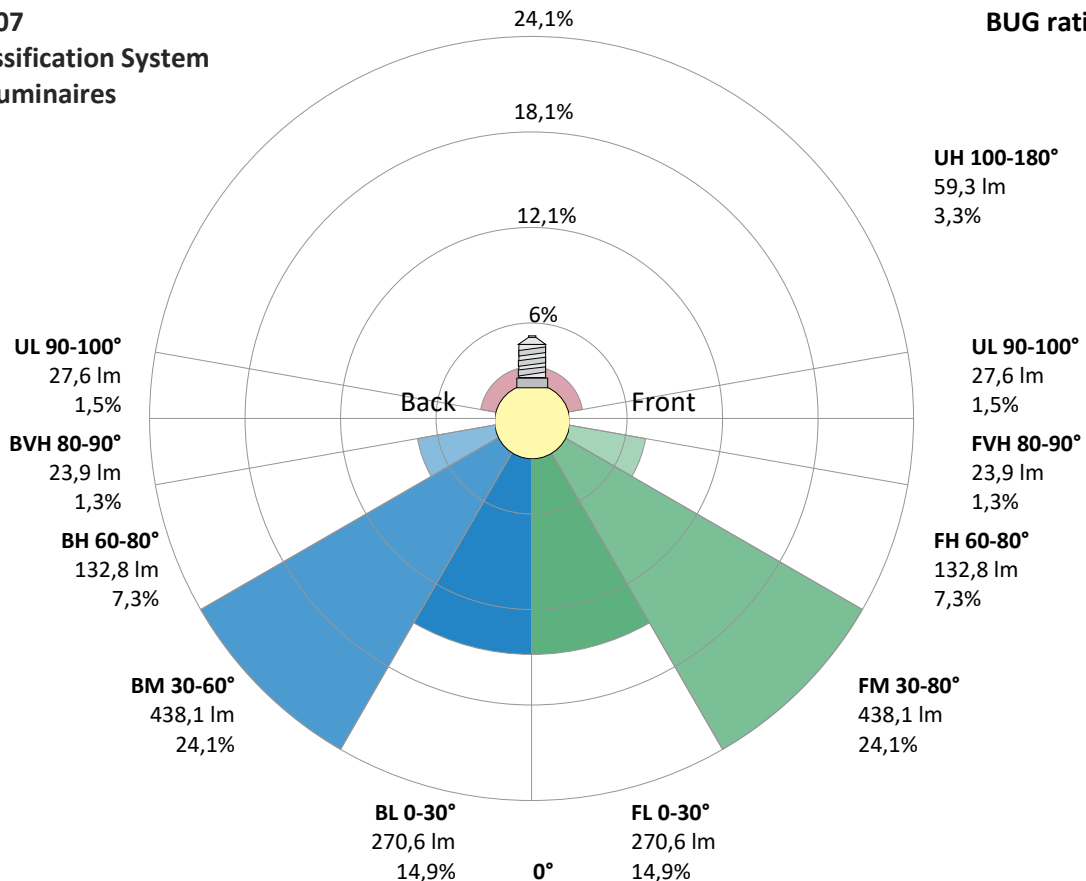
Zone (γ)	Lumen	% Total
0-30°	541 lm	29,8%
0-40°	875 lm	48,1%
0-60°	1417 lm	78,0%
60-90°	313 lm	17,2%
70-100°	172 lm	9,5%
90-120°	62 lm	3,4%
0-90°	1731 lm	95,2%
90-180°	87 lm	4,8%
0-180°	1818 lm	100,0%

### BUG rating

	Lumen	% Total
<b>Forward light</b>		
Low(0-30°)	271 lm	14,9%
Medium(30-60°)	438 lm	24,1%
High(60-80°)	133 lm	7,3%
Very high(80-90°)	24 lm	1,3%
<b>Back light</b>		
Low(0-30°)	271 lm	14,9%
Medium(30-60°)	438 lm	24,1%
High(60-80°)	133 lm	7,3%
Very high(80-90°)	24 lm	1,3%
<b>Uplight</b>		
Low(90-100°)	28 lm	1,5%
High(100-180°)	59 lm	3,3%

## IESNA TM-15-07 Luminaire Classification System For Outdoor Luminaires

**BUG rating B1 U3 G1**



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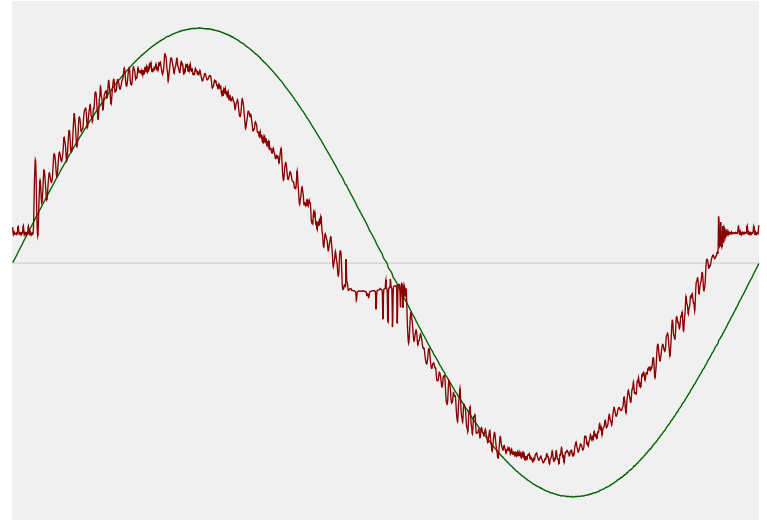


## Power Details

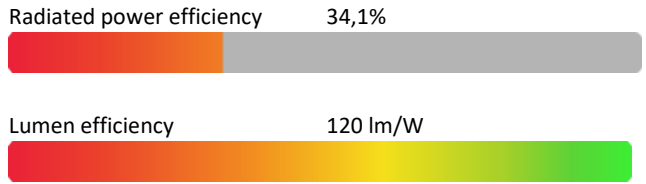
### Input Power

Power feed to light source	15,2 W
Frequency of input power	50 Hz
RMS Input voltage feed, $V_{RMS}$	230 V
RMS Input current feed, $I_{RMS}$	0,069 A
Volt-Ampere or apparent power = $V_{RMS} * I_{RMS}$	15,91 VA
Displacement factor of AC power feed	0,96
Power factor of AC current feed	0,95
Total harmonic distortion of the current	11,14%
Total harmonic distortion of the voltage	0,06%

### Input Power Curve



### Efficiency



## Stabilization Details

### Warmup Conditions

Stable period	15 min
Stable change max	2,0%
Minimum time	15 min

### Color Temperature Change

CCT start	3999 K
CCT shift	+1 K
CCT end	4000 K

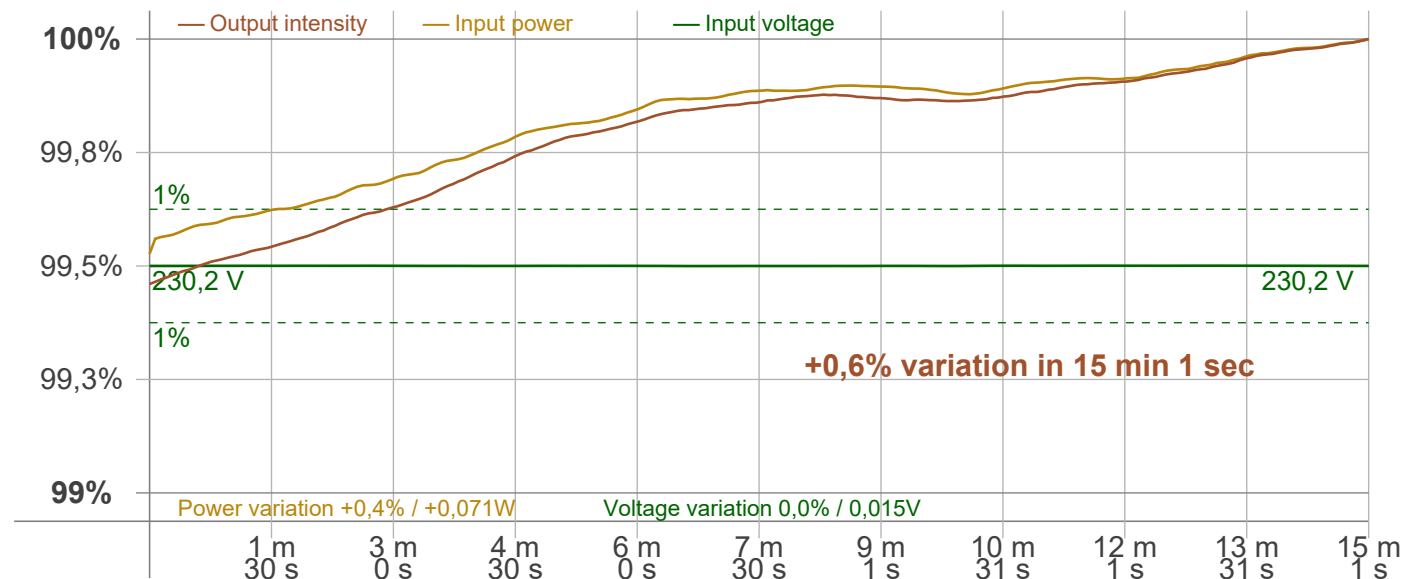
### Warmup Result

Total warmup time	Lamp stabilized in 15 min 1 sec
Warmup variation	+0,6%

### Output Change

Output start	1808 lm
Output change	+10 lm
Output end	1818 lm

## Stabilization Curve



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## Flicker /TLA details

Flicker Meter Type: Viso Systems LabFlicker  
 Frequency of input power: 50 Hz  
 Flicker/TLA sample rate: 20000 samples/s

**Measurement time**  
 PstLM: 180 sec  
 All other indices: 1,2 sec

### Flicker indices according to Illuminating Engineering Society (IES)

Flicker frequency: 98,04 Hz  
 Percent Flicker: 0,14 %  
 Flicker index: 0

### Flicker indices according to California Energy Commission (CEC) 2016b

JA8/10 40 Hz: 0,02 %  
 JA8/10 90 Hz: 0,02 %  
 JA8/10 200 Hz: 0,12 %  
 JA8/10 400 Hz: 0,13 %  
 JA8/10 1000 Hz: 0,13 %

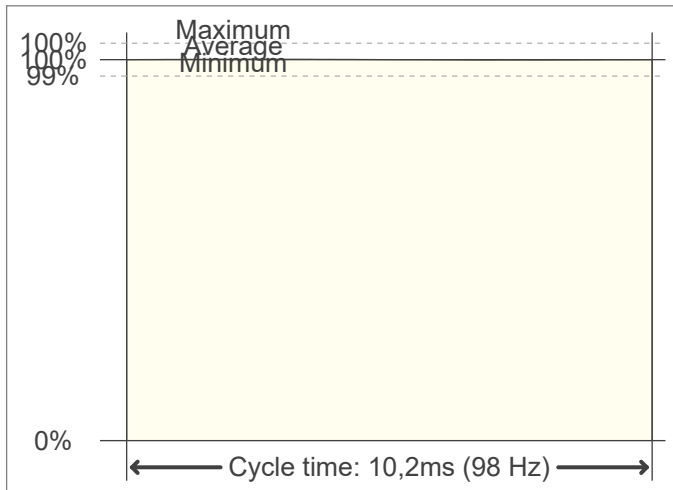
### TLA indices (re IEC TR 61547-1, IEC 61000-3-3 and IEC 61000-4-15)

PstLM value (F < 80 Hz): 0,01  
 SVM value (80 < F < 2000 Hz): 0

### Flicker indices according to Lighting Research Center (2015)

Perception metric, Assist Mp: 0,01

### Flicker frame (frame of one flicker period in time domain)



### Flicker FFT (flicker curve in frequency domain)



### IEEE 1789 Frequency/modulation plot

