BENTHAM

BGS400

Lamp & Luminaire Goniophotometer
(C-γ, B-ß Plane)

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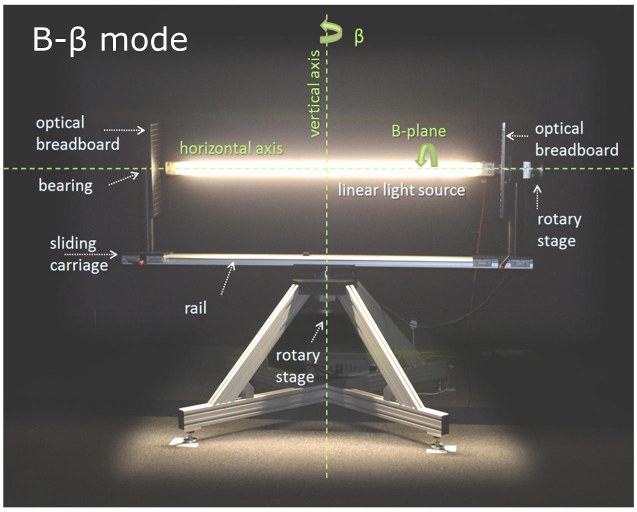
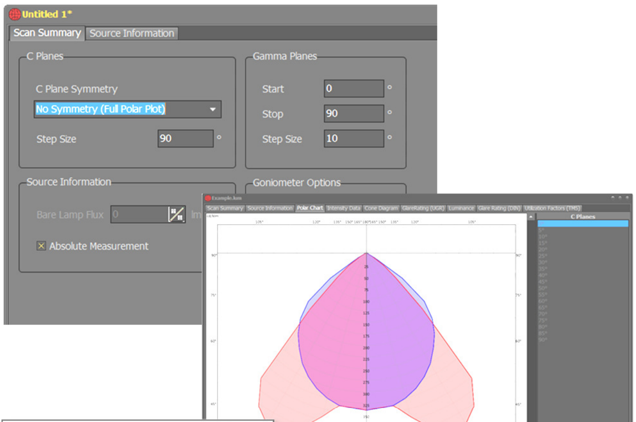
BGS400 Luminaire Goniophotometer (C-γ, B-ß Plane)

The BGS400 moving lamp and luminaire gonio-photometer is an economical, turnkey solution for the evaluation of source luminous intensity profile, yielding a wide range of parameters including photometric data in accordance with standards EN13032-1 and EN13032-4 and in the implementation of EU commission regulation 1194/20121, ecodesign of directional sources.

Key Features include:

- Two axis moving lamp & luminaire goniophotometer
- Operation in C-γ and B-ß modes
- Customisable sample mounting using optical breadboard and lamp mounting accessories
- Precision photometer with NMI traceable calibration
- Fully automated operation through BenBGS software
- Determination of photometric data of lamps and luminaires in accordance with EN13032-1 and the future EN13032-4
- Computation of UGR tables, utilisation factors, Söllner diagram, cone diagram and beam angle
- Export to Eulumdat (*.ldt) and IES (*.IES) file formats
- Evaluation of total luminous flux of directional sources in accordance with EU Ecodesign regulation 1194/2012
- Generation of customisable reports





C Planes

C Plane Symmetry: No Symmetry (Full Polar Plot)

Step Size: 90 °

Gamma Planes

Start: 0 °

Stop: 90 °

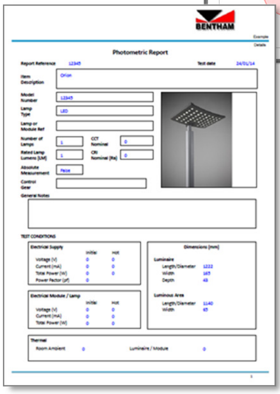
Step Size: 10 °

Source Information

Bare Lamp Flux: 0

☒ Absolute Measurement

Goniometer Options



Photometric Report

Report Reference: 12345 Test date: 24/01/14

Item Description: Orion

Model Number: 12345

Lamp Type: LED

Lamp or Module Ref:

Number of Lamps: 1 CCT Nominal: 0

Rated Lamp Lumens [LM]: 1 CRI Nominal [Ra]: 0

Absolute Measurement: False

Control Gear:

General Notes

TEST CONDITIONS

Electrical Supply	Initial	Hot
Voltage (V)	0	0
Current (mA)	0	0
Total Power (W)	0	0
Power Factor (pf)	0	

Electrical Module / Lamp	Initial	Hot
Voltage (V)	0	0
Current (mA)	0	0
Total Power (W)	0	0

Dimensions (mm)

Luminaire

Length/Diameter: 1222

Width: 165

Depth: 43

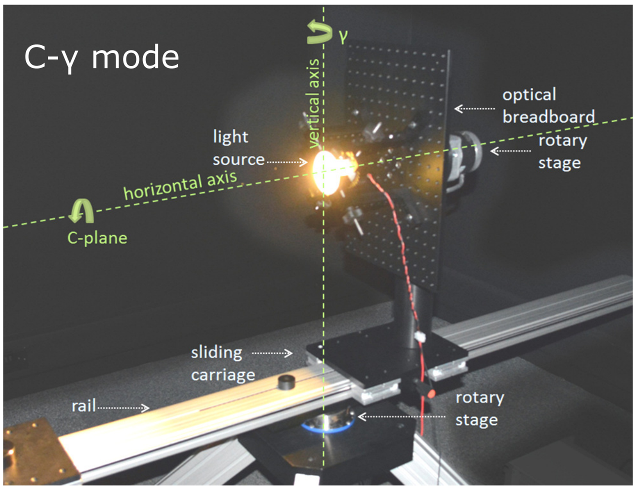
Luminous Area

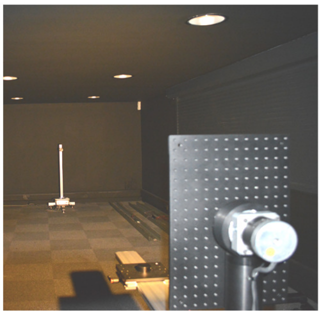
Length/Diameter: 1140

Width: 65

Thermal

Room Ambient: 0 Luminaire / Module: 0





BGS400 Luminaire Goniophotometer

The BGS400 moving lamp and luminaire goniophotometer is an economical, turnkey solution for the evaluation of source luminous intensity profile, yielding a wide range of parameters including photometric data in accordance with standards EN13032-1 and EN13032-4 and in the implementation of EU commission regulation 1194/20121, ecodesign of directional sources.

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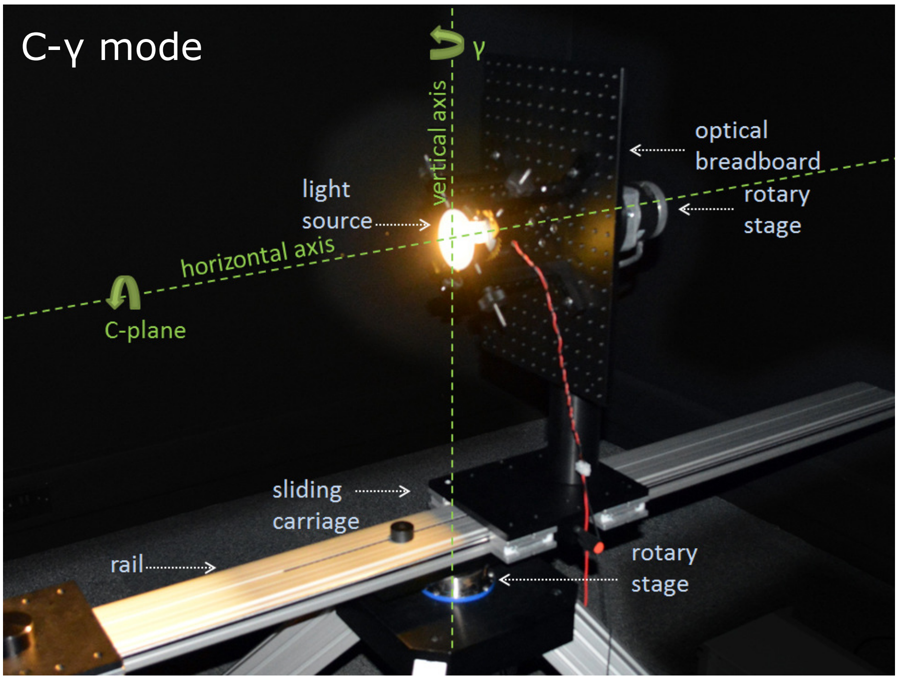


System Overview

The BGS400 goniophotometer is based on sample rotation about the horizontal and vertical axes using two precision geared micro-stepping motors with a fixed photometer located in the far field.

Goniometer

The vertical rotational axis is fitted with a 2m long rail upon which translatable carriages may be mounted and by which manner the post-mounted horizontal rotational axis is positioned.

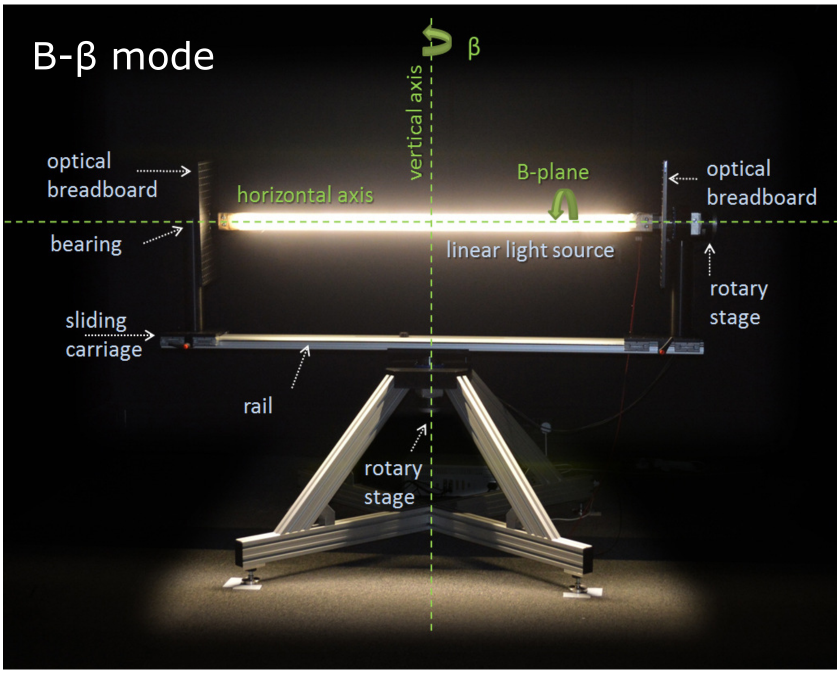
The horizontal rotational axis is fitted with a 300x 450mm optical breadboard to which the sample may be mounted to provide measurement in the C-γ mode.

The addition of a post mounted with a second 300x450mm optical breadboard on a bearing unit, permits the measurement of linear sources in the B-β mode.

The carriages may be translated along the rail and locked in place using a hand lever. In this manner, in the C-γ mode, one can ensure that the source optical centre is coincident with the vertical rotational axis of the goniometer whilst in the B-β mode one can adapt the position of both uprights to accommodate luminaires of different lengths.

Lamp and Luminaire Mounting

The BGS400 system ready allows the adaption of a wide range of sockets and mounts directly to the horizontal rotational axis.



For the ultimate flexibility, the use of optical breadboards allows full customisation of lamp and luminaire mounting necessary to accommodate the extremely wide range of sources that the BGS400 is designed to measure. Upon the metric (M6) optical breadboards, clamps, sockets and holders may easily be mounted to hold the sample under test in place.

The BGS400 comprises a modular set of mounting components to adapt a wide range of lamp types, to which may be added mounting solutions generate by the user.

Photometer

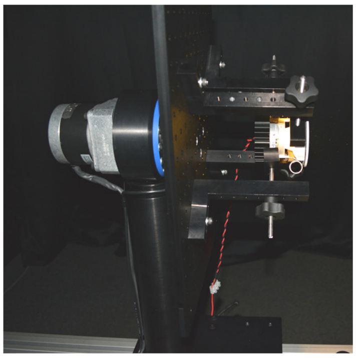
The illuminance produced by the source at the plane of the photometer is measured by a precision Bentham DH400-VL photometric detector (photometric match, $f_1<3\%$) coupled to a computer-controlled ORM400 optical radiation meter.

The source luminous intensity is determined from the product of the measured illuminance and the square of the source– photometer distance.

The photometer is mounted on a movable frame to permit variation of the photometric distance where required. The minimum recommended photometric distance 10x largest luminous dimension of the DUT.

Stepping Motor Drive

The stepping motors driving both rotational axes are driven by micro-stepping drives housed in the PMC MAC controller and interfaced to computer via USB 2.0.



BenBGS Software

The BGS400 system is entirely automated by the Windows BenBGS software.

This application has been written to facilitate the measurement of sources, allowing the viewing of results and the production of measurement reports and photometric data files.

Overview

The BGS400 fully automates the motion of the goniometer and corresponding measurement of illuminance, culminating in representation of photometric properties, ecodesign directional lamp calculations (where applicable) and the export to Eulumdat file.

Since photometric files require the provision of data in the C-γ co-ordinate system, all measurements are performed in this mode; where the BGS400 goniophotometer is configured in the B-β mode for the measurement of linear sources, a transformation is made from the selected C-γ angles to the target angles in the B-β co-ordinate system.

The functions are summarised as follows:-

Initiate New Measurement

- C-Planes: select range of C-planes to measure from pull down list (based upon symmetry considerations, where known) and provide a step size
- γ : Input range and step size
- Select absolute or relative measurement (and input bare lamp flux)
- Select goniometer mode, C-γ/B-β
- Input data on source under test, including dimension of source and luminous areas and electrical properties

Presentation of Results

At the end of a measurement, the user is presented with a multi-tabbed window including items shown over the next two pages.

Export to Photometric Data File

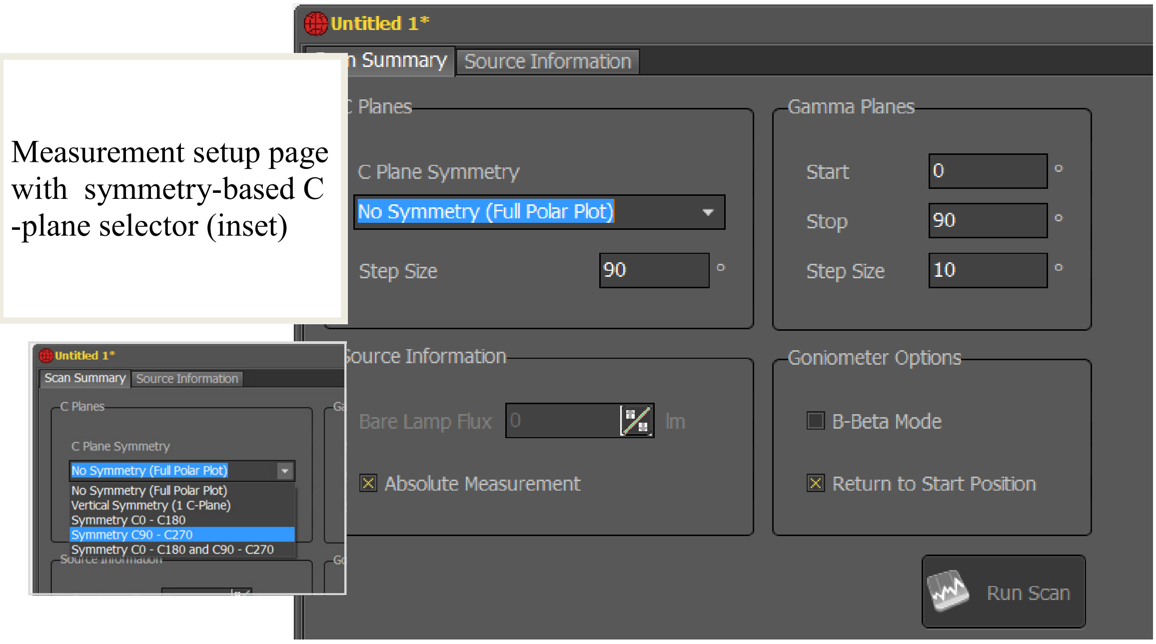
The user may directly export the measurement results to an Eulumdat (*.ldt) or IES (*.ies) photometric data file, both of which may be imported into lighting design software such as DIALux and Relux.

Ecodesign Directive

Calculations should be effected upon the measured luminous intensity to determine if at least 80% of the total luminous flux is within a solid angle of π sr (120° cone) and if so to determine the luminous flux in 90°/120° as required.

Production of Measurement Report

A measurement report based on user-selected elements, and based upon a customisable template may be directly generated as a pdf file.



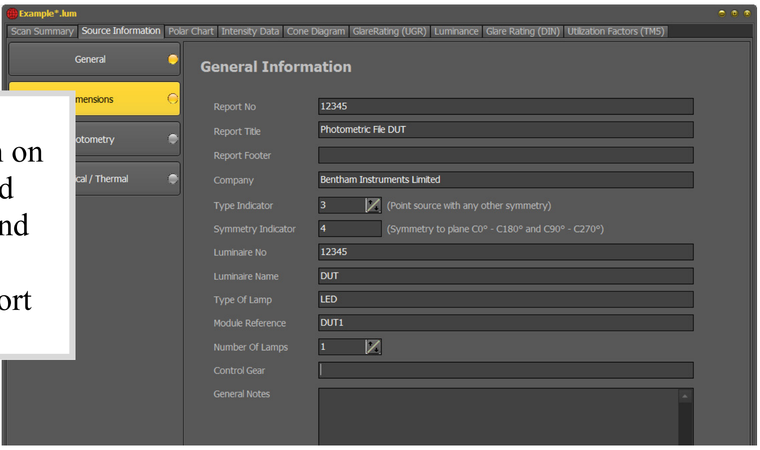
C Plane Symmetry: No Symmetry (Full Polar Plot)
Step Size: 90 °

Start: 0 °
Stop: 90 °
Step Size: 10 °

Bare Lamp Flux: 0 lm
☒ Absolute Measurement

☐ B-Beta Mode
☒ Return to Start Position

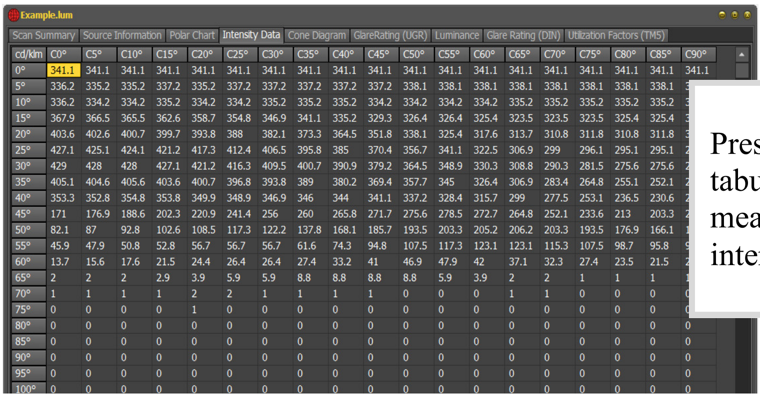
Measurement setup page with symmetry-based C-plane selector (inset)



General Information

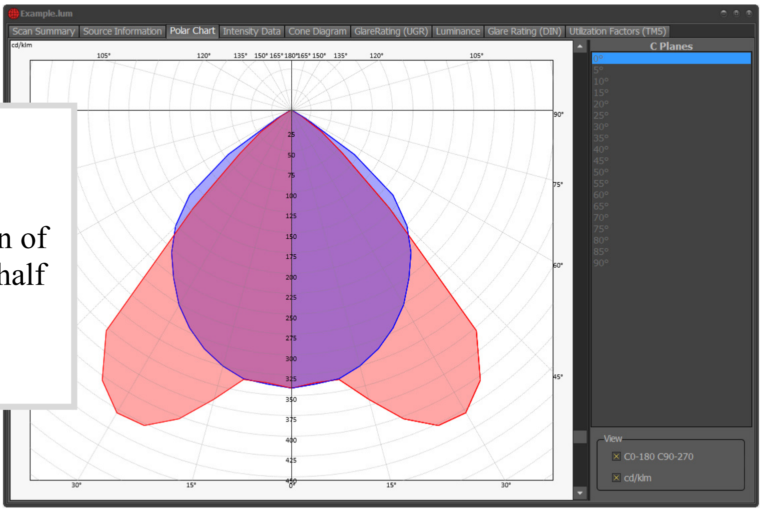
Report No: 12345
Report Title: Photometric File DUT
Report Footer:
Company: Bentham Instruments Limited
Type Indicator: 3 (Point source with any other symmetry)
Symmetry Indicator: 4 (Symmetry to plane C0° - C180° and C90° - C270°)
Luminaire No: 12345
Luminaire Name: DUT
Type Of Lamp: LED
Module Reference: DUT1
Number Of Lamps: 1
Control Gear:
General Notes:

Input information on luminaire required for calculations and inclusion in measurement report

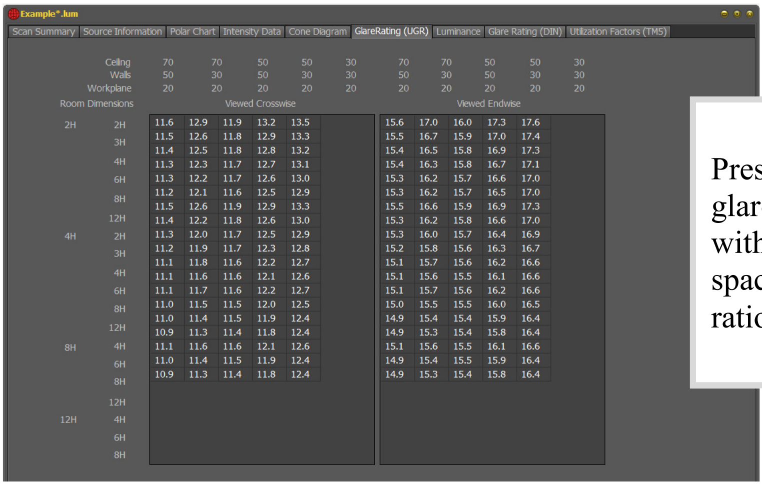


cd/klm	C0°	C5°	C10°	C15°	C20°	C25°	C30°	C35°	C40°	C45°	C50°	C55°	C60°	C65°	C70°	C75°	C80°	C85°	C90°
0°	341.1	341.1	341.1	341.1	341.1	341.1	341.1	341.1	341.1	341.1	341.1	341.1	341.1	341.1	341.1	341.1	341.1	341.1	341.1
5°	336.2	335.2	335.2	337.2	335.2	337.2	337.2	337.2	337.2	337.2	338.1	338.1	338.1	338.1	338.1	338.1	338.1	338.1	
10°	336.2	334.2	334.2	335.2	334.2	334.2	335.2	335.2	335.2	334.2	334.2	334.2	334.2	335.2	335.2	335.2	335.2	335.2	
15°	367.9	366.5	365.5	362.6	358.7	354.8	346.9	341.1	335.2	329.3	326.4	326.4	325.4	323.5	323.5	323.5	325.4	325.4	
20°	403.6	402.6	400.7	399.7	393.8	388	382.1	373.3	364.5	351.8	338.1	325.4	317.6	313.7	310.8	311.8	310.8	311.8	
25°	427.1	425.1	424.1	421.2	417.3	412.4	406.5	395.8	385	370.4	356.7	341.1	322.5	306.9	299	296.1	295.1	295.1	
30°	429	428	428	427.1	421.2	416.3	409.5	400.7	390.9	379.2	364.5	348.9	330.3	308.8	290.3	281.5	275.6	275.6	
35°	405.1	404.6	405.6	403.6	400.7	396.8	393.8	389	380.2	369.4	357.7	345	326.4	306.9	283.4	264.8	255.1	252.1	
40°	353.3	352.8	354.8	353.8	349.9	348.9	346.9	346	344	341.1	337.2	328.4	315.7	299	277.5	253.1	236.5	230.6	
45°	171	176.9	188.6	202.3	220.9	241.4	256	260	265.8	271.7	275.6	278.5	272.7	264.8	252.1	233.6	213	203.3	
50°	82.1	87	92.8	102.6	108.5	117.3	122.2	137.8	168.1	185.7	193.5	203.3	205.2	206.2	203.3	193.5	176.9	166.1	
55°	45.9	47.9	50.8	52.8	56.7	56.7	56.7	61.6	74.3	94.8	107.5	117.3	123.1	123.1	115.3	107.5	98.7	95.8	
60°	13.7	15.6	17.6	21.5	24.4	26.4	26.4	27.4	33.2	41	46.9	47.9	42	37.1	32.3	27.4	23.5	21.5	
65°	2	2	2	2.9	3.9	5.9	5.9	8.8	8.8	8.8	8.8	5.9	3.9	2	2	1	1	1	1
70°	1	1	1	1	2	2	1	1	1	1	0	0	0	1	1	0	0	0	0
75°	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
80°	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
85°	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
90°	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
95°	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
100°	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Presentation of tabulated data of measured luminous intensity

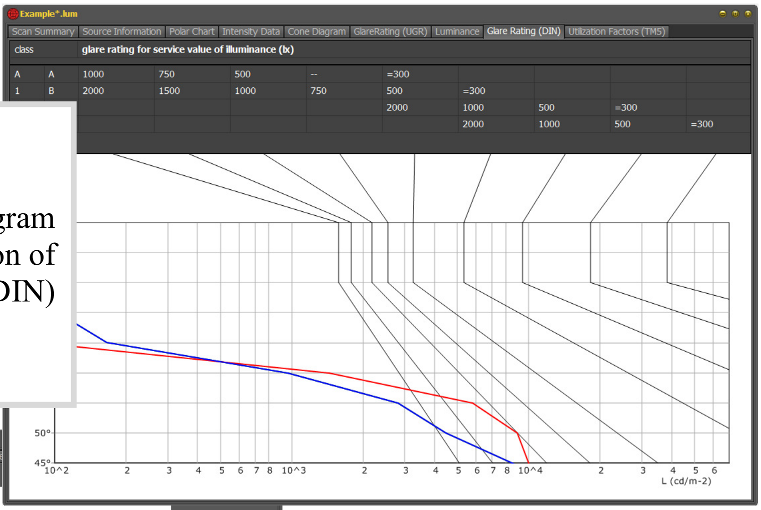


Polar diagram allowing selection of which measured half -planes to show



Ceiling		70	70	50	50	30	70	70	50	50	30
Walls		50	30	50	30	30	50	30	50	30	30
Workplane		20	20	20	20	20	20	20	20	20	20
Room Dimensions		Viewed Crosswise					Viewed Endwise				
2H	2H	11.6	12.9	11.9	13.2	13.5	15.6	17.0	16.0	17.3	17.6
	3H	11.5	12.6	11.8	12.9	13.3	15.5	16.7	15.9	17.0	17.4
	4H	11.4	12.5	11.8	12.8	13.2	15.4	16.5	15.8	16.9	17.3
	6H	11.3	12.3	11.7	12.7	13.1	15.4	16.3	15.8	16.7	17.1
	8H	11.3	12.2	11.7	12.6	13.0	15.3	16.2	15.7	16.6	17.0
	12H	11.2	12.1	11.6	12.5	12.9	15.3	16.2	15.7	16.5	17.0
4H	2H	11.5	12.6	11.9	12.9	13.3	15.5	16.6	15.9	16.9	17.3
	3H	11.4	12.2	11.8	12.6	13.0	15.3	16.2	15.8	16.6	17.0
	4H	11.3	12.0	11.7	12.5	12.9	15.3	16.0	15.7	16.4	16.9
	6H	11.2	11.9	11.7	12.3	12.8	15.2	15.8	15.6	16.3	16.7
	8H	11.1	11.8	11.6	12.2	12.7	15.1	15.7	15.6	16.2	16.6
	12H	11.1	11.6	11.6	12.1	12.6	15.1	15.6	15.5	16.1	16.6
8H	4H	11.1	11.7	11.6	12.2	12.7	15.1	15.7	15.6	16.2	16.6
	6H	11.0	11.5	11.5	12.0	12.5	15.0	15.5	15.5	16.0	16.5
	8H	11.0	11.4	11.5	11.9	12.4	14.9	15.4	15.4	15.9	16.4
	12H	10.9	11.3	11.4	11.8	12.4	14.9	15.3	15.4	15.8	16.4
12H	4H	11.1	11.6	11.6	12.1	12.6	15.1	15.6	15.5	16.1	16.6
	6H	11.0	11.4	11.5	11.9	12.4	14.9	15.4	15.5	15.9	16.4
	8H	10.9	11.3	11.4	11.8	12.4	14.9	15.3	15.4	15.8	16.4

Presentation of UGR glare rating table with selection of spacing to height ratio (0.25 or 1)



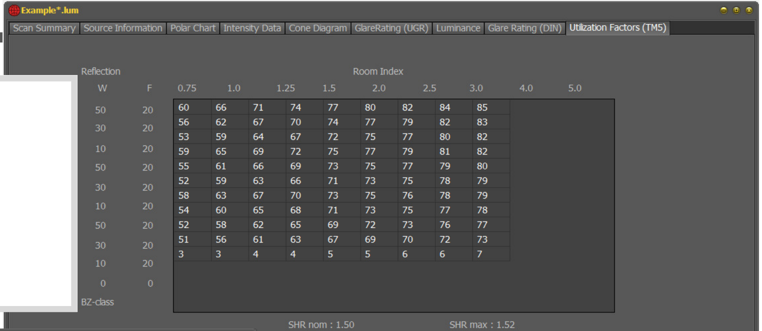
class		glare rating for service value of illuminance (lx)								
A	A	1000	750	500	--	=300				
1	B	2000	1500	1000	750	500	=300			
						2000	1000	500	=300	
							2000	1000	500	=300

Söllner diagram representation of glare (DIN)

● C0-C180
○ C90-C270

Half peak divergence : 43.81°

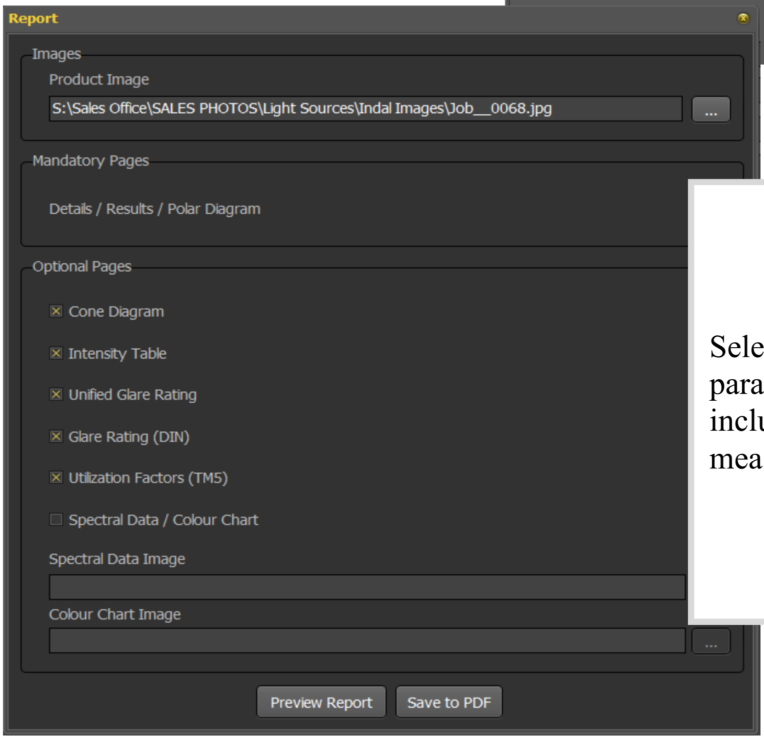
Cone diagram including beam angle, illumination diameter and peak illuminance



Reflection		Room Index								
W	F	0.75	1.0	1.25	1.5	2.0	2.5	3.0	4.0	5.0
50	20	60	66	71	74	77	80	82	84	85
30	20	56	62	67	70	74	77	79	82	83
10	20	53	59	64	67	72	75	77	80	82
50	20	59	65	69	72	75	77	79	81	82
30	20	55	61	66	69	73	75	77	79	80
10	20	52	59	63	66	71	73	75	78	79
50	20	58	63	67	70	73	75	76	78	79
30	20	54	60	65	68	71	73	75	77	78
10	20	52	58	62	65	69	72	73	76	77
0	0	51	56	61	63	67	69	70	72	73
BZ-class		3	3	4	4	5	5	6	6	7

SHR nom : 1.50　SHR max : 1.52

TM5 utilisation factors table



Images

Product Image: S:\Sales Office\SALES PHOTOS\Light Sources\Indal Images\Job__0068.jpg

Mandatory Pages

Details / Results / Polar Diagram

Optional Pages

☒ Cone Diagram

☒ Intensity Table

☒ Unified Glare Rating

☒ Glare Rating (DIN)

☒ Utilization Factors (TM5)

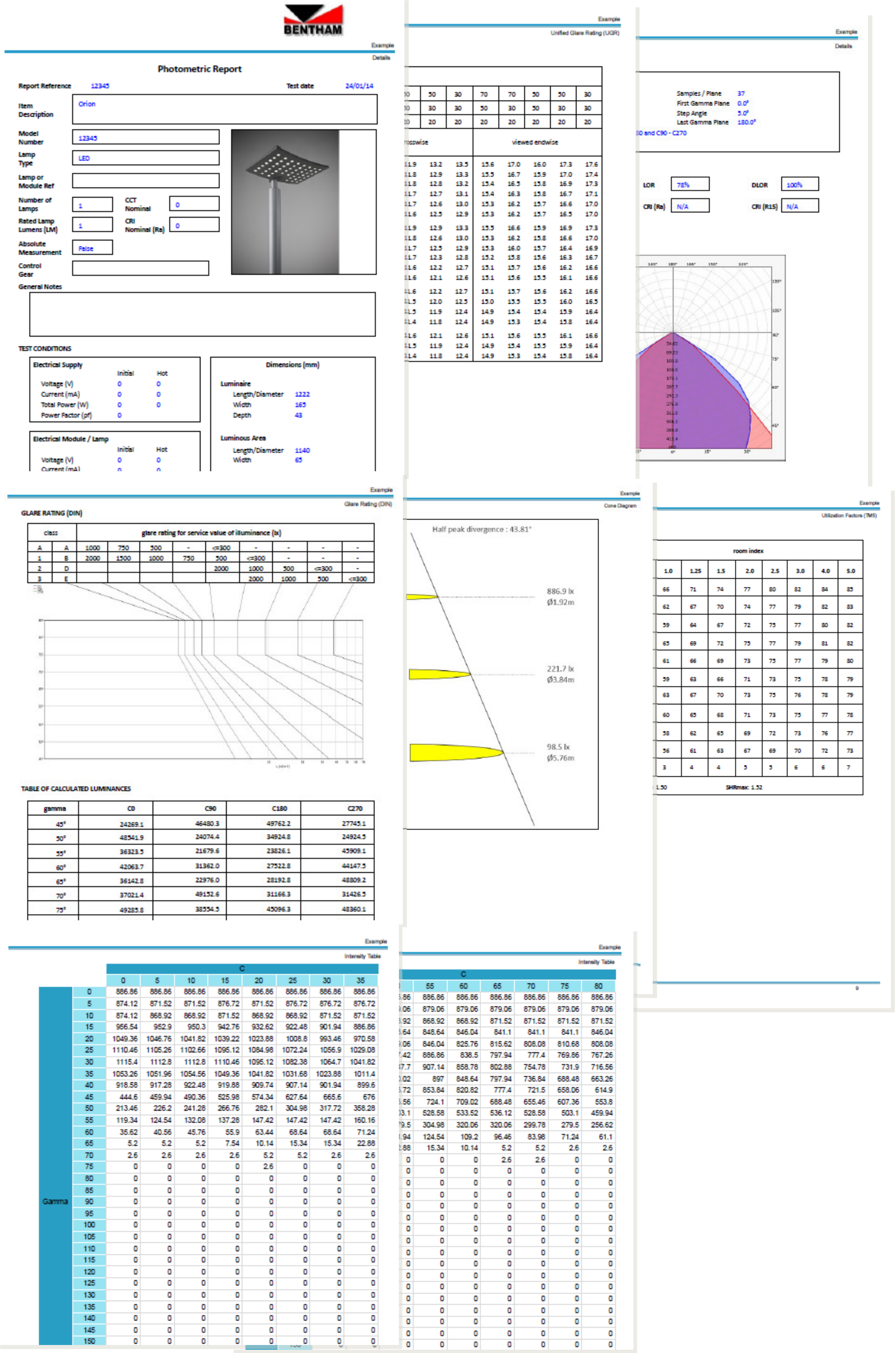
☐ Spectral Data / Colour Chart

Spectral Data Image

Colour Chart Image

Selection of parameters to be included in measurement report

Example Measurement Report



BENTHAM

Example

Details

Photometric Report

Report Reference	12345	Test date	24/01/14
Item Description	Orion		
Model Number	12345		
Lamp Type	LED		
Lamp or Module Ref			
Number of Lamps	1	CCT Nominal	0
Rated Lamp Lumens (LM)	1	CRI Nominal (Ra)	0
Absolute Measurement	False		
Control Gear			

General Notes

TEST CONDITIONS

Electrical Supply

	Initial	Hot
Voltage (V)	0	0
Current (mA)	0	0
Total Power (W)	0	0
Power Factor (pf)	0	

Electrical Module / Lamp

	Initial	Hot
Voltage (V)	0	0
Current (mA)	0	0

Dimensions (mm)

Luminaire

Length/Diameter	1222
Width	165
Depth	43

Luminous Area

Length/Diameter	1140
Width	65

Example

Unified Glare Rating (UGR)

50	30	70	70	50	50	30
30	30	50	30	50	30	30
20	20	20	20	20	20	20
rosswise		viewed endwise				
13.2	13.5	15.6	17.0	16.0	17.3	17.6
12.9	13.3	15.5	16.7	15.9	17.0	17.4
12.8	13.2	15.4	16.5	15.8	16.9	17.3
12.7	13.1	15.4	16.3	15.8	16.7	17.1
12.6	13.0	15.3	16.2	15.7	16.6	17.0
12.5	12.9	15.3	16.2	15.7	16.5	17.0
12.9	13.3	15.5	16.6	15.9	16.9	17.3
12.6	13.0	15.3	16.2	15.8	16.6	17.0
12.5	12.9	15.3	16.0	15.7	16.4	16.9
12.3	12.8	15.2	15.8	15.6	16.3	16.7
12.2	12.7	15.1	15.7	15.6	16.2	16.6
12.1	12.6	15.1	15.6	15.5	16.1	16.6
12.2	12.7	15.1	15.7	15.6	16.2	16.6
12.0	12.5	15.0	15.5	15.5	16.0	16.5
11.9	12.4	14.9	15.4	15.4	15.9	16.4
11.8	12.4	14.9	15.3	15.4	15.8	16.4
12.1	12.6	15.1	15.6	15.5	16.1	16.6
11.9	12.4	14.9	15.4	15.5	15.9	16.4
11.8	12.4	14.9	15.3	15.4	15.8	16.4

Example

Details

Samples / Plane	37
First Gamma Plane	0.0°
Step Angle	5.0°
Last Gamma Plane	180.0°

0 and C90 - C270

LOR	78%	DLOR	100%
CRI (Ra)	N/A	CRI (R15)	N/A

Example

Glare Rating (DIN)

GLARE RATING (DIN)

class		glare rating for service value of illuminance (lx)								
A	A	1000	750	500	-	<=300	-	-	-	-
1	B	2000	1500	1000	750	500	<=300	-	-	-
2	D					2000	1000	500	<=300	-
3	E						2000	1000	500	<=300

TABLE OF CALCULATED LUMINANCES

gamma	C0	C90	C180	C270
45°	24269.1	46480.3	49762.2	27745.1
50°	48541.9	24074.4	34924.8	24924.5
55°	36323.5	21679.6	23826.1	45909.1
60°	42063.7	31362.0	27522.8	44147.5
65°	36142.8	22976.0	28192.8	48809.2
70°	37021.4	49152.6	31166.3	31426.5
75°	49285.8	38554.5	45096.3	48360.1

Example

Cone Diagram

Half peak divergence : 43.81°

Example

Utilization Factors (TM5)

room index							
1.0	1.25	1.5	2.0	2.5	3.0	4.0	5.0
66	71	74	77	80	82	84	85
62	67	70	74	77	79	82	83
59	64	67	72	75	77	80	82
65	69	72	75	77	79	81	82
61	66	69	73	75	77	79	80
59	63	66	71	73	75	78	79
63	67	70	73	75	76	78	79
60	65	68	71	73	75	77	78
58	62	65	69	72	73	76	77
56	61	63	67	69	70	72	73
3	4	4	5	5	6	6	7

1.50 SHRmax: 1.52

Example

Intensity Table

		C							
		0	5	10	15	20	25	30	35
Gamma	0	886.86	886.86	886.86	886.86	886.86	886.86	886.86	886.86
	5	874.12	871.52	871.52	876.72	871.52	876.72	876.72	876.72
	10	874.12	868.92	868.92	871.52	868.92	868.92	871.52	871.52
	15	956.54	952.9	950.3	942.76	932.62	922.48	901.94	886.86
	20	1049.36	1046.76	1041.82	1039.22	1023.88	1008.8	993.46	970.58
	25	1110.46	1105.26	1102.66	1095.12	1084.98	1072.24	1056.9	1029.08
	30	1115.4	1112.8	1112.8	1110.46	1095.12	1082.38	1064.7	1041.82
	35	1053.26	1051.96	1054.56	1049.36	1041.82	1031.68	1023.88	1011.4
	40	918.58	917.28	922.48	919.88	909.74	907.14	901.94	899.6
	45	444.6	459.94	490.36	525.98	574.34	627.64	665.6	676
	50	213.46	226.2	241.28	266.76	282.1	304.98	317.72	358.28
	55	119.34	124.54	132.08	137.28	147.42	147.42	147.42	160.16
	60	35.62	40.56	45.76	55.9	63.44	68.64	68.64	71.24
	65	5.2	5.2	5.2	7.54	10.14	15.34	15.34	22.88
	70	2.6	2.6	2.6	2.6	5.2	5.2	2.6	2.6
	75	0	0	0	0	2.6	0	0	0
	80	0	0	0	0	0	0	0	0
	85	0	0	0	0	0	0	0	0
	90	0	0	0	0	0	0	0	0
	95	0	0	0	0	0	0	0	0
	100	0	0	0	0	0	0	0	0
	105	0	0	0	0	0	0	0	0
	110	0	0	0	0	0	0	0	0
	115	0	0	0	0	0	0	0	0
	120	0	0	0	0	0	0	0	0
	125	0	0	0	0	0	0	0	0
	130	0	0	0	0	0	0	0	0
	135	0	0	0	0	0	0	0	0
	140	0	0	0	0	0	0	0	0
	145	0	0	0	0	0	0	0	0
	150	0	0	0	0	0	0	0	0

Example

Intensity Table

C					
55	60	65	70	75	80
886.86	886.86	886.86	886.86	886.86	886.86
879.06	879.06	879.06	879.06	879.06	879.06
868.92	868.92	871.52	871.52	871.52	871.52
848.64	846.04	841.1	841.1	841.1	846.04
846.04	825.76	815.62	808.08	810.68	808.08
886.86	838.5	797.94	777.4	769.86	767.26
907.14	858.78	802.88	754.78	731.9	716.56
897	848.64	797.94	736.84	688.48	663.26
853.84	820.82	777.4	721.5	658.06	614.9
724.1	709.02	688.48	655.46	607.36	553.8
528.58	533.52	536.12	528.58	503.1	459.94
304.98	320.06	320.06	299.78	279.5	256.62
124.54	109.2	96.46	83.98	71.24	61.1
15.34	10.14	5.2	5.2	2.6	2.6
0	0	2.6	2.6	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0

Goniometer	
Angular rotation (no dead angle)	C-γ mode: Horizontal rotational axis (C-planes) = 360° Vertical rotational axis (γ) = 0-140/160° B-β mode: Horizontal rotational axis (B-planes) = 360° Vertical rotational axis (β)= 140/160°
Angular resolution	Horizontal rotational axis: 0.05° Vertical rotational axis: 0.05°
Area occupied by goniometer	2m diameter circular area
Maximum sample size	C-γ mode: 500 mm diameter, 300mm deep B-β mode: 1.65m long, 500mm diameter
Maximum sample weight	C-γ mode: 20 kg B-β mode: 40 kg
Photometric Detector/ ORM400	
Spectral function	CIE 1924 V(λ) Spectral Luminous Efficiency Function for Photopic Vision
Spectral response range	380-780nm
Photopic match, f_1	<3%
Angular response, f_2	<1.5%
Linearity, f_3	<0.2%
Typical responsivity	5x 10^{-10}A/ lux
Calibration traceability	NPL, UK
Diffuser diameter	7mm
Stray Light Suppression	Variable aperture baffle tube
Connector	BNC
Amplifier gain ranges	10^{10}-10^{5} V/A
Maximum input	100μA
Input impedance	Virtual ground
Gain accuracy & stability	±1 %, 200 ppm/ °C
Output stability	5-500 ppm/ °C dependent on gain range
ADC resolution	4 ½ digit BCD (0 to 19999) (>14 bit resolution)
Luminous intensity range	0.01D^2-200000D^2 (D photometric distance (m))
Area occupied by photometer frame	0.5x 0.5m
General	
Power Supply	PMC MAC- 110/220V 50/60Hz, ORM400– transformer
Interface	PMC MAC & ORM400- USB 2.0