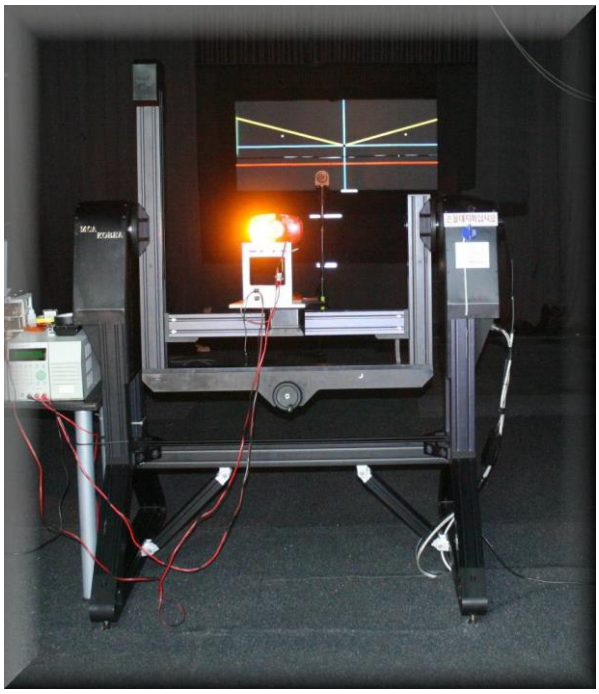

ASG-1.0

and

ASG-1.1

Automotive and Signalling Goniophotometers

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Introduction.

Our company, Photometric Solutions International (PSI), is a manufacturer of quality photometric and colorimetric equipment. Including our former incarnation as Optical & Photometric Technology (OPT), we have been servicing the lighting industries for 30 years. During this time we have earned an outstanding reputation for our attention to detail in our customer service, and our *Flexibility*, *Reliability* and *Affordability*.

- We have close associations with National and International Test Agencies for laboratory accreditation.
- Our staff stay at the forefront of photometric technology through our involvement in international organisations such as the CIE. Our company Technical Director Tony Bergen is President of CIE Australia and Secretary of CIE Division 2; and our CEO Dr Steve Jenkins is also on the CIE Australia Committee. Both also serve on many international CIE Technical Committees and for other standardization organisations.
- We have dedicated service teams based throughout the world who can service our equipment and provide calibration services.
- We have our own accredited public testing laboratory, which means that our staff are actively involved in testing and measurement on a daily basis and thus are very familiar with all aspects of the equipment operation.

Part 1. ASG-1.1 Budget Automotive Goniophotometer System.

Mechanical and Motion

The goniometer has +/- 90 degrees vertical (tilt) movement and unlimited horizontal (rotation) movement. Both axes have better than 0.05-degree accuracy (on the tilt axis this is up to 15 degrees of tilt and then 0.1 degrees accuracy up to the upper limit) and better than 0.01-degree resolution.

Test items of up to 400 mm in any dimension can be tested, i.e. there is at least 400 mm clearance between the pivot point of the goniometer and the two vertical faces of the tilting frame, making a total horizontal width of 800 mm in the centre of the goniometer.

Manual Z-axis movement has a total travel of 150 mm, from 200 mm below pivot point down to 350mm.

There is a maximum of 10 kg load for the test item plus mounting jig. These load limits assume that the load is evenly distributed. A counterbalance is used to reduce the strain on the motors at the higher tilt angles.

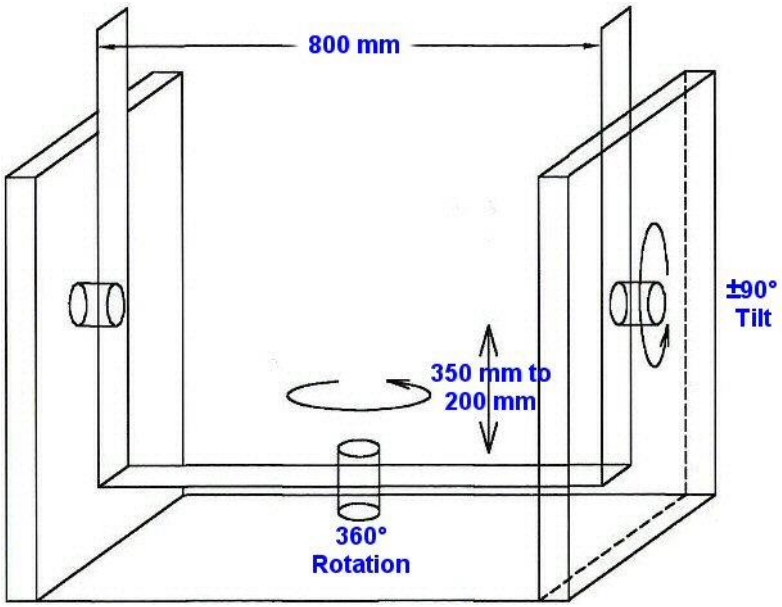


Figure 1: ASG-1.1 Dimensional Schematic

The ASG-1.1 is floor-standing, as shown in Figure 2 below, and can be fixed directly into the floor.

Figure 2: ASG-1.1

Control Cabinet

A control cabinet is supplied with the goniometer. This houses the motor controller and other circuitry required to coordinate the motion and measurement. The control cabinet has an ON/OFF switch, and contains interfaces for electrical power and communications with the PC.

Test Item Alignment

A remote, handheld controller can be provided so that the operator can walk around the test item during the alignment process (see Optional Extras). This makes the process of alignment much easier and more convenient for the operator.

An inbuilt laser is provided which is coincident with the tilt axis to assist the process of alignment.

A mounting table is included with many drilled and tapped holes to attach test item mounting jigs to it. No mounting jigs are provided with the system, however design suggestions can be provided by PSI on request.

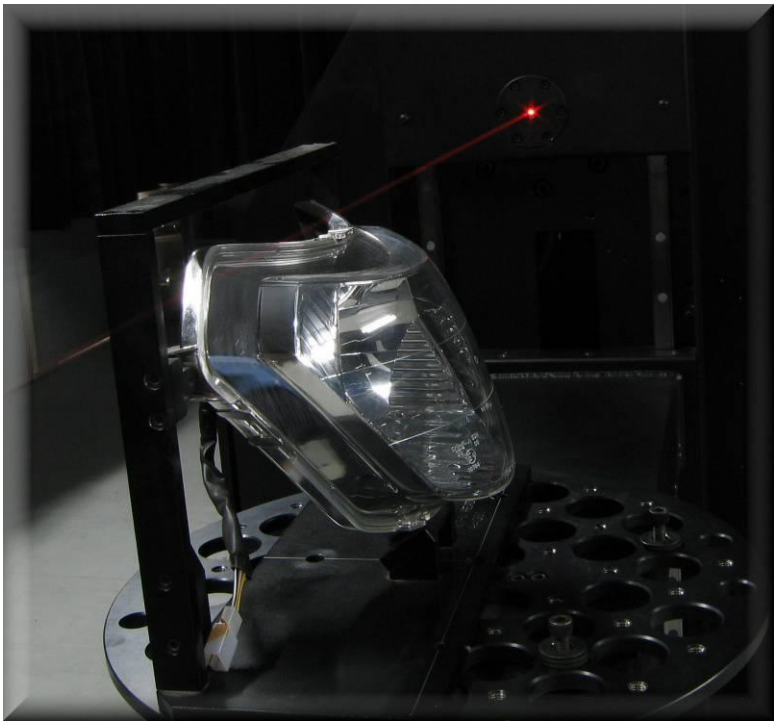


Figure 3: Alignment Laser and Test Item Mounting Plate

Photometric Measurement System

The measurement system (photometer) consists of a photocell, photocurrent preamplifier and analogue-to-digital converter. The photocell is thermostatically controlled at 35 °C and has an 8 mm receptive area and a responsivity of around 14 nA/lx.

The photocell has a V (lambda) response with f_1' < 1.50% (Class L), which is consistent with CIE and ECE recommendations for photocells for measurement of automotive devices and signals, and is therefore suitable for LEDs and coloured signals.

The photocell is fed into a multi-ranging photocurrent preamplifier, with built-in analogue-to-digital conversion, that is controlled by the PC. Digital or software triggering from the motor controller to the data acquisition card means that fast sampling of test scans can be achieved. The amplifier has variable integration time so that it can measure all types of sources including DC and also pulse-width modulated (PWM) light sources.

The Photometric Measurement System has an operating range from 10^{-5} lx up to $5x10^{4}$ lx. This corresponds to around 0.0001 cd at a test distance of 3.162 metres. An ISO-17025 certified calibration certificate with traceability is provided with the system.

The photocell is mounted on a sturdy stand and appropriately masked and baffled. The client has the option to have one fixed test distance (usually 25m or 4m), or to have a mobile photocell stand to accommodate any test distance up to 25m. A second photocell with photocell stand automation can also be provided (see Optional Extras) to fully automate the transition between test distances.

Figure 4: Photocell and Amplifier

Power Supplies

No test item power supplies or electrical parameter measurement interfaces have been included in this quotation, however they can also be provided and incorporated into the system.

Software

The comprehensive software provided with the system is in two parts – the control software and the report generation software.

The control software operates in an easy-to-use and step-by-step manner. It is not menu-driven, rather it operates more like a software wizard so that it is very user-friendly.

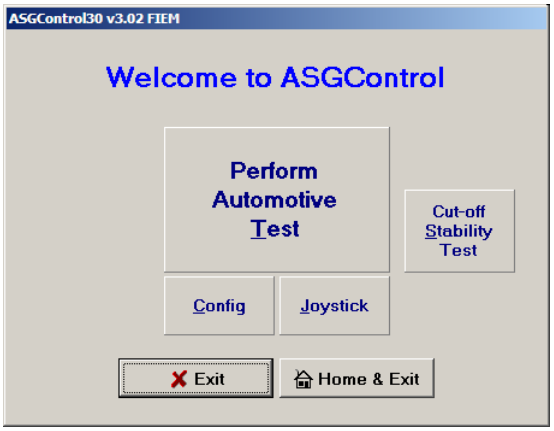


Figure 5: The ASGControl Software Main Menu

You can see from the main menu shown above that the major functions are cleasly identified and easy to access.

Other control software features are shown on the following pages.

These rules are entered into the software, and the user has the ability to modify these at will in case of Rule changes in future. The operator also has the ability to create their own test routines for convenience and for R&D purposes.

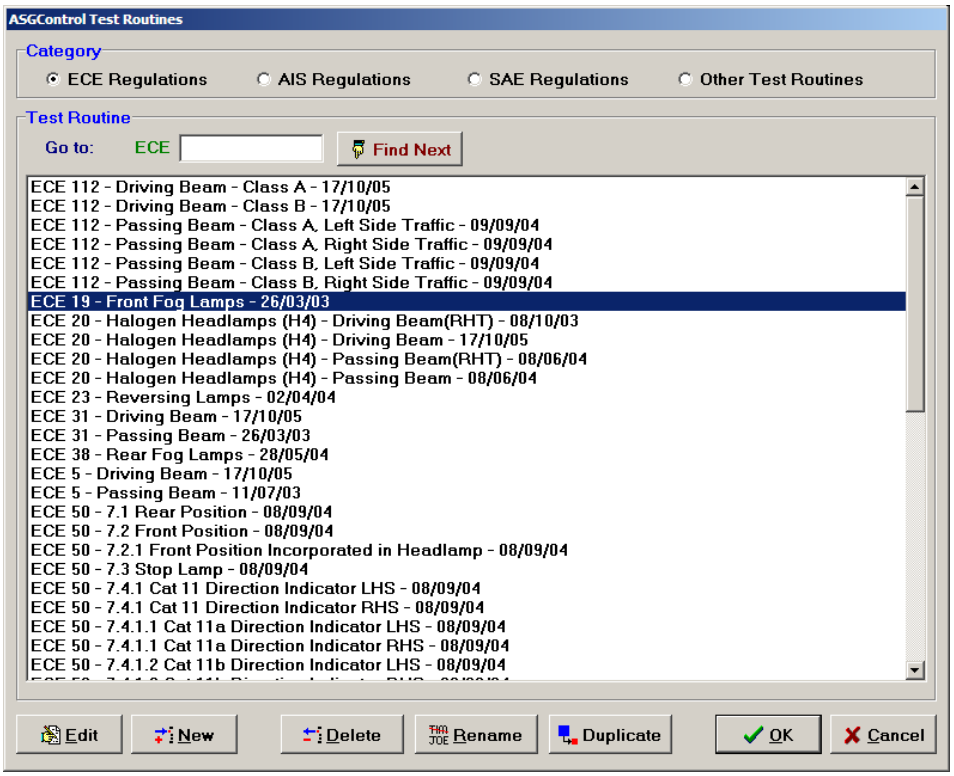


Figure 6: Test Routine Selection Window

Joystick control for arbitrary movement of goniometer.

This includes moving the goniometer to H and V angles, plus access to other functions.

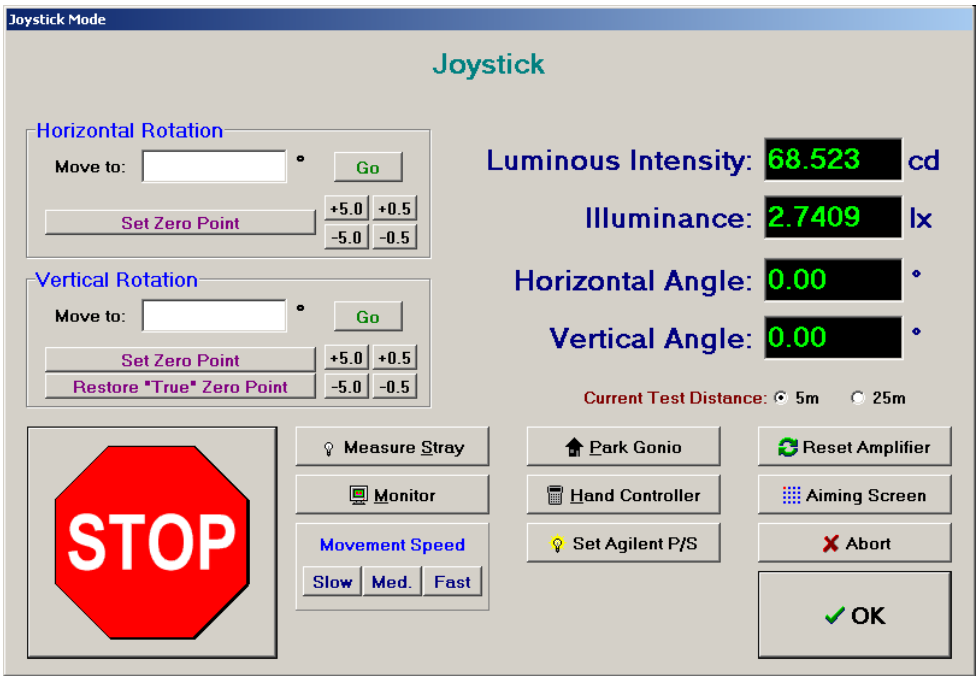


Figure 7: Joystick Control Window

Photometer monitoring screen to view lamp stability.

This can be used to ensure that the test item is fully stabilised and warmed up before starting the test. Includes some basic statistics and an “Auto-start” option to automatically start the test after a given time.

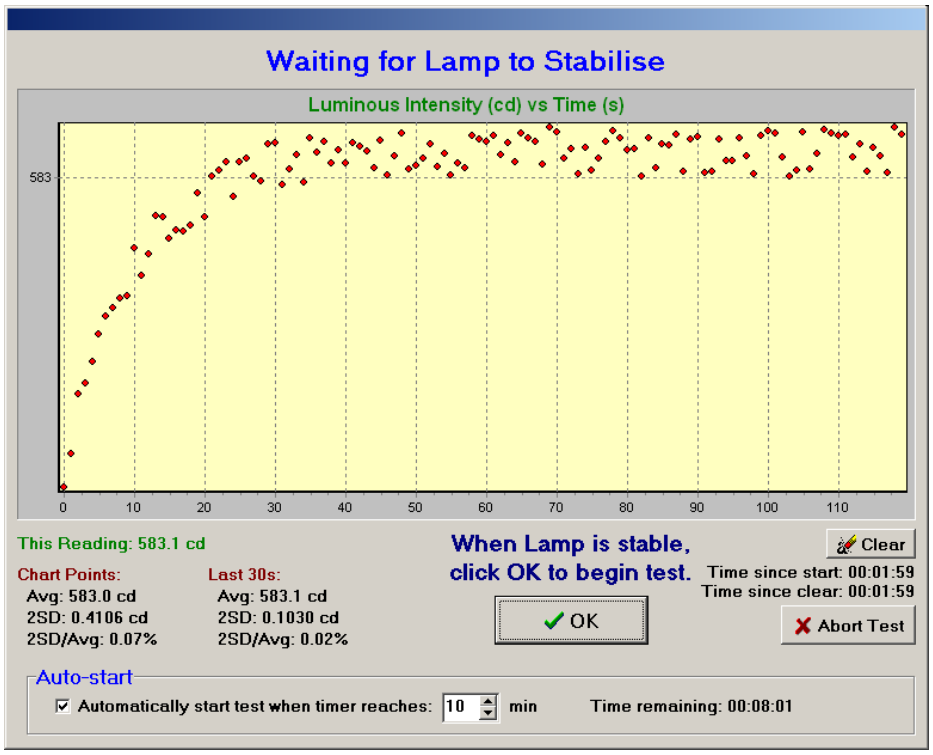


Figure 8: Photometer Monitor Window

Standard Lamp Library

Working standard lamps can be entered into the software. Software will automatically set the electrical parameters required for the lamp, *plus it will also keep track of the burn time of lamps and alert user when the lamp needs to be recalibrated.*

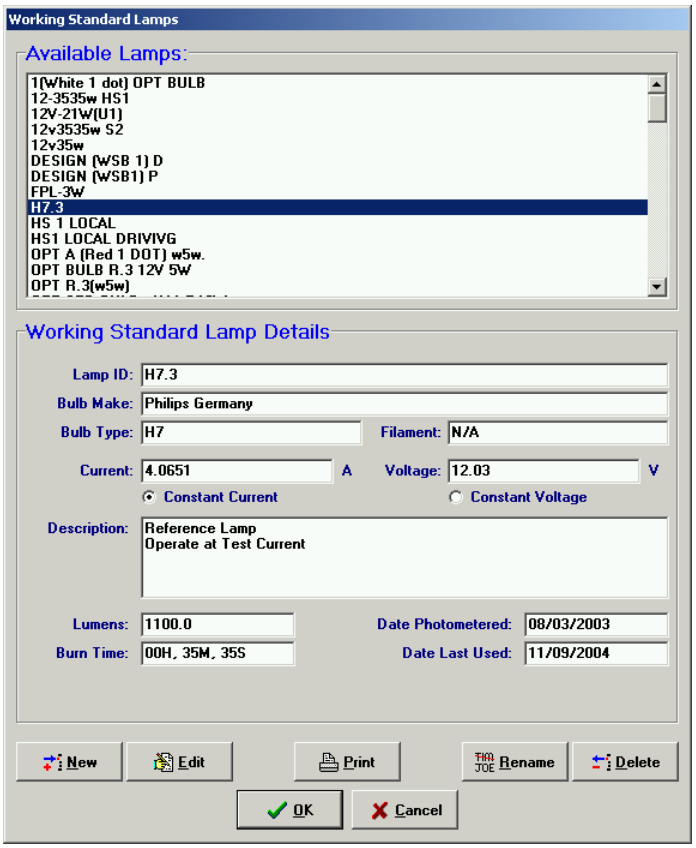
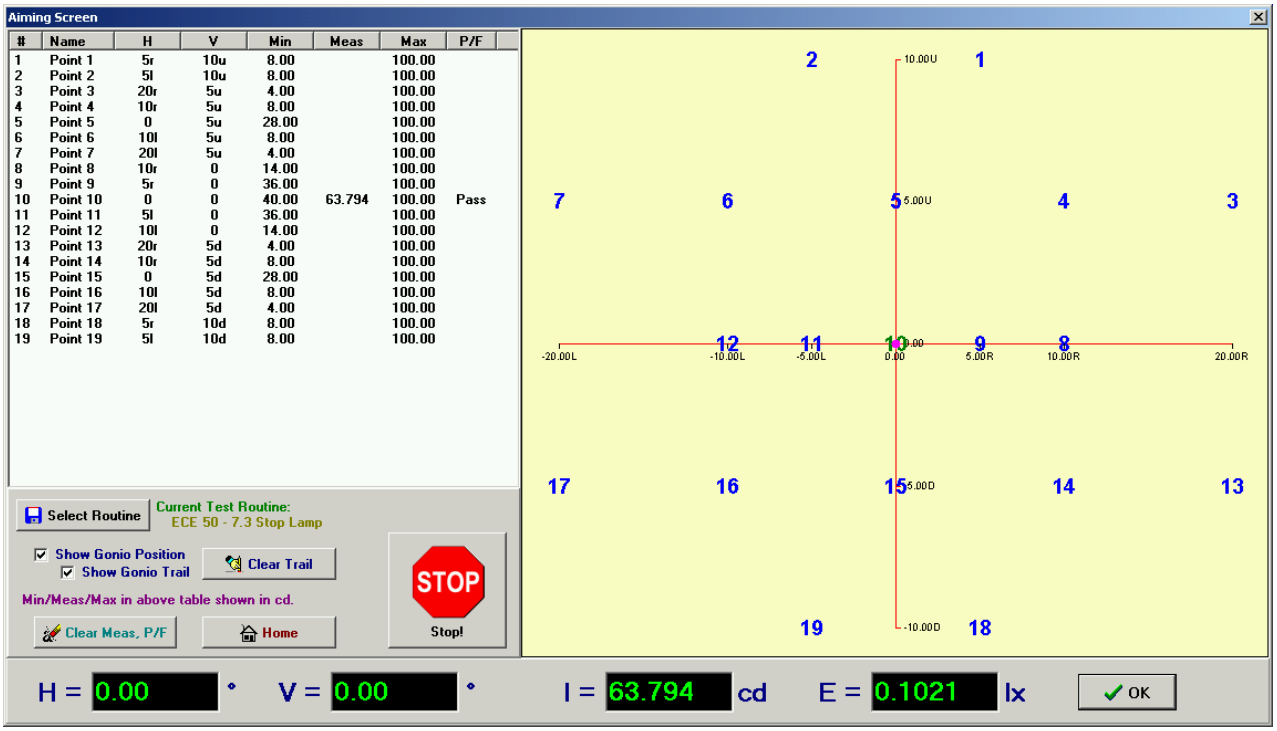


Figure 9: Standard Lamp Library

Aiming Screen Function

The “Aiming Screen” function is for quickly checking key test points before starting a full test. The user simply clicks on a test point and the software will automatically move the gonio to the correct location and check if the test point passes or fails. The operator can then quickly re-align if necessary and straight away see the result.



#	Name	H	V	Min	Meas	Max	P/F
1	Point 1	5r	10u	8.00		100.00	
2	Point 2	5l	10u	8.00		100.00	
3	Point 3	20r	5u	4.00		100.00	
4	Point 4	10r	5u	8.00		100.00	
5	Point 5	0	5u	28.00		100.00	
6	Point 6	10l	5u	8.00		100.00	
7	Point 7	20l	5u	4.00		100.00	
8	Point 8	10r	0	14.00		100.00	
9	Point 9	5r	0	36.00		100.00	
10	Point 10	0	0	40.00	63.794	100.00	Pass
11	Point 11	5l	0	36.00		100.00	
12	Point 12	10l	0	14.00		100.00	
13	Point 13	20r	5d	4.00		100.00	
14	Point 14	10r	5d	8.00		100.00	
15	Point 15	0	5d	28.00		100.00	
16	Point 16	10l	5d	8.00		100.00	
17	Point 17	20l	5d	4.00		100.00	
18	Point 18	5r	10d	8.00		100.00	
19	Point 19	5l	10d	8.00		100.00	

Figure 10: “Aiming Screen” Window

Cut-off stability (retention) monitoring test.

This is monitoring the vertical deflection of the cut-off line of a low-beam to check how far it deviates between 3 minutes and 60 minutes from activation (according to ECE requirements).

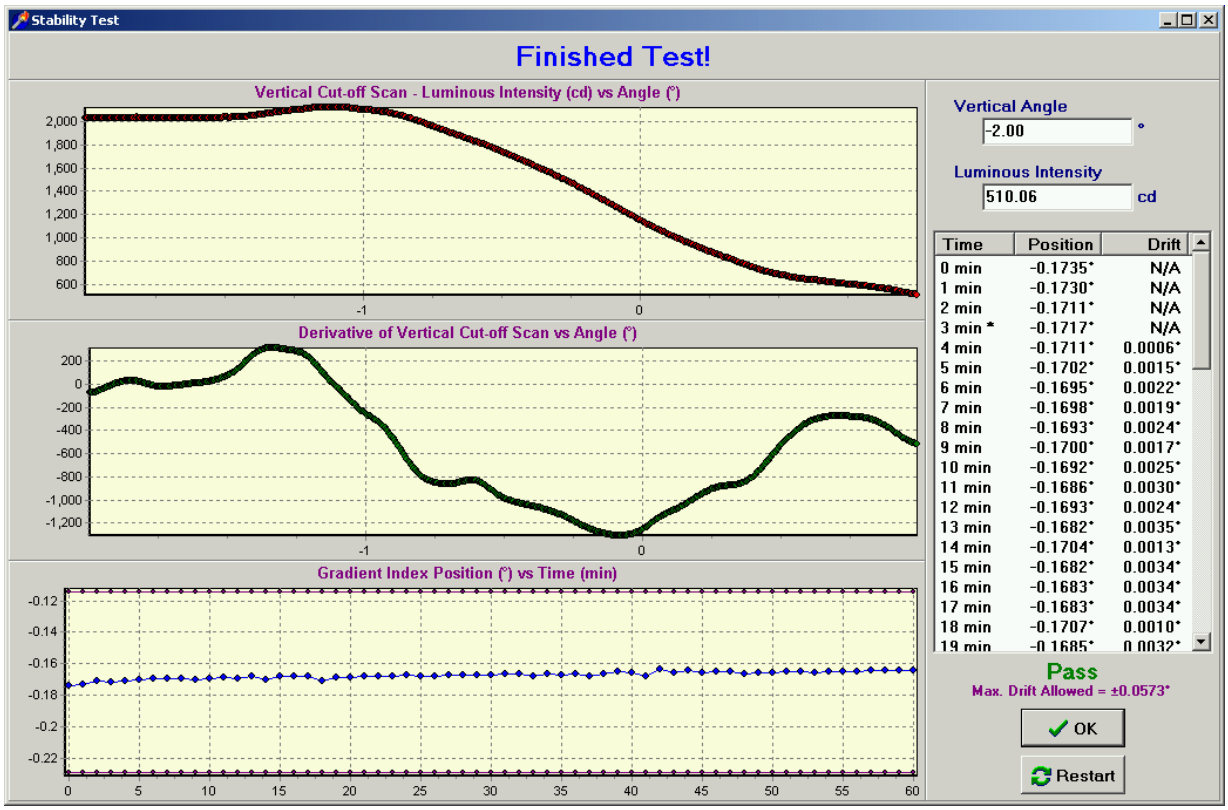


Figure 11: Cut-off Stability Test Window

Flashing Mode Test

This is the Flashing Mode measurement for LED indicators according to ECE 6.

The LED indicator is operated in flashing mode and the flash intensity measured after 1 minute and after 30 minutes of flashing. Then the indicator is operated continuously on and allowed to stabilise. Multiplication factors are then made to correct the luminous intensity values measured during the testing to what the intensity would after 1 minute and 30 minutes of flashing. According to ECE 6 (and other Standards including ADR) the indicator must pass at all points for both the 1 minute and 30 minute values.

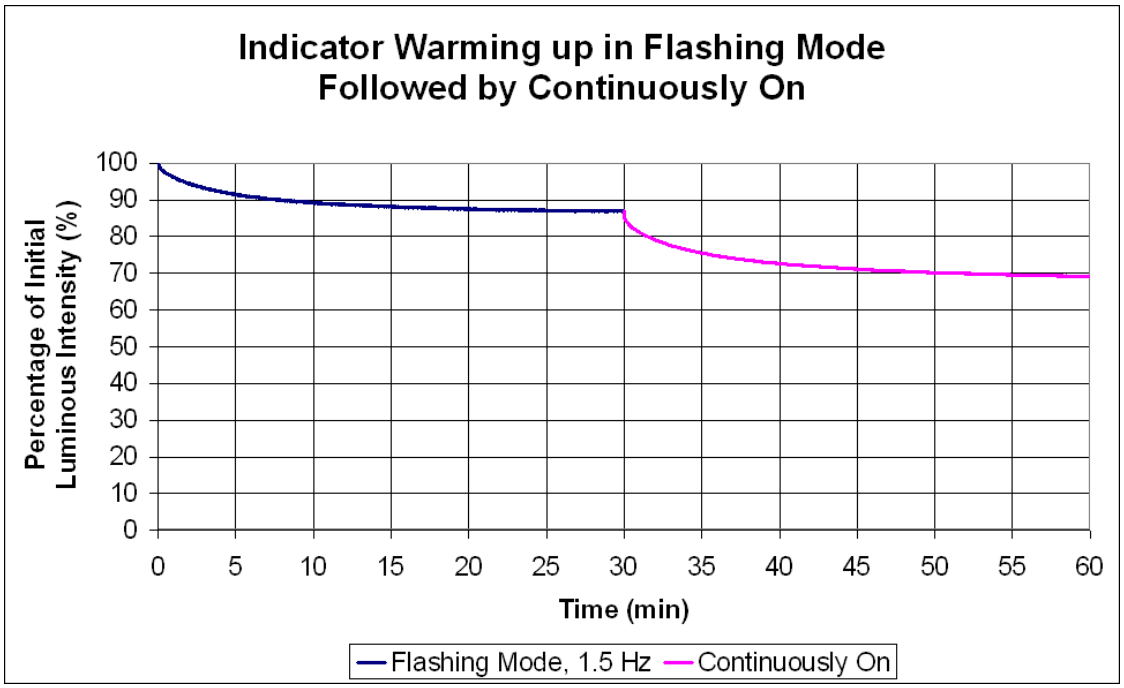


Figure 12: Flashing Mode Measurement for LED Indicators

* Please note that this flashing mode software requires that the Power Supply with GPIB Interface option given in the Optional Extras is also chosen.

The ASG-1.1 Config allows the user to perform system configuration tasks such as:

- Setting the test distance(s);
- Adjusting the photometer responsivity settings in case of re-calibration;
- Applying a correction factor in circumstances where the full lamp lumens cannot be used (eg: testing an indicator which would melt if the lamp is run continuously at its normal operating parameters);
- Setting the home positions on the goniometer axes;
- Adjusting the number of triggers per second that the software will use when acquiring test scan data.

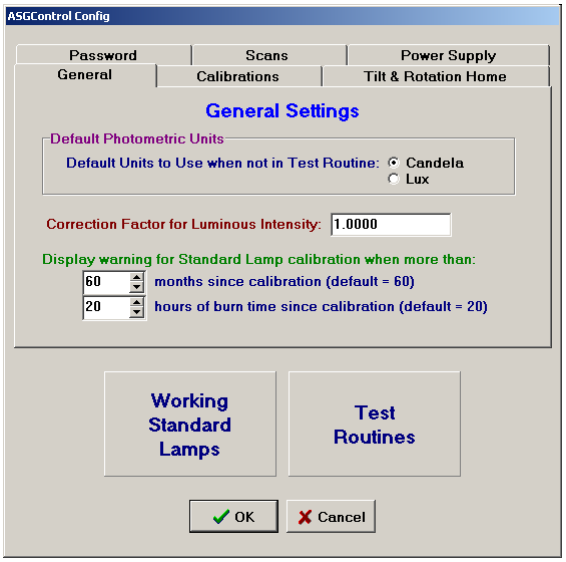


Figure 13: ASGControl Config Window

The report generator provides several different formats of reports, ranging from single-page to tabulated output of test scan data.

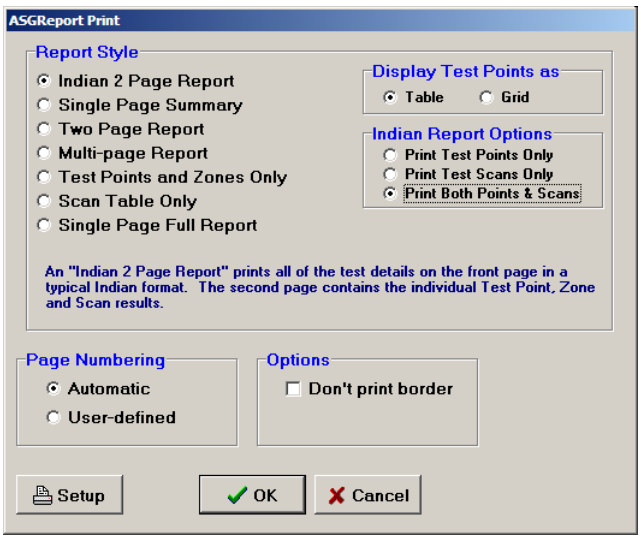


Figure 14: ASGReport Print Window

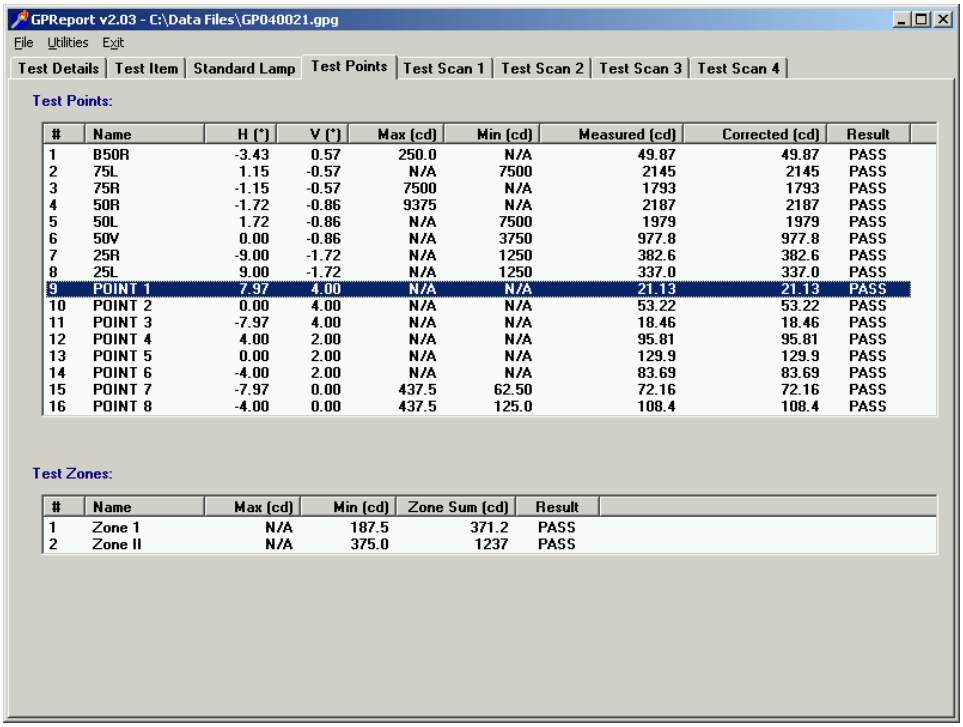
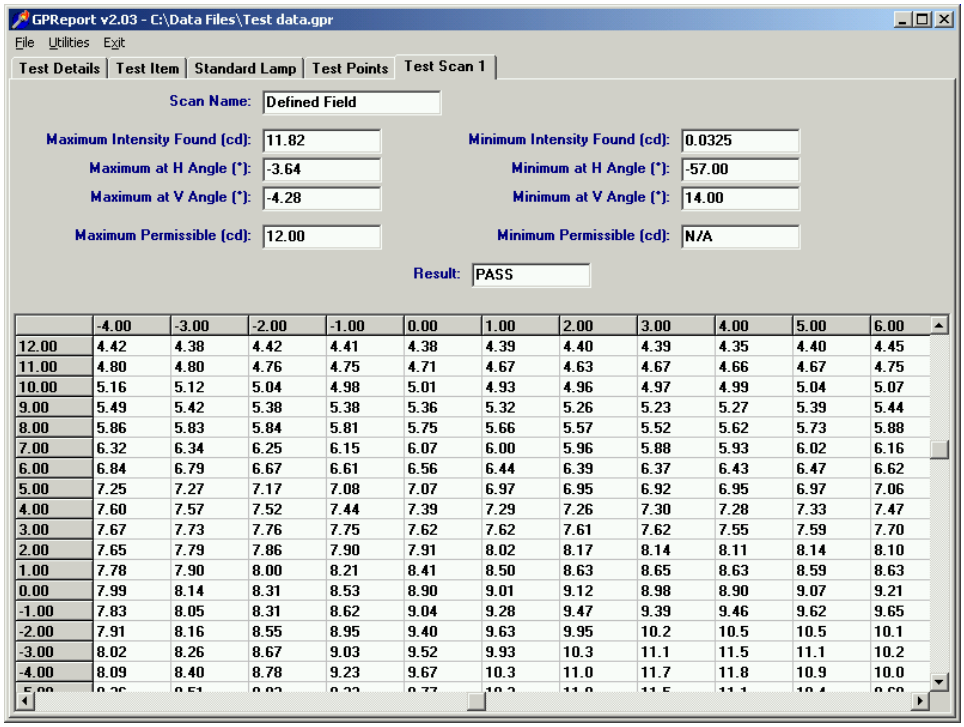
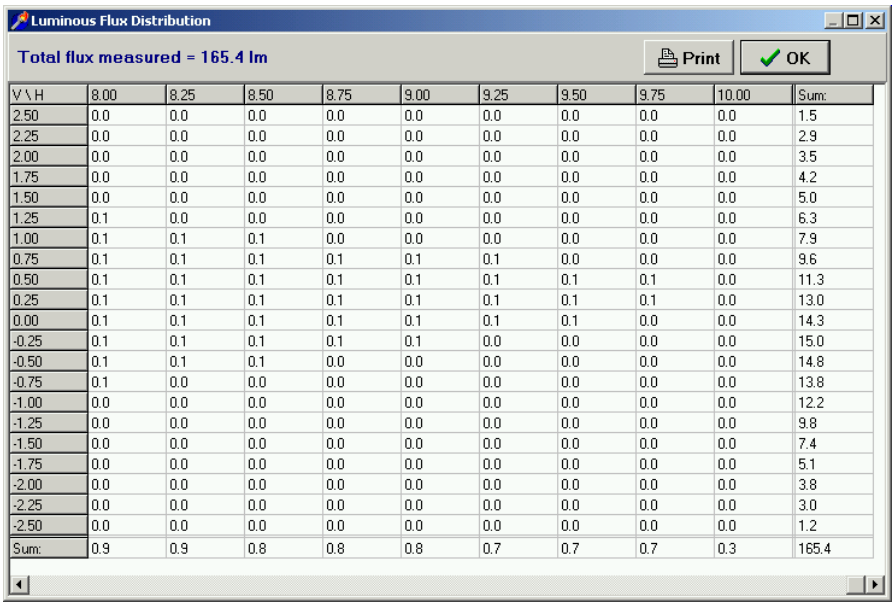


Figure 15: Test Point Results Window



	-4.00	-3.00	-2.00	-1.00	0.00	1.00	2.00	3.00	4.00	5.00	6.00
12.00	4.42	4.38	4.42	4.41	4.38	4.39	4.40	4.39	4.35	4.40	4.45
11.00	4.80	4.80	4.76	4.75	4.71	4.67	4.63	4.67	4.66	4.67	4.75
10.00	5.16	5.12	5.04	4.98	5.01	4.93	4.96	4.97	4.99	5.04	5.07
9.00	5.49	5.42	5.38	5.38	5.36	5.32	5.26	5.23	5.27	5.39	5.44
8.00	5.86	5.83	5.84	5.81	5.75	5.66	5.57	5.52	5.62	5.73	5.88
7.00	6.32	6.34	6.25	6.15	6.07	6.00	5.96	5.88	5.93	6.02	6.16
6.00	6.84	6.79	6.67	6.61	6.56	6.44	6.39	6.37	6.43	6.47	6.62
5.00	7.25	7.27	7.17	7.08	7.07	6.97	6.95	6.92	6.95	6.97	7.06
4.00	7.60	7.57	7.52	7.44	7.39	7.29	7.26	7.30	7.28	7.33	7.47
3.00	7.67	7.73	7.76	7.75	7.62	7.62	7.61	7.62	7.55	7.59	7.70
2.00	7.65	7.79	7.86	7.90	7.91	8.02	8.17	8.14	8.11	8.14	8.10
1.00	7.78	7.90	8.00	8.21	8.41	8.50	8.63	8.65	8.63	8.59	8.63
0.00	7.99	8.14	8.31	8.53	8.90	9.01	9.12	8.98	8.90	9.07	9.21
-1.00	7.83	8.05	8.31	8.62	9.04	9.28	9.47	9.39	9.46	9.62	9.65
-2.00	7.91	8.16	8.55	8.95	9.40	9.63	9.95	10.2	10.5	10.5	10.1
-3.00	8.02	8.26	8.67	9.03	9.52	9.93	10.3	11.1	11.5	11.1	10.2
-4.00	8.09	8.40	8.78	9.23	9.67	10.3	11.0	11.7	11.8	10.9	10.0

Figure 16: Test Scan Results Window



V \ H	8.00	8.25	8.50	8.75	9.00	9.25	9.50	9.75	10.00	Sum:
2.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5
2.25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.9
2.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5
1.75	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.2
1.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0
1.25	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.3
1.00	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	7.9
0.75	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	9.6
0.50	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	11.3
0.25	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	13.0
0.00	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	14.3
-0.25	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	15.0
-0.50	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	14.8
-0.75	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.8
-1.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.2
-1.25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.8
-1.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.4
-1.75	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.1
-2.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.8
-2.25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0
-2.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2
Sum:	0.9	0.9	0.8	0.8	0.8	0.7	0.7	0.7	0.3	165.4

Figure 17: Luminous Flux Distribution Window

Other advanced output can also be provided such as:

- IsoLux Diagrams (Birdseye, Driver's View, Vertical Plane);
- GreyScale Diagrams (Birdseye, Driver's View, Vertical Plane);
- 3D IsoLux;
- IsoCandela;
- Horizontal Scans;
- Road Cast Pattern;

For these items, please see the "Advanced Report Software" section in the Optional Extras.

PC

The client is to supply a PC according to PSI's specifications. The most common problems encountered are usually computer related, so we prefer that the client supply a PC so that any problems can be serviced locally under warranty.

Documentation

The goniometer comes with a User Manual (in English) which provides a review of the photometric theory of goniophotometry and details the procedures for measuring luminous intensity distributions and testing the test items to various international standards on the ASG-3.0 in easy to follow instructions. It also contains connection diagrams and a troubleshooting guide to the goniophotometer system.

Installation and Training

PSI will install and commission the equipment, including:

- Unpacking and laying out the equipment;
- Levelling of the equipment;
- Alignment with optic axis;
- Placement of photocell stand;
- Installation of software.

Additionally, the installation team will perform a photometric calibration of the system and three (3) days training will be provided on site. The quoted price includes all airfares, meals and accommodation for the installation team. For clients who are new to photometry, further training on the basics of photometry and photometric measurement can be provided on request (not included in price).

Installation Requirements

The building arrangements are the responsibility of the client. This includes:

- Laboratory construction;
- Painting of wall, floor and ceiling surfaces a matt black colour;
- Construction of solid floor;
- Construction of stray light baffles and curtains;
- Dust-proofing and air conditioning.

The room should be at least 2.5 m wide, preferably wider, and must be at least two meters longer than the longest required test distance. For test distances greater than 10m, stray light baffles such as wooden panels or curtains should be placed on the walls, floor and ceiling. PSI staff can advise the client of the requirements in advance or at the time of installation.

The entire room should be light-tight and dust-proof. An air lock is preferable, however a partitioned area around the entrance where visitors can replace their shoes with slippers is acceptable. The room needs to be maintained at 25 °C and preferably around 50-70 % humidity.

Mains supply should be properly earthed, stabilised and filtered. The mains electrical supply for the entire system should be provided through an uninterruptible power supply (UPS) system, or at the very least through a voltage stabiliser, and should include an isolation transformer and line filter. PSI can advise the client regarding the best locations of power outlets.

Delivery to anywhere in metropolitan Melbourne is included for free, otherwise if out of metropolitan Melbourne then the price is ex-works (EXW, Incoterms 2010). If the equipment is to be installed in an existing building, the client is responsible for any costs in removing and rebuilding doors or walls to allow entry of the equipment.

Warranty

PSI provides an unconditional warranty on all of the photometric equipment supplied for 12 months from the date of final acceptance, or according to the limitations of the warranty of the manufacturer of any individual component. During the warranty period, PSI will repair or replace any faulty equipment at no charge to the client. The client is responsible for fixing hardware failures in the PC system, however PSI will actively assist the client in determining the nature of and resolving any such problem that may occur.

This warranty does not cover misuse, abuse or accidental damage to the equipment. In such a case all repairs and travel and accommodation expenses will be borne by the Client.

Part 2. Additional Models

ASG-1.1+

The ASG-1.1+ is the same as the ASG-1.1 except with the following size differences:

- The internal horizontal width is 1000 mm, i.e. there is a 500 mm clearance between the pivot point of the goniometer and the two vertical faces of the tilting frame. This allows for measurement of larger assemblies in the horizontal direction.
- The Z-axis has a total travel of 250 mm: from 200 mm below the pivot point down to 450 mm. This gives more height adjustment and is an advantage for laboratories who need to measure taller test items.

There is still a maximum of 10 kg load for the test item plus mounting jig.

ASG-1.0

The ASG-1.0 is a smaller version of the ASG-1.1. It is table-mounted instead of floor-standing: the client will need to provide a sturdy wooden table or bench onto which the goniometer can be bolted.

The sizes are as follows:

- The internal horizontal width is 500 mm, i.e. there is a 250 mm clearance between the pivot point of the goniometer and the two vertical faces of the tilting frame. Thus the distance from the centre of the lamp to the edge of the lamp must be less than 250 mm.
- The Z-axis has a total travel of 100 mm: from 150 mm below the pivot point down to 250 mm.

There is a maximum of 6 kg load for the test item plus mounting jig.

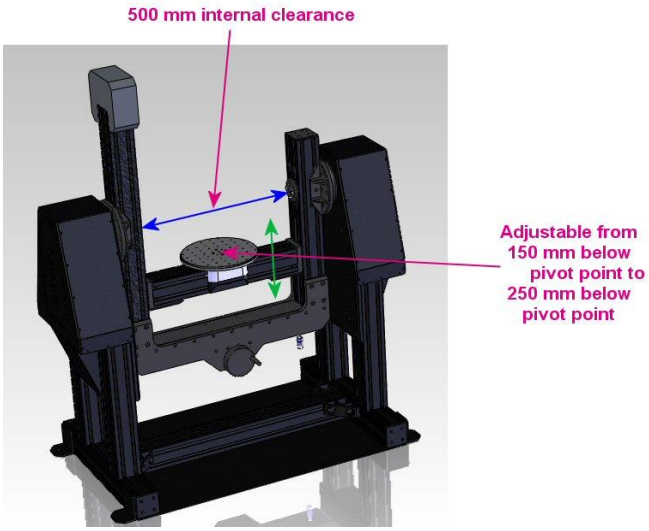


Figure 18: ASG-1.0

Part 3. Optional Extras

Programmable Power Supply with Software Interface

An Agilent 6653A 35V 15A DC Power Supply will be supplied, along with a GPIB Interface and Software Control. The user enters the required voltage or current into the software and the software will automatically power up and power down the test item and read the lamp's electrical parameters and save these along with the test data.

DVMs & Current Shunt with Software Interface

Two Digital Voltmeters and a Current Shunt will be supplied, along with Software Control. The software will interface the two DVMs and automatically read the lamp's current and voltage to display in the test report. The DVMs and shunt will come with calibration certificates.

This method is widely recognised (by the UN-ECE, the IEC and most accreditation bodies) as the correct way to conduct lamp voltage and current measurement.

Filament Switch

A Filament Switching system will be supplied and interfaced to the software. Using this, the operator can automatically switch between two filaments under software control, for example passing/driving beams or stop/tail. This option also requires the Power Supply option above to be selected.

Professional Rack System with Secondary Display

A professional 19" rack system will be supplied which will house a secondary display system.

Figure 19: Secondary Display Mounted in Rack

The secondary display system consists of a flatscreen monitor in a panel mounted in or on the rack. The display shows both of the angular components, the candela measurement, the lux measurement and other important information.

This is very useful for seeing the luminous intensity or illuminance emitted by the test item when aligning test items. It also gives the laboratory a modern, professional feel.

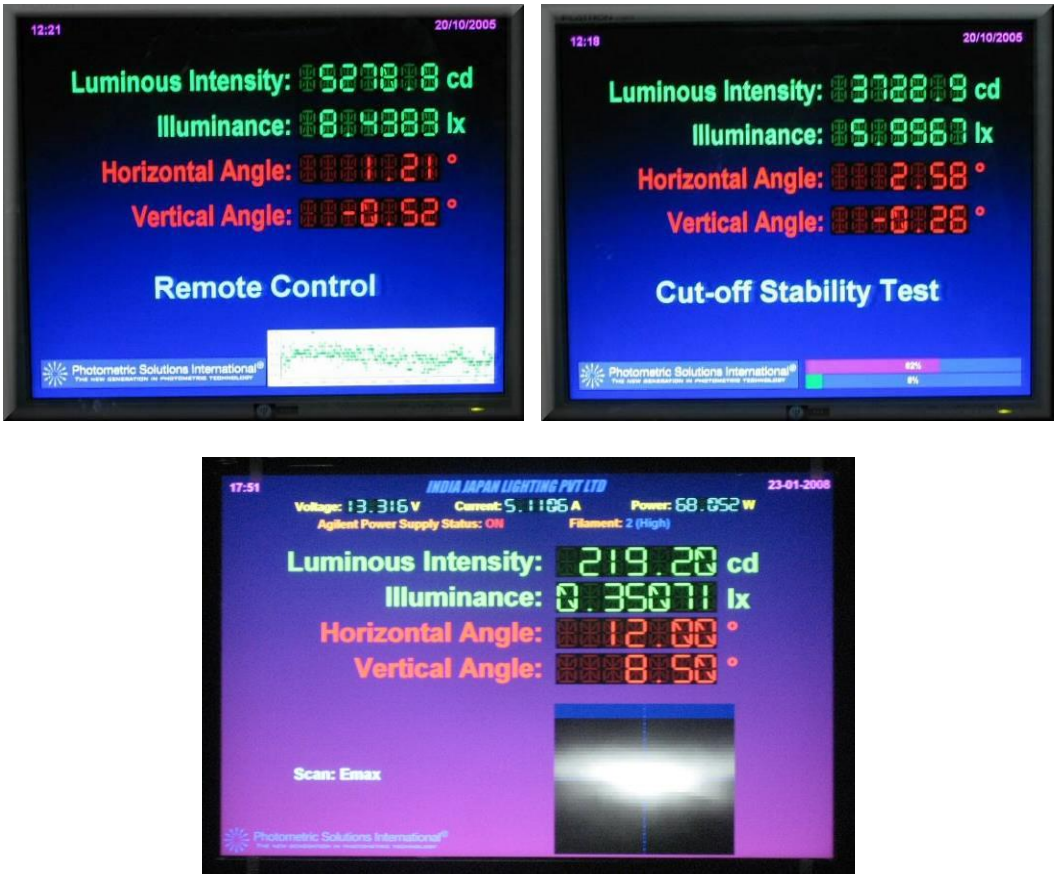


Figure 20: Sample Secondary Display

As can be seen in Figure 20 above, while a test is being performed the secondary monitor shows a greyscale image of the beam while measuring test scans, which is very useful for immediately noticing any anomalies or aiming issues.

The rack is normally positioned next to the desk where the operator sits, and can also house the power supply, DVMs, shunt and filament switch options as selected above (these options must be included separately). The rack will contain a system On/Off switch rather than this being placed on the goniometer itself.

Remote Handheld Controller

A Remote Handheld Controller gives the operator extra flexibility when aligning test items. The operator can move around the goniometer holding the hand-held controller and so see the test item alignment from different perspectives.

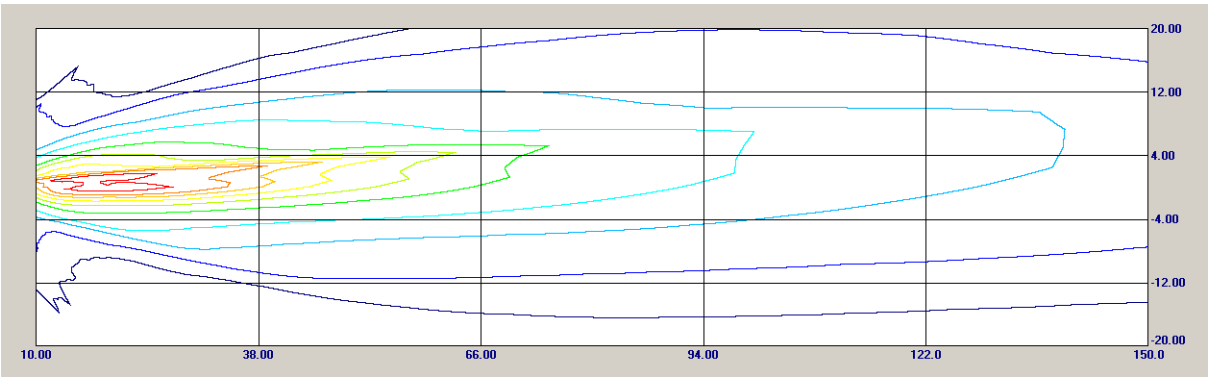
Figure 21: Remote Handheld Controller

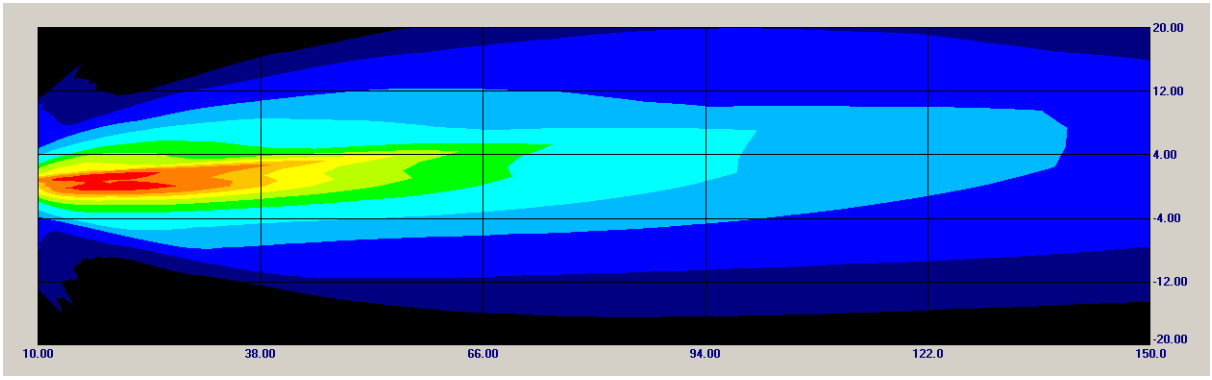
Advanced Software Upgrade

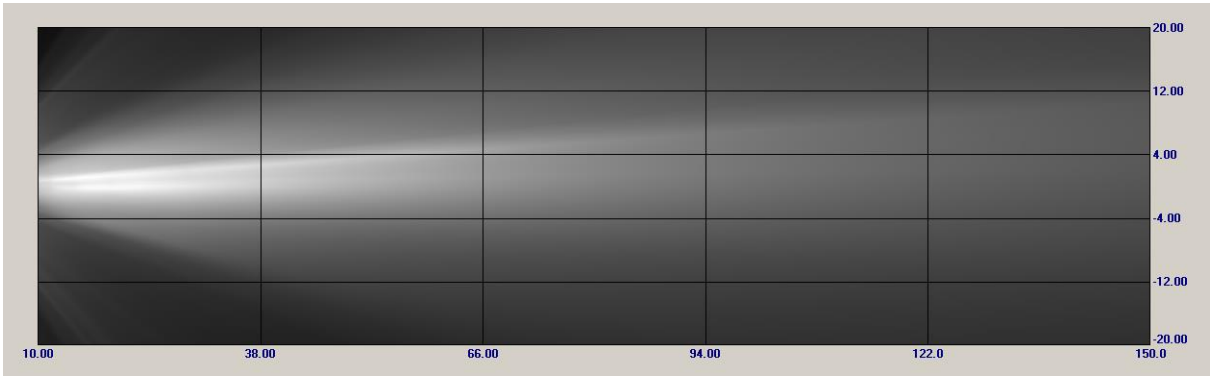
For the ultimate professional report, the Advanced Software includes items such as:

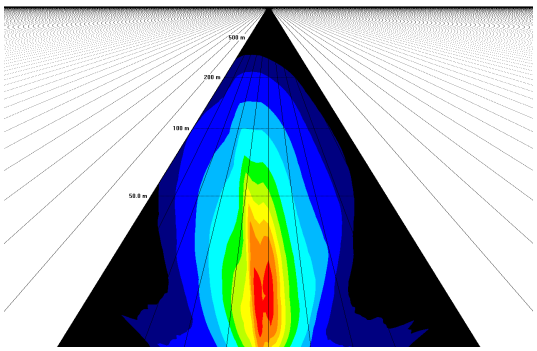
- IsoLux Diagrams (Birdseye View, Driver's View, Vertical Plane);
- GreyScale Diagrams (Birdseye View, Driver's View, Vertical Plane);
- 3D IsoLux;
- IsoCandela;
- Horizontal Scans;
- Road Cast Pattern.

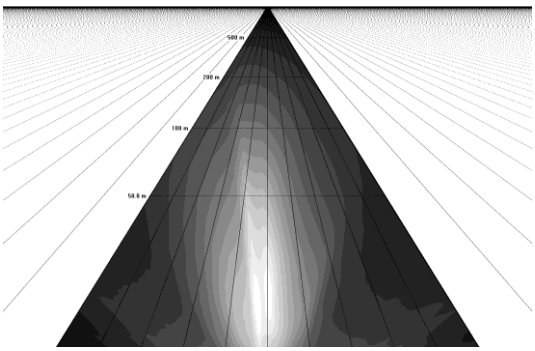
Sample images are shown below.

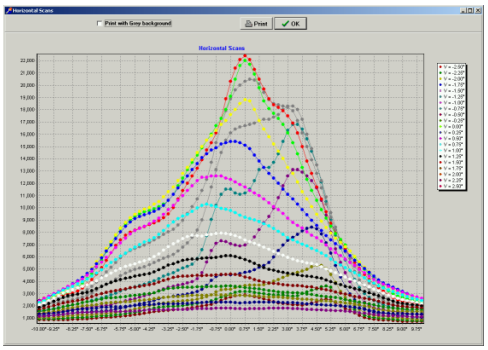


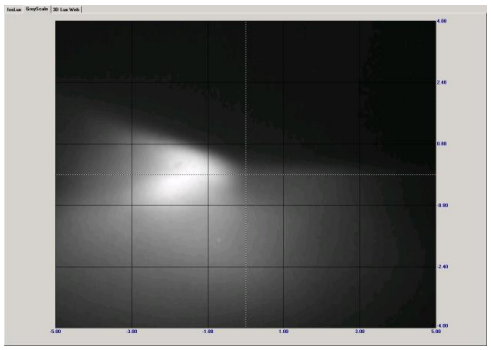


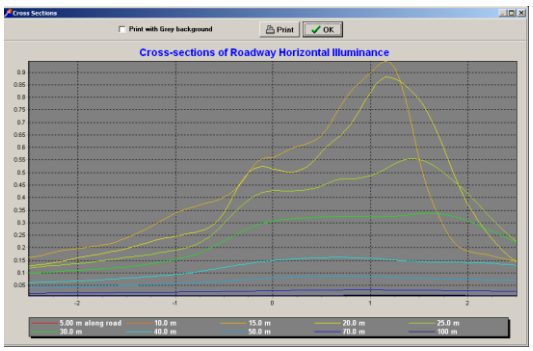


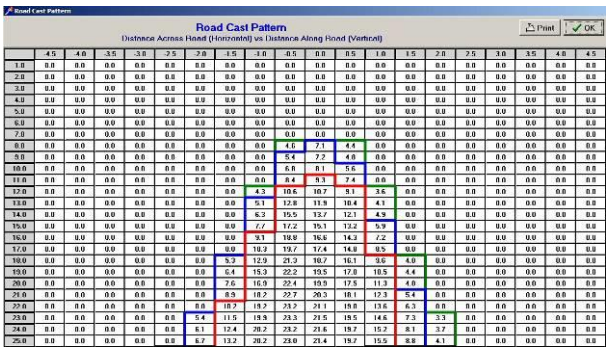












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8.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.6	7.1	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.4	7.2	4.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.8	8.1	5.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
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20.0	0.0	0.0	0.0	0.0	0.0	0.0	7.6	16.9	22.4	19.9	17.5	11.3	4.8	0.0	0.0	0.0	0.0	0.0	0.0
21.0	0.0	0.0	0.0	0.0	0.0	0.0	8.9	18.2	22.7	20.3	18.1	12.3	5.4	0.0	0.0	0.0	0.0	0.0	0.0
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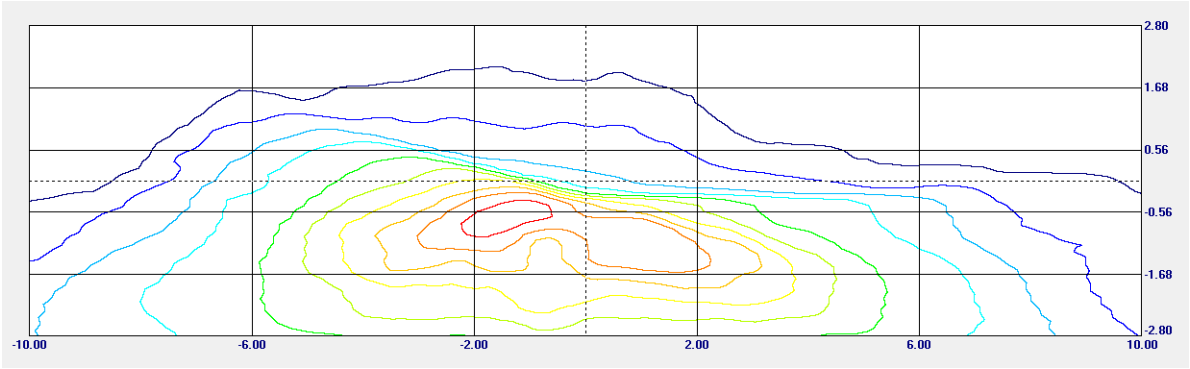
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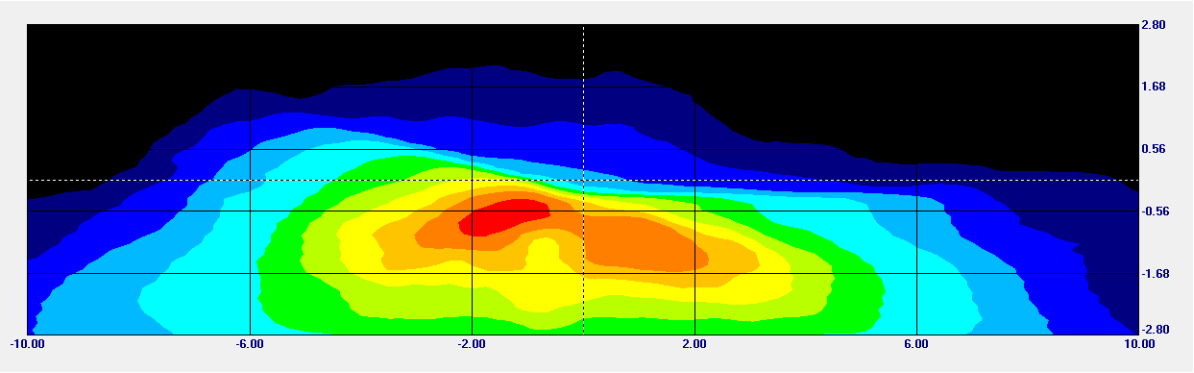
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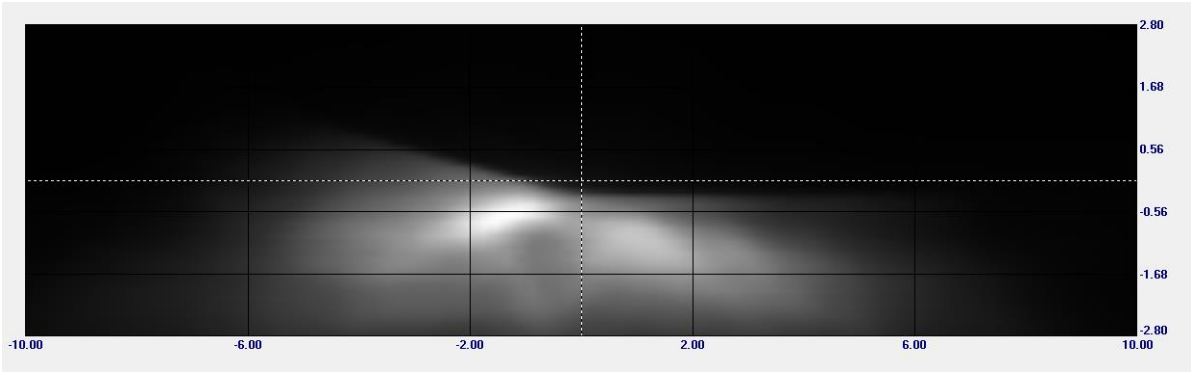
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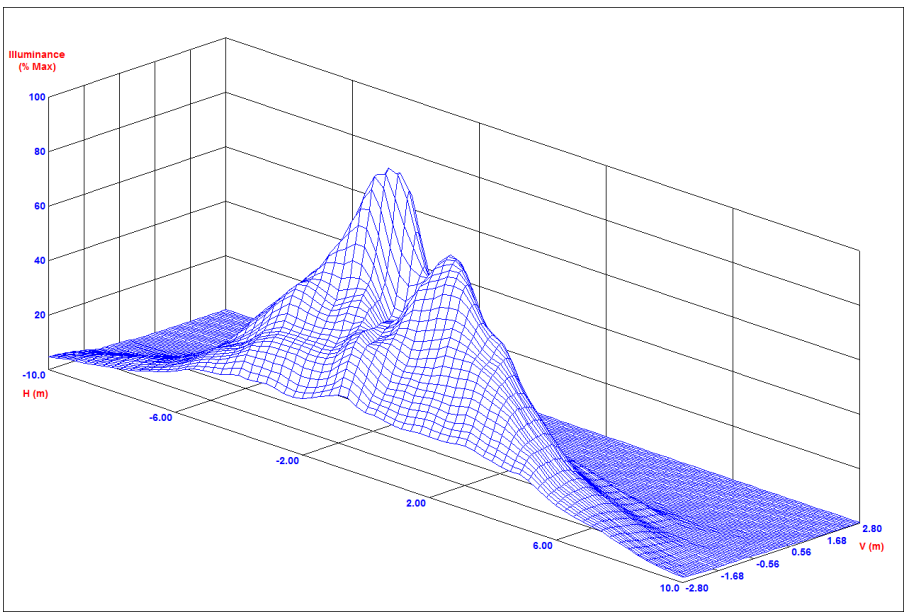
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1.68
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V (m)