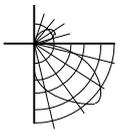


## LightLab A100 A type Intensity Distribution Photometer.

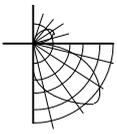




## LightLab A100 A type Intensity Distribution Photometer.

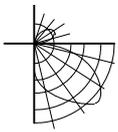
### Photometer assembly comprises:

- A.1** A Compact, precision built, fully automated, A Type Goniometer comprising free standing steel superstructure. This goniometer is designed as a general purpose test platform that has the capability of testing a range of light sources when coupled with the appropriate options. The A100 has been successfully used by laboratories in the fields of automotive signalling (including headlamps), aviation and marine lighting, traffic lanterns, and for testing of LED sources.
- A.2** A sample support arm and its counterbalance which rotates about a fixed shaft and is driven via a toothed belt with geared DC servo control motor through a harmonic drive gearbox with an angular resolution of better than  $0.001^\circ$ . Positioning accuracy when calibrated is better than 0.02 degrees. The tilt arm arc extends 160 degrees, allowing the sample to be inclined by 100 degrees and declined by 60 degrees. Limit switches and physical stops limit the travel to the designed arc. The tilt speed is infinitely adjustable to  $4^\circ$  per second.
- A.4** A precision machined steel mounting table allowing 360 degrees of rotation of the sample about the table axis with an angular resolution of better than  $0.001^\circ$  and accuracy of better than 0.02 degrees. The sample rotation is motorised. The motorised raising and lowering of the photometric centre of the sample is actuated by an integral controller. The extent of travel of the raising and lowering is limited by over-travel limit switches. The rotation speed is infinitely adjustable to  $9^\circ$  per second.
- A.8** The photometer is capable of photometric measurements on luminaires with a maximum mass of 20kg. Table size is 400mm diameter and the A100 can accommodate samples with a maximum horizontal dimension of 400mm from centre to extremity and up to 500mm to height of photometric centre. Range of travel of the table raise / lower axis is 250mm
- A.5** All three axes of motion (arm tilt, table rotation and raise / lower movement) are powered by sealed drives with high reduction ratio, zero backlash, harmonic drive gearboxes requiring no maintenance or lubrication for the life of the system. The operation is inaudible with negligible power consumption. The position of the tilt arm and table rotation axes is determined by high precision angle encoders forming a closed loop with the host computer as controller. All working surfaces are precision ground and matched to ensure long term accuracy and stability.
- A.7** Lasers for the precise alignment of the sample to the optical axis of the system. The lasers double as system calibration and assurance monitoring devices. Photocell positioning accuracy can be tested with the simple push of a button during testing.
- A.9** The optical path length of the system is adjustable from 1m to the client requirements. Standard path lengths of 4m, 11m and 25m are supported for automotive and marine/aviation testing. The photocell support system consists of adjustable plates fitted to the laboratory floor with a standard removeable tower. One tower is provided as standard, others may be purchased as an option. An optional baffling assembly can be attached to each support tower to restrict the field of view of the photocell.
- A.10** Levelling and alignment of the goniometer system is achieved through precision machined alignment feet fitted to the base of the goniometer.
- A.11** The operation of the goniometer is inherently safe. All movement commands issued to the goniophotometer axes are mediated by the software to ensure the motion is within the limits of operation. All linear axes and axes limited to an arc are fitted with overtravel switches. The goniophotometer is fitted with emergency stop switches which will halt all motion independent of the computer system.



## LightLab A100 A type Intensity Distribution Photometer.

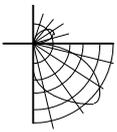
- A.12** All of the goniophotometer electronics are mounted within an industrial junction box for easy accessibility. Wiring diagrams for all of the electronics are supplied along with the identification of servicing test points.
- A.13** All electronic components in the goniophotometer are supplied by internationally recognised companies allowing simplified field servicing.
- A.14** A selection of photocells is available for the A100. The standard photocell is a high quality temperature stabilised cell with opal face to minimise effects of non-uniform illuminance. For other photocells please refer to the table of options.



## LightLab A100 A type Intensity Distribution Photometer.

### Specification summary:

|  |                    |  |
|--|--------------------|--|
| Angular limits for rotational axes   | Resolution         | All axes < 0.001°  |
|  | Accuracy           | All axes < 0.02°   |
|  | Arm traversal      | Inclination : 100°<br>Declination : 60°  |
|  | Table traversal    | No limit, continuous rotation  |
| Photocell Specifications<br><br>All options have 35° C temperature stabilisation | Standard photocell | 20 nA / lux response   |
|  | Option PhotR100    | 120 nA / lux response, CIE characteristics as per Photocell Table 1 in the summary section   |
| Software   | Control            | Unlimited scriptable test formats – plane/angle based and single point based, wizard based procedures, calibration tracking, diagnostics |
|  | Report             | Client formatting of test reports. Standard test reports include all details necessary to demonstrate compliance to relevant standards.  |
| System Supply  |                    | 100 – 120V or 220 – 240V (50/60 Hz)  |

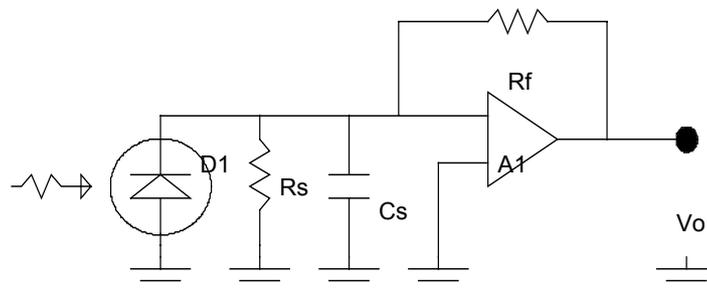
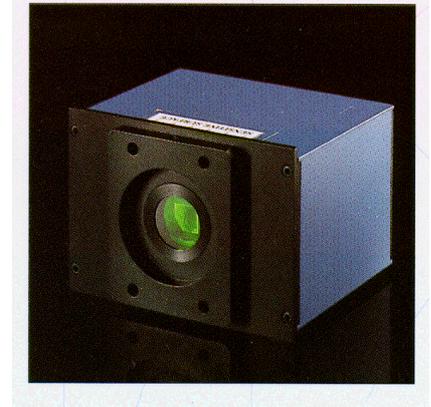


## LightLab A100 A type Intensity Distribution Photometer.

### B.1 Photoelectric Detector

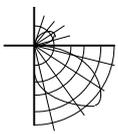
All of the photodetectors supplied meet the following minimum specifications below, specific features of each photocell option are listed in the Specification Summary section.

- Thermally stabilised Si-photovoltaic cell (35 degrees Celsius) with high accuracy  $V\lambda$  correction using the full filter method ( $f_1 < 1.0\%$ ,  $f_1 \leq 2.0\%$ , refer CIE Pub No 53). Photodetector comes complete with spectral response calibration certificate and separate power supply for the cell heater.
- very high shunt resistance ( $R_s$ ), giving the system a low overall noise gain.
- low shunt capacitance ( $C_s$ ), giving fast response to rapidly changing intensities.



**Simplified Photocell Input Circuit.**

- Noise gain a to  $R_f/R_s$
- Frequency response a  $1/(C_s \times R_f)$



## LightLab A100 A type Intensity Distribution Photometer.

### B.2 Photocell Interface

The interface electronics used in the Model R100 Photometer drives the output from the photocell into a virtual earth (refer simplified photocell input circuit) via a low noise, low capacitance 'Triax' cable and will measure over the range 2nA (resolution 10fA) to 2mA (10nA resolution). Precision is 5 & 1/2 digits auto ranging. The unit is fully programmable via an IEEE-488 bus and has selectable 50Hz or 60Hz line integration to reduce noise. The interface electronics has an integral display so it can display the photocell value independently of the computer.

With the standard cell, at a nominal test distance of 4m, the dynamic range of the A100 system is 1mcd to 250,000cd, at a test distance of 25m the upper limit is 6Mcd. The photocell can be set to perform measurements of either illuminance (lux or foot candles) or luminous intensity (candelas).

### B.3 Computer

The photometer is fully computer controlled and is therefore supplied complete with computer.

Specifications:

- IBM PC compatible, Pentium IV processor.
- 40 GB Hard disk.
- 256 Mb RAM.
- SVGA 15" colour screen and interface card.
- IEEE-488 interface card and software.
- An optional printer
- 19" rack mount industrial computer chassis and enclosure.



### B.4 Hand Controller

The portable hand controller option allows for manual set-up of the sample also contains the interface electronics for speed control of both mirror and luminaire motors and laser on/off. This allows the operator to easily align the sample prior to testing. All controls available from the hand controller are duplicated at the PC.

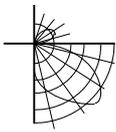
### B.5 Instrumentation Rack

The instrumentation rack comes pre-wired forming the 'control center' for the photometer. As the wiring is inside the instrumentation rack all photometer wiring 'out of view' and adds to the professional presentation of the laboratory system. Additionally, because the control system is supplied pre-wired, laboratory installation time is significantly reduced.



### B.6 Laser Alignment

Standard system alignment tools include a wall mounted self-levelling rotating laser which is used during installation and subsequent checking of system alignment. During operation the main usage is to determine the height of the optical axis of the system during test sample set up. A second portable laser is used to define the location of the optical axis of the system during set up, and provides an easy method of aligning the photocell towers.



## LightLab A100 A type Intensity Distribution Photometer.

### **B.7 Colour measurement system.**

The spectroradiometer used in the A100 uses a revolutionary optical design incorporating a 2048 pixel CCD. The spectrometer has significant advantages in measurement acquisition speed and reliability over traditional designs. From the raw spectral data the following metrics are computed, the colour subsystem is a complete colour measuring instrument in its own right suitable for all colour measurements.

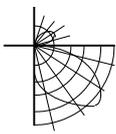
- Spectral Energy Distribution
- Colour co-ordinates x, y, u, v
- Correlated colour temperature
- General and Special colour rendering index
- UCS Chromaticity 2<sup>nd</sup> Field
- CIE Chromaticity 2<sup>nd</sup> Field
- CIE and UCS Chromaticity diagrams with point representation of the sample

The functionality of the colour measurement system is fully integrated into the software measurement system and is fully automated via the computer. All of the common tasks are automated : calibration of the system, performing test measurements and even diagnostic functions are all included as step by step wizards, considerably easing operator use. Furthermore all of the test data is electronically logged and can be retrieved at a later date.

### **B.8 Hewlett Packard HP6629A Programmable dc Power Supply. (Optional)**

The A100 is optionally supplied with a programmable DC Power Supply to drive the test sample. Control of the power supply during operation is from the computer through an IEEE-488 controller or the front panel. Brief supply specifications : 8A / 50V maximum output, calibrated accuracy to better than 1mA and 1mV.

LightLab uses and recommends Hewlett Packard power supplies.



## LightLab A100 A type Intensity Distribution Photometer.

The R100 photometer is supplied with a system control software package as standard and one or more report processing software packages depending on the field of interest :

**C1. Control** for machine operation

**C2. Report Automotive (ECE)** to generate test reports to European ECE standards.

**C3. Report Automotive (SAE)** to generate test reports to North American SAE standards.

**C4. Report Automotive (JIS)** to generate test reports to Japanese JIS standards.

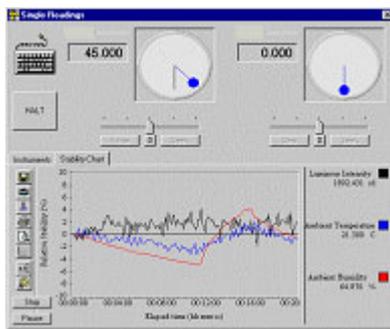
**C5. Report Traffic Lantern** to generate test reports for traffic lanterns.

**C6. Report Marine** to generate test reports for marine lanterns.

### **C1. CONTROL FOR WINDOWS**

Control of the photometer operations is managed by the program 'CONTROL', which includes the following features :

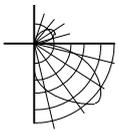
- Automatic or manual operation of photometer
- All tasks, such as performing a test or calibration of the goniophotometer, are wizard based to ensure accurate and efficient use by laboratory staff. You will even be reminded when to perform calibrations.
- Graphic display of polar distribution during testing
- User programmable vertical and luminaire rotation angles. Standard test formats pre-programmed to optimise testing throughput and include operation in C<sub>γ</sub> or C-level format. Software will adapt to and make use of all test data logged.
- Automatic logging of acquired data to hard disk
- Selection of cell/ lamp colour correction factor



The goniometer control software package is Windows based and allows complete configuration of the goniometer when performing a test including the number and location of the planes of data and the angles that are sampled in each plane. It comes supplied with predefined test formats to test to local standards.

A 'single readings' mode is included which allows a lamp stability check to be made during setup and testing. Diagnostics are run every time Control is started and whenever a test is run to ensure the goniometer system is operating correctly. All measurements available from the instrumentation are displayed, including luminous intensity and illuminance and the horizontal and vertical angles.

An integral feature of the control software is tracking of sample stability. It provides graphical plotting of all measured parameters versus time, so laboratory staff can check sample stability. This minimises unnecessary warm-up time and increases laboratory efficiency.



## LightLab A100 A type Intensity Distribution Photometer.

- C2. Report Automotive (ECE)**
- C3. Report Automotive (SAE)**
- C4. Report Automotive (JIS)**

The goniophotometer software package is pre-programmed to perform standard ECE / SAE / JIS tests based on data acquired from the A100 measurement system. All relevant photometric and colorimetric information specified in the standard is included in the report allowing the document to be used both as a certification document and for research and development. All common test categories are included, as part of our maintenance program we continue to revise and add new standards as they are issued.

The software is written with an open output format so that the format of the report can be modified to suit your requirements which facilitates customising the international standards to local conditions. The modifications can be performed either by LightLab staff or by your technicians.

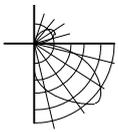
To facilitate research and development the photometric information can be presented in a number of different forms including : isolux and isocandela diagrams, 3d lux and candela diagrams, summary of the requirements of the standard with an indication of performance and pass / fail summary for each.

For example, a partial selection of the ECE module includes :

|  |             |
|--|-------------|
| Front Direction Indicator                | ECE R 6/00  |
| Rear Direction Indicator                 |             |
| Supplementary Side Direction Indicator   |             |
| Front Position (Side) lamp               | ECE R 7/01  |
| Rear Position (Side) lamp                |             |
| Stop lamp                                |             |
| Reverse lamp                             | ECE R 23/01 |
| Dipped beam headlight                    | ECE R 20/01 |
| High beam headlight                      |             |
| Rear reflex CIL                          | ECE R 3/02  |
| Rear registration plate                  | ECE R 4/00  |
| Position, Stop, D/I for L group vehicles | ECE R 50/00 |

- C5. Report Traffic Lantern**
- C6. Report Marine**

Additional details available on application.



## LightLab A100 A type Intensity Distribution Photometer.



### **D.1 Temperature Indicator.**

The system includes one HP Data Acquisition Unit configured as a digital thermometer, mounted into instrumentation rack and connected via IEEE instrumentation bus to the control computer. RTD temperature sensor is built into the photometer.

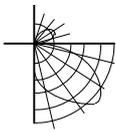
### **D.2 Reflex testing module (automotive).**

The reflex testing module incorporates both hardware and software elements to extend the functionality of the A100 goniometer to allow testing of retroreflective devices. The hardware is composed of a remote tower system incorporating a stabilised optical source and a photocell with adjustable position. Standard photocell positions for testing to common geometries are preset.

A software module is supplied with the reflex testing module to allow ready creation of reports. As with all report modules the format can be adapted by either LightLab or the client to suit local formatting requirements.

### **D.3 Photocell stands.**

The photocell stand is a self contained support structure for the photocell. It is composed of 2 parts : a floor locked mounting plate for alignment and a removeable support superstructure. One photocell stand is supplied standard with the photometer system along with 2 mounting plates, supporting 2 test distances, additional mounting plates can be supplied at a nominal cost. Additional photocell stands can be also be supplied.



## LightLab A100 A type Intensity Distribution Photometer.

### **E.1 Training at Client site (standard training)**

Standard training is 3 days at the Client's site on completion of the photometer installation. The engineers will be trained in all aspects of standard laboratory procedures including calibration, sample preparation, testing procedures and production of final test reports.

Additional training can be provided if required, please refer to options below.

### **E.2 Initial training at LightLab's test facility in Melbourne, Australia (optional)**

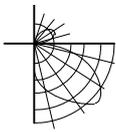
Initial training of two engineers for a period of one week will be provided at LightLab's facilities in Melbourne, Australia. LightLab will arrange for all accommodation, meals, transport etc. Training is an expanded version of that offered in item E.1 above. This is an option that must be specified at time of order.

### **E.3 Installation at Client site (optional)**

LightLab will provide two engineers for one week to aid system installation at the Client's premises. If additional installation time is required it can be provided, please refer to options.

### **E.4 Pre-installation setup and advice (optional)**

LightLab will provide advice to the client to help setup the laboratory system including such items as air-conditioning, electrical power, provision of laboratory space, customer specific jigs etc. which are not a part of this quotation. LightLab will send one engineer to the client's facility after receipt of L/C for discussions on the proposed laboratory setup. This is an option that must be specified at time of order.



## LightLab A100 A type Intensity Distribution Photometer.

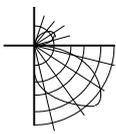
### F. A100 photometer summary:

#### The A100 comprises:

- A100 A type goniophotometer with single section superstructure
- Remote photodetector tower and locating plate
- Built in wall mounted leveling laser and system alignment laser
- Thermally stabilised photodetector and 5 ½ digit display
- Computer, computer interface and control and measurement instrumentation in laboratory grade instrumentation rack
- Computer software for control of goniometer and report creation
- Installation and training
- All instruction manuals
- Warranty for 1 year

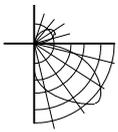
#### Options

| <i>Item</i> | <i>Description</i>  | <i>Qty</i>     |
|-------------|---|----------------|
| MaintA100   | <b>Maintenance contract</b><br>LightLab will maintain and service the goniophotometer system upon expiry of the warranty. Maintenance includes annual calibration, software updates, training courses and servicing where required.   | 1              |
| ReflexA100  | <b>Reflex Measurement System</b><br>System for precision measurement of retroreflective devices. Integrates into A100 system.   | 1              |
| PendA100    | <b>Hand controller</b><br>Remote joystick controller with two axes of movement for positioning table and tilt arm axes.   | 1              |
| TowerA100   | <b>Photodetector tower</b><br>One tower is supplied standard with the goniometer, additional towers can be used to reduce setup time when changing test distances.  | 1              |
| ReportA100  | <b>Report processing software</b><br>Each of the report processing modules for the international standards (ECE / JIS / SAE / traffic lanterns / marine) is available as an option.   | 1              |
| SpecA100    | <b>Colour measurement system</b><br>Full spectrum spectrometer fully integrated into the A100 measurement system. Allows measurement of colour for standards requirements.  | 1              |
| LISA100L    | <b>Luminous Intensity Standard Lamps – LightLab</b><br>One set of three intensity standard incandescent lamps, medium bi-post base, 110V 1000W including one 4 contact kelvin socket. Used for intensity calibration of the photometer. Lamps come serialized and with LightLab (NML) calibration certificates. | Set of 3 lamps |



## LightLab A100 A type Intensity Distribution Photometer.

|           |   |                  |
|-----------|---|------------------|
| LISA100   | <p><b>Luminous Intensity Standard Lamps – NML</b></p> <p>One set of three intensity standard incandescent lamps, medium bi-post base, 110V 1000W including one 4 contact kelvin socket. Used for intensity calibration of the photometer. Lamps come serialized and with National Measurement Laboratory (NML) calibration certificates.</p>                                    | Set of 3 lamps   |
| LRSIA100  | <p><b>Relative Spectral Irradiance Standard Lamps</b></p> <p>One set of three spectral irradiance lamps for calibration of relative spectral irradiance of the colour measurement system, E27 base, 24V 60W. Used for spectral calibration of the colour measurement system. Lamps come serialised and with National Measurement Laboratory (NML) calibration certificates.</p> | 1 set of 3 lamps |
| LRSIA100L | <p><b>LightLab Relative Spectral Irradiance Standard Lamps</b></p> <p>One set of three spectral irradiance lamps for calibration of relative spectral irradiance of the colour measurement system, E27 base, 24V 60W. Used for spectral calibration of the colour measurement system. Lamps come serialised and with LightLab calibration certificates.</p>                     | 1 set of 3 lamps |
| LMFA100   | <p><b>Sample Mounting Fixtures</b></p> <p>Fixtures for attaching samples to the table of the photometer. Due to the wide range of sample types these will be built to specification.</p>  | 1                |
| PTA100    | <p><b>Printer</b></p> <p>HP Laserjet 1200 1200 DPI laser configured for LightLab software or HP Deskjet Cxi960 colour inkjet printer. Other printers available on request.</p>  | 1                |
| TIPreA100 | <p><b>Pre-Installation Inspection</b></p> <p>LightLab will provide one engineer for a 3 day pre-installation visit to inspect and arrange installation of the laboratory.</p>   | 1                |
| TIExA100  | <p><b>Training &amp; Installation Extensions</b></p> <p>LightLab will provide training and installation service of 3 days and 1 week respectively as part of the core service. This option allows extension of the training and installation to your requirements.</p>  | 1                |
| PhotA100  | <p><b>Photocell</b></p> <p>Choose from a range of precision photocells to increase the accuracy of measurement for the goniometer system. The characteristics and upper limits of operation for the CIE parameters common to all of the photocells are listed in the photocell table below. Other CIE parameters determined at request of client.</p>                           | 1                |
| FiltA100  | <p><b>Coloured and Neutral density filters</b></p> <p>For calibration of the photocell according to the method of CIE Pub 24. This allows field verification of the system performance in terms of spectral response and linearity.</p>   | 1                |
| 2yA100    | <p><b>2 year warranty</b></p> <p>This option gives a one year extension to usual one year system warranty, total 2 years.</p>   | 1                |



## LightLab A100 A type Intensity Distribution Photometer.

| Characteristic                        | Symbol for associated error parameter | Maximum Value         |
|---------------------------------------|---------------------------------------|-----------------------|
| V( $\lambda$ ) match                  | f1                                    | 1.5 %                 |
| Cosine Response                       | f2                                    | -                     |
| Linearity                             | f3                                    | 0.1%                  |
| Error of display unit                 | f4                                    | 0.2 %                 |
| Fatigue                               | f5                                    | 0.2%                  |
| Evaluation of modulated light         | f7                                    | -                     |
| Polarization dependence               | f8                                    | -                     |
| Influence of non-uniform illumination | f9                                    | 1.0 %                 |
| Range change                          | f11                                   | 0.1%                  |
|                                       |                                       |                       |
| UV response                           | U                                     | 0.2%                  |
| IR response                           | R                                     | 0.2%                  |
| Temp. dependence                      | A                                     | 0.2 % / K             |
|                                       |                                       |                       |
| Responsivity                          |                                       | 30, 60 or 120nA / lux |

Photocell Table 1 – for CIE parameters not listed here please contact LightLab for specifications