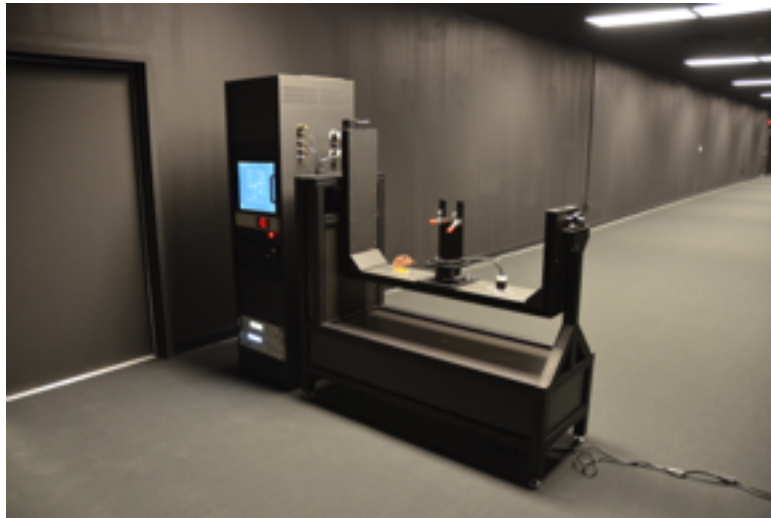


# Type A Goniometer



## **A-type Goniometer used to measure automotive and signal lighting, and retroreflectors**

Over 35 years of leadership in light metrology enables Labsphere to offer the A-type Goniometer.

The A-type Goniometer delivers easy operation with accurate results in the space of a A-type. State-of-the-art hardware and control, coupled with sophisticated data collection provides an easy and practical fully-automated test system for testing automotive lamps to SAE, ECE and JIS standards, testing retroreflectors, as well as generating IES-A files.

The high value, high performance of the A-type Goniometer can significantly cut your development time while saving time a cost by not having to send your lighting products out for third party testing. All the while protecting your IP throughout development by managing test and characterization in house.

## Labsphere Goniometer Benefits Summary

- The Goniometer is designed for testing automotive lamps, reflex, license lamps and heavy truck lamps, suitable for SAE, ECE, JIS and other International automotive standards.
- Create complete test reports with pass/fail criteria shown for all points and zones as necessary, including report of re-aimed test points.
- For luminaire tests, easily create the IES data formatted files compatible with leading design and data analysis software tools for creating detail reports in industry standards.
- Complete turnkey solution including Goniometer, optometer and photodiodes, optional CCD spectrometer, control rack and electronics, temperature sensors, lamp standard, computer and preprogrammed control software, display, and keyboard and mouse
- The detector remains at a fixed height in reference to the lateral axis of the device under test (DUT). During the test; the DUT rotates about the horizontal and vertical axis on an A Type Coordinate system; when measuring luminaires includes automatic transfer of Type C Data Formats.
- System can be designed for lengths as short as 20 feet and as long as 100 feet (for full certification of results.)
- Limited field of view spectral sensor for reducing stray light.
- Includes interchangeable optical density that allow test over a high dynamic range of lamp intensities.
- Optometer and photodiode allow for very precise measurement ranges, as low as 0.01 cd and as high as 10,000,000 cd.
- Fixed and auto ranging CCD spectrometer for spectral intensity and color uniformity, or tristimulus detector options.
- Automatic dark current compensation reduces errors, boosts accuracy
- Includes NIST traceable Spectral Intensity standard for user calibration at any time
- Machines grid pattern mounting plate and vertical table accessory make mounting many different lamp types and sizes quick and easy.
- Precision drives providing unrivaled accuracy
- High-speed data collection and point-to-point options for accurate data collection
- Temporal stability data for measured thermal, photometric and electrical data
- High-quality construction delivers years of trouble-free performance
- An extremely strong steel framework allows the safe attachment of heavy luminaires
- Backed by Labsphere., the foremost producer of light metrology systems.

## **Goniometer COMPONENTS**

The A-type Goniometer consists of four basic components:

### **Lamp Swing-Arm and Support Structure**

The height of the test luminaire or lamp is fixed on a -180,+180 degree rotating lateral horizontal axis. The arm rotates in circles around the vertical axis, eliminating constant repositioning of the test item to different heights.

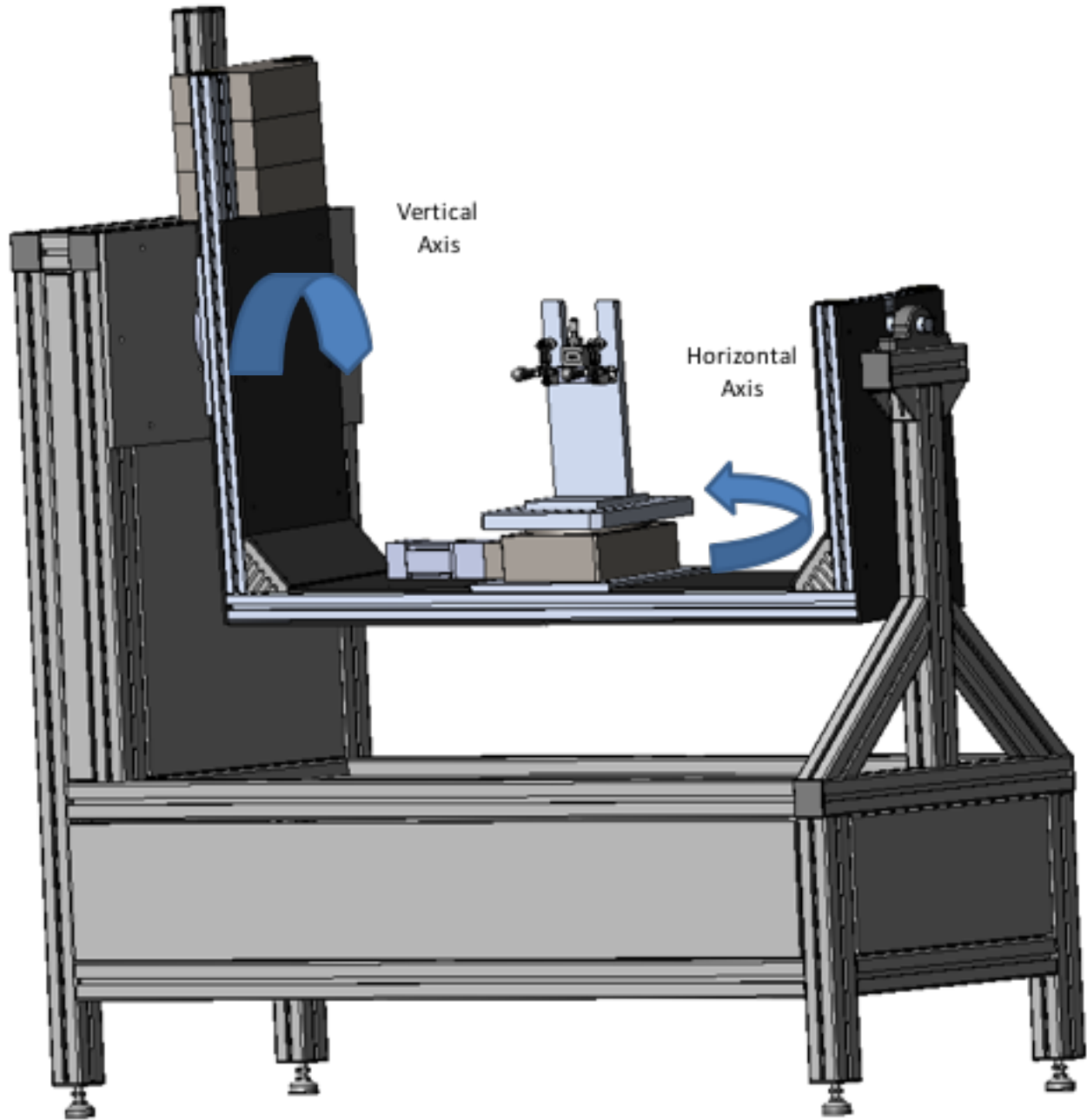
This component holds the DUT during testing and includes the sensor support on a rail, swing-arm, the rotating DUT mounting fixtures, power connections and the temperature sensors

### **Goniometer Integrated Console**

This unit contains all of the system's electric and electronic equipment including main power switches, power supplies, power analyzer, motor controllers and computer and computer interfaces.

### **Computer Station**

This includes a computer and the Goniometer control software to control the operation and data collection functions of the Goniometer during testing. All information controlled and collected are displayed on the computer monitor. Additional automated software produces IES-A and Excel Files for full data analysis.



## COMPONENT FEATURES

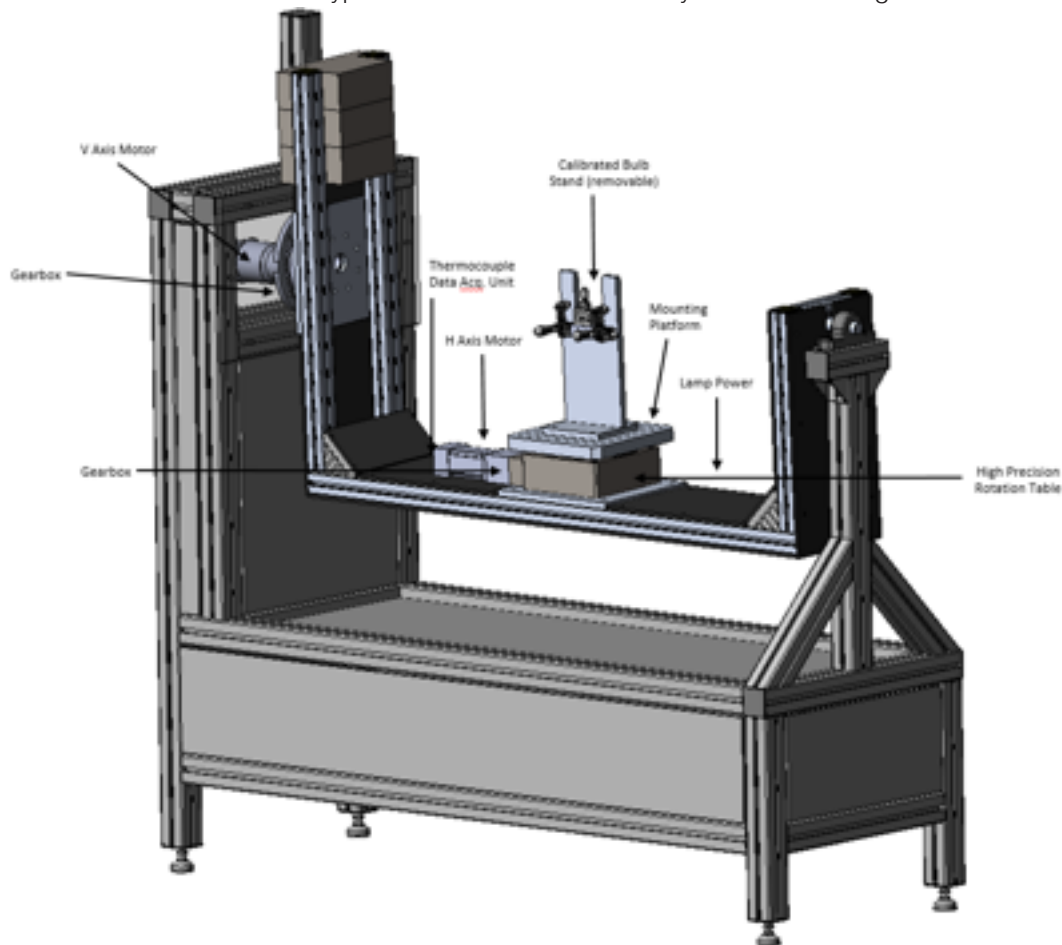
### Lamp Swing-Arm and Support Structure

The main vertical swing-arm and lateral access mounting assembly are all engineered and manufactured to produce the most stable test platform available. Precision assembly ensures that the lamp swing-arm is balanced to provide for continuously accurate alignment throughout all rotational positions.

The DUT or lamp is mounted at a height in the center of the DUT lateral axis and reference to the detector optical axis throughout the test. The DUT rotates about the vertical axis in reference to the fixed sensor.

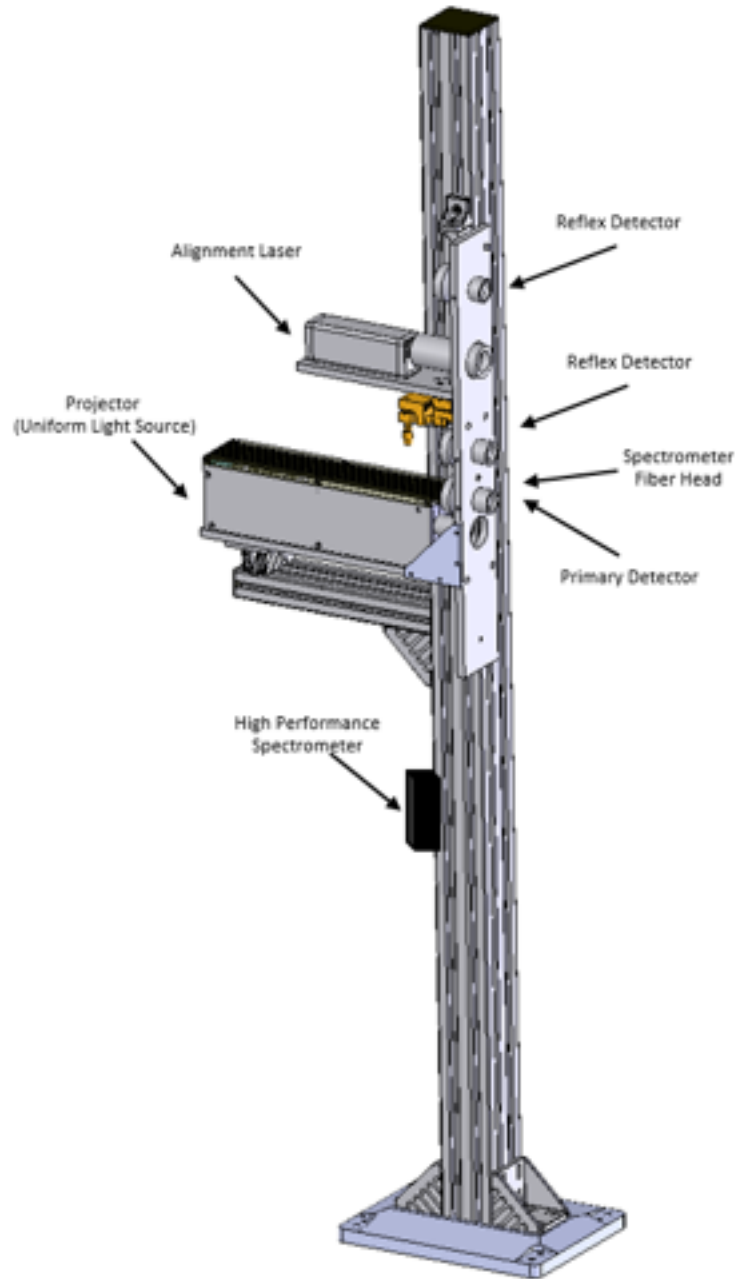
The DUT is positioned at the Goniometer's vertical axis which allows the Goniometer to accommodate a variety tall fixtures up to 0.6 meter. Because the width of the height of the DUT support and lateral axis is 1.2m, light loss due to shadowing is kept to an absolute minimum.

Precision digital motors are coupled to the vertical axis shaft and the DUT rotation shaft, and are constantly monitored by the system's homing sensor, ensuring that swinging arm position and the luminaire angles are precise throughout the test sequence. Resolution of each motor of the A-type Goniometer is an extremely fine @ 0.01° degrees.



## Detector Tree

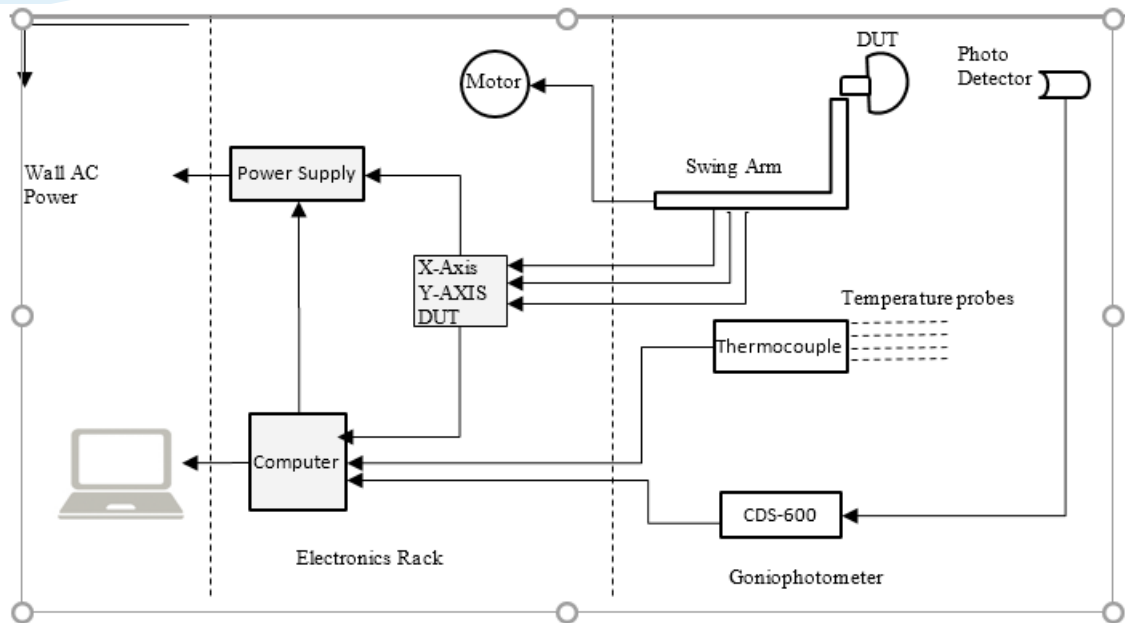
The detector tree contains all components needed to measure the intensity and color of the DUTs under test. The primary detector is mounted at the centerline of the optical system, while the reflex detectors are mounted at the proper angular heights to report off-axis reflex as required.



Control rack houses all of the automation and controllers to operate the Goniometer. Contained within the control rack are the computer, the power supplies, the safety system, the power analyzer, computer monitor, keyboard and mouse.

## Computer Control Rack





## Photometric Measurement System

The photometric test equipment consists of an optometer and one more detector heads (number of heads depends on options chosen.) Optometer is an 8 channel high precision light meter. Measures all 8 channels independently with a wide dynamic range. May be specified with standard 2ms-10ms slew rates, or for pulse measurement and high speed read on the fly may optionally be configured with 1 ms slew rate. Able to measure 10 true decades of range while adjusting the integration time from 1 ms to 999s, measuring from 0.1 pA to 2mA of signal in 12 bit resolution. Detector heads are custom machined, optically enhanced silicone detectors for high sensitivity to read ultra low light levels less than 1cd at 100' test distance with integral photopic filter. The high quality, Si-photodiode is carefully matched to the photometric DIN and CIE  $V(\lambda)$  nominal curve using a multilayer optical correction filter. The  $V(\lambda)$  matching of the luminous flux measurement head generally corresponds to the DIN-5032-T7 quality class B or better.

The measurement range of optometer combined with light detector is calculated by the measurement range specification of the optometer and the responsivity of the detector head as follows:

- Offset signal  
= Maximum Resolution = meter current offset signal / detector sensitivity  
*Sample: 0.1 pA (0.1E - 12 A) / 3 nA/(mW/cm<sup>2</sup>) (irradiance detector) = 0.33 nW/cm<sup>2</sup>*
- Minimum measurable irradiation  
= offset signal \* signal to noise ratio factor  
*Sample: 0.33 nW/cm<sup>2</sup> \* 50 = 17 nW/cm<sup>2</sup>*
- Maximum measurable irradiation \*  
= max. signal current detector / detector sensitivity  
*Sample: 1 mA (10E - 3 A) / 3 nA/(mW/cm<sup>2</sup>) = 333333 W/cm<sup>2</sup>*
- Display range  
= Offset signal to maximum measurable signal  
*Sample: 0.33 nW/cm<sup>2</sup> to 333333 W/cm<sup>2</sup>*
- Measurement range  
= min measurable irradiation to maximum measurable irradiation  
*Sample: 17 nW/cm<sup>2</sup> to 333333 W/cm<sup>2</sup>*



### **Spectrometer Sensor (optional)**

The sensor is Ocean optics Flame CCD array spectrometer. The highly sensitive CCD Array Spectrometer offer low noise and a broad spectral response with calibrated ranges from 200 to 850 nm. For use with A-type Goniometer it is used for the visible range of 380 to 780nm. When coupled with an A-type Goniometer the spectrometers avoid the inherent photometric errors associated with filter-based photometers by correcting measurements to f' near 0%; The multi-channel spectral analyzer is designed for real-time spectral analysis. The instantaneous spectral acquisition provides the radiometric, photometric, and color characteristics of the lamp or luminaire. The fast results help to maintain high scan rates, excellent linearity and low drift, and is housed in a shielded chamber. The optical fiber field of view helps to exclude stray light not emitted directly from the luminaire itself. This serves to block stray light from room surfaces, by allowing the optical fiber to collect light only from the intended source.

The housing has a thread end compatible with the 2.54 cm optical density filters included with system. The optical filters can be thread onto the housing in the beam path. Filter correction are applied in software. The optical filters allow for attenuation of high intensity lamps from saturating the sensors, increasing the sensitivity and dynamic range of the system.

The optical fiber sensor can be moved along the optical rail to change the distance between the sensor and the vertical rotation axis of the system. Industry recommendations for keeping in the far field for Goniometer is 5x the area of illumination. In most cases it is not necessary to move the sensor distance from it fixed position.

The spectrometer is calibrated for spectral intensity. The spectral intensity is used to determine color distribution. The spectrometer can be calibrated at any time by the user using spectral intensity lamp standard provided with the system. Dark correction is measured during calibration with the standard lamps and applied with very measurement thereafter.

The spectrometer is housed in the Goniometer detector tree structure. It is interfaced to the Goniometer console computer via USB or Ethernet.

## **Goniometer Console**

This component contains all of the system's electrical and electronic controls. Main power switches and a test primary lamp voltage input, power analyzer and computer are included in the Goniometer console. A single bundles cable is routed between the

### **Three options are available:**

Option 1: DC power Supply, no Power Analyzer: This option the Chroma 62006P-300-8 DC Power supply is included and mounted in the console. The lamp power can come from the Chroma 61603 DC Power supply, main line or an independent external power supply. If from the Chroma 61603, the power to the lamp is control via the system control software. The voltage to the lamp is routed can be routed the console directly to the lamp, independent of the console.

Option 2: DC power Supply and Power Analyzer: This option the Chroma 62006P-300-8 DC Power supply and the Yokogawa WT 310E power analyzer is included and mounted in the console. The lamp power can come from the Chroma 62006P-300-8 AC Power supply, main line or an independent external power supply. If from the Chroma 62006P-300-8, the power to the lamp is control via the system control software. The current from the power supply is routed through the power analyzer.

Option 3: DC Power supply, AC power supply and Power Analyzer: This options includes a Chroma 62006P-300-8 DC Power supply, Chroma 61603 AC Power supply and the Yokogawa WT 310E power analyzer is included and mounted in the console. The lamp power is fully computer controlled for either AC or DC operation, with automatic relay switching to deliver the right voltage to your lamp.

A Yokogawa power analyzer meter is installed which incorporates a large digital display of volts, amps and watts. The meter measures the exact lamp characteristics by use of remote sensing leads to the test luminaire. Measurement of Power Factor and Total Harmonic Distortion are available.

## **Computer and Software**

The functional heart of the A-type Goniometer is the computer hardware and software which control the system's entire operation. Virtually all functions of the system are computer automated including the vertical arm rotation. lamp/luminaire rotation, selection of data points and the recording of data.

The computer system provided with the A-type Goniometer consists of MS Windows- based equipment totally configured and integrated to provide full system operation, data collection, processing, fully licensed Microsoft Excel and data file outputs.

### **Control Software**

Comprehensive software controls the operation of the A-type Goniometer and gathers the appropriate test data for the particular type of DUT being tested. Standard test formats for most automotive tests from SAE, ECE and JIS, and may be created and saved by the test operator from easy-to-use menus. All supplied test sets can be customized per the customer as well as created per customer requirements.

The software is MS Windows 7-based. It allows automatic or manual operation of the system, with pre-stored horizontal (lateral) and vertical angle formats for commonly-used test procedures. Test data are automatically collected and stored in PDF files or IES-A data formats.

### **Data Processing Software**

Upon completion spectral intensity spatial scans of the lamp or luminaire the data is processed to compute luminous intensity, x, y, and CCT and save it in IES-A data format for data analysis. (This option is only available when the spectrometer option is included.) Data can be exported to external spreadsheet software where the spectral intensity at every angle as well as intensity and color are reported.

### **Data Presented During Scans**

- Intensity (candlepower)
- CCT
- Chromaticity x and y
- Set and actual angles
- Sensor saturations levels
- Axial plot
- Iso-candela Plot
- Birds Eye Plot

### **IES Formats**

Labsphere's software supports IES-A testing formats for analysis and reporting.

### **Lamp and Luminaire Size**

See Specifications: Custom-designed equipment to handle or mount different luminaire sizes and to fit customer's specific DUTs also available. Please request information. Standard size A-type can handle luminaires up to 1.2m tall x .06m wide and a weight up to 10 kg (greater weight can be tested, please request at time of order higher max weight to support your needs.)

### **Standard Lamps**

A standard lamp is included and are calibrated in Labsphere's industry leading light metrology labs reference to a NIST reference standard. Optional additional lamps are available in sets of three.

The standard lamps are calibrated for directional spectral intensity. Software routines are provided for user-selectable Goniometer calibration. Calibration routine is fully automated and logged for traceability to standards.

## INCLUDED ITEMS

### Hardware:

- A Goniometer supporting the main vertical swing arm and horizontal shaft.
- The vertical swing arm motor, temperature monitor, and spectrometer are enclosed in the base of the black framed Goniometer chassis.
- A precision rotating vertical axis incorporating +/-180° rotation of the arm around the DUT emitting surface.
- A precision rotating horizontal (lateral) axis incorporating +/-90° rotation fitted with a low profile lateral (horizontal) axis enclosed with black metal sheathing.
- A horizontal framework holding a lateral shaft, onto which are attached plates for mounting of the DUT from above or below.
- Means for adjusting the depth of the horizontal arm which holds the vertical shaft and DUT, using locking rail system.
- Vertical rotation drive motor, which is a high-precision digital stepping motor operating under computer control, manually or automatically.
- Lamp/luminaire rotation drive motor, which is a high precision digital stepping motor operating under computer control, either manually or automatically.
- A high dynamic range spectrometer calibrated for spectral intensity over the visible spectral range. (optional)
- A housing for the optical fiber and optical density filters.
- Ambient and DUT optical thermal sensors
- Optical Density filter set
- Spectral Intensity lamp standard and mounting fixture
- Edison Lamps Base (optional)
- A console housing incorporating:
  - A Windows-based computer system and display with wireless keyboard and mouse
  - Goniometer electronic interface
  - DC Power supply
  - Optional AC power supply
  - Optional Digital Power Analyzer
  - Emergency off "panic" button (three, one on control rack and two on the Goniometer base)

**Software:**

All software is Windows based.

Standard data collection software package, offering:

- Automatic or manual operation
- Automated and manual control of vertical rotation
- Automated and manual control of lamp/luminaire rotation
- Selectable vertical angle intensity steps
- Selectable lamp/luminaire rotation increments and angles
- Output in industry standard format (IES) or PDF file formats
- Single readings mode with the capability to input the desired vertical and lamp/luminaire angular location, with automatic rotation to selected angles
- Fully automated calibration software routines using standard lamps calibrated for directional spectral intensity.
- LM-79 stabilization routine
- Temporal graphing data
- Operator selectable data collection vertical angles. Specify starting and ending angles, and step increment. Step increment as small as 0.01 degrees.
- Operator selectable luminaire horizontal angles. Specify starting and ending angles, and step increment. Step increment as low as 0.01 degrees.
- Output in industry standard format, or format compatible with Excel spreadsheet.

## SUMMARY OF TECHNICAL SPECIFICATIONS

Measurement Method	Far field
Type	A-type. Description in Appendix.
Axis	V-plane axis automated, H-axis rotation automated
Operation	Fully Automated save loading lamp samples and align process
Shipping weight	~300kg
Area occupied by Goniometer	<1.7m x 0.75m x 1.5m (control rack 0.56m x 0.64m x 2m)
Sensor Distance	10m to 33m
Device Limit Size	1.2m x 0.6m
Spectrometer	Ocean Optics Flame
Max Lamp weight	~51kg (heavier is available as needed)
Wire routing route their	Axial feedthrough for system cabling and to allow customer to own source cables when needed
Electric connections	90-240VAC, 15A, 50- 60-Hz
Power Analyzer Voltage Range	12VAC - 240 VAC <+/- 0.2V
Power Analyzer Current Range	0A - 3A (Avg: +/- 0.1mA)
Power Analyzer Power Range	0W - 200W (Avg: +/- 0.001W)
Electrical measurements	Lamp Power factor, voltage, and current
Lumen	1 - >10000
Intensity Range (cd)	0.01 to >1,000,000
Color Temperature	1000K to 10,000K +/-35K (with spectrometer option)
CRI	0-100 +/- 0.7 (with spectrometer option)
UI	Interface(s) to entering control and test parameters and display measurement results
Operating System	Windows 7
Angular Rotation	
Angular Resolution	0.01 degree /step
<b>Report Inputs</b>	Can assume symmetry in distribution: Minimum of 2 C-planes (orthogonal to each other) should be measured to predict symmetric LID
	Report Generator per LM-79 with option to include user logo (productivity in reporting)

Report Inputs

Descriptive Informations

- a) Date and testing agency
- b) Manufacturer's name and designation of product under test
- c) Lamp category
- d) Lamp or Luminaire
- e) Ambient Temperature
- f) Power factor
- g) THD
- h) Current
- i) Voltage
- j) Warm up
- k) Lumen
- l) Lamp Characteristics based on lamp type
- m) Measurement quantities measured (angles, luminous intensity, total luminous flux, luminous efficacy, etc.)
- n) Rated electrical values (AC (frequency) or DC) of product tested
- o) Total operating time of the product for measurements including stabilization
- p) LM-79 stability procedure using intensity measurement at a fixed point. Ability to save warmup intensity data.
- q) Ambient temperature
- r) Orientation (burning position) of product during test
- s) Photometric method or instrument Goniometer
- t) Designation and type of reference standard used (wattage, lamp type, intensity distribution type - Omni-directional/directional
- u) Correction factors applied (e.g. spectral mismatch, intensity distribution, etc)
- v) Photometric measurement conditions: photometric distance.
- w) Measured total luminous flux (lm) and input voltage (V), current (A), and power (W) of each SSL product
- x) Luminous intensity distribution (IES.net)
  - i. Peak intensity
  - ii. Cone Illuminance
  - iii. Beam angle
- y) Color quantities (chromaticity coordinates, CCT, and CRI with tristimulus)
- z) Spectral power distribution
- aa) Color Uniformity
- bb) Bandwidth of spectroradiometer
- cc) Equipment used
- dd) Statement of uncertainties (Labsphere) Deviation from standard operating procedures, if any
- ee) Designed with full scale stray light correction routine (accuracy)

Data Format

\*.PDF Report, \*.IES IESNA, and \*LDT

Traceability (where applicable)

NIST

## OPTIONAL EQUIPMENT

Available optional equipment consists of individual accessories or complete systems providing enhanced capabilities.

### PART NUMBER

### DESCRIPTION

AA-01305-000

A TYPE GONIOMETER

#### OPTIONS

AA-01305-001

Reflex Single Angle

AA-01305-002

Reflex Three Angles

AA-01305-003

License Lamp

AA-01305-004

Thermocouple Integration

AA-01305-005

Color Measurement (Spectrometer)

AA-01305-006

Color Measurement (Tristimulus)

AA-01305-007

Pulsed measurement option for flashing light

### INSTALLATIONS

AA-01308-000

Installation – North America

AA-01308-001

International Installation – Western Europe

AA-01308-002

International Installation – Eastern Europe

AA-01308-003

International Installation – Latin America

AA-01308-004

International Installation – Africa South of Sahara

AA-01308-005

International Installation – North Africa, Southwest Asia

AA-01308-006

International Installation – Southern Asia

AA-01308-007

International Installation – Eastern Asia

AA-01308-008

International Installation – South Pacific

### ACCESSORIES

AA-01309-000

NIST Calibrated Sources

AA-01309-001

Remote Control and Monitoring (up to 3 machines)

AA-01309-002

Safety Light Curtain (May increase with room setup)

AA-01309-003

AC Power Supply

### EXTENDED WARRANTIES

AA-01310-000

Software (12 Months)

2% of Invoice

AA-01310-001

Parts Only (12 Months)

5% of Invoice

AA-01310-002

Parts and Labor (12 Months)

7% of Invoice

AA-01310-003

Part and Labor w/1 week service (12 months)

10% of Invoice

AA-01310-004

Software (24 Months)

3.5% of Invoice

AA-01310-005

Parts Only (24 Months)

9% of Invoice

AA-01310-006

Parts and Labor (24 Months)

13% of Invoice

AA-01310-007

Part and Labor w/1 week service (24 months)

18% of Invoice



## EXTENDED DESCRIPTION OF OPTIONAL EQUIPMENT

Available optional equipment consists of individual accessories or complete systems providing enhanced capabilities.

Reflex Measurement (Single Axis and Three Axes) – Enable the capability to measure reflex reflectors, warning triangles or reflective materials. Includes a projector to create uniform light on test sample, one or three detectors and an illuminance detector head for measuring the projected beam illuminance.

License Lamp – Enables the ability to measure luminance and color of license lamps (customer supplied mounting fixture.)

Thermocouple integration – Allows for measurement of ambient and 6 user applied thermal couple positions. Records automatically for testing, can be used to trigger stabilization and can be used in graphical monitoring tests. Type J, K or T thermocouples per user request.

Color Measurement – Provides ability to measure color of lamps, measure color over angle and to create color IES files. Able to choose spectrometer or tristimulus option for color measurement. Tristimulus measurement uses an RGB detector for measurement of the illuminance and luminous color. Its photometric responsivity and the cosine field of view function of the Y-detector correspond to the DIN 5032- Article 7 quality class B. Instead of the red, green and blue receptors found in the human detector is equipped with four photodiodes. Separation of the x function in x-short and x-long photodiode enables the detector to guarantee outstanding measurement results when combined with blue dominant light spectra.

Pulse Measurement – Enable the ability to measure flashing lights to SAE requirements, conspicuity and anticollision.. Can measure aircraft or automotive flashing lights. Can handle random or fixed period flashing lights. More details for test algorithms available upon request.



Remote Monitoring – Enable to user to view and operate software and machine movement from a remote location. Includes remote monitor, keyboard and mouse in addition to camera's and a monitor to view camera's. Allows for safe remote operation of equipment.

The A-type Goniometer, with options, meet the applicable requirements of the following standards and recommended practices:

### **Commission International de l'Eclairage**

CIE Publication no. 121. The Photometry and Goniophotometry of Luminaires CIE Publication no. 70. The Measurement of Absolute Intensity Distributions

### **Illuminating Engineering Society of North America:**

- IES LM-75-01 Goniometer Types and Photometric Coordinates

### **Automotive Test Specification**

Goniometer comes with the following applicable tests, others can be added as specified by customer.

- SAE J1395, J2039, J914, (Backup, Tail, Stop, CHMSL, Side Marker, Fog, Headlamp, Position, Warning and Side Marker lamps)
- DOT C4, C3, C2 (Conspicuity testing)
- ECE 98, 113, 112, 23, 7, 6 (Backup, Tail, Stop, CHMSL, Side Marker, Fog, Headlamp, Position and Side Marker lamps)
- JIS (Motorcycle low and high beam)

Sample Test Report

Labsphere

Test number: 3,116  
 Date/Time: 7/18/2016 8:25:58 PM  
 Operator: Matt Sommers  
 Part number: 001  
 Sample number: 1  
 Cavity number: 2  
 Description: Stop Lamp (1 Lighted Section)  
 Specification: SAE J586 FEB84  
 Voltage: 6.1926  
 Current: 18.1956  
 Bulb type: 881  
 Orientation (H/V): H  
 Warm up time (min:sec): 0:00.0  
 Ambient temp: 30.6°C  
 This is a test report.

Luminous Intensity, Candela

Test Points Degrees		Measured	Required	
			Minimum	Maximum
10.00U	5.00L	912,240 Cd*	16	300
10.00U	5.00R	912,240 Cd*	16	300
5.00U	20.00L	977,385 Cd*	10	300
5.00U	10.00L	977,385 Cd*	30	300
5.00U	V	977,385 Cd*	70	300
5.00U	10.00R	977,384 Cd*	30	300
5.00U	20.00R	977,384 Cd*	10	300
H	10.00L	1,000,001 Cd*	40	300
H	5.00L	1,000,000 Cd*	80	300
H	V	1,000,001 Cd*	80	300
H	5.00R	1,000,001 Cd*	80	300
H	10.00R	1,000,000 Cd*	40	300
5.00D	20.00L	977,385 Cd*	10	300
5.00D	10.00L	977,385 Cd*	30	300
5.00D	V	977,384 Cd*	70	300
5.00D	10.00R	977,384 Cd*	30	300
5.00D	20.00R	977,384 Cd*	10	300
10.00D	5.00L	912,240 Cd*	16	300