

HIGHT SPEED MOVING MIRROR GONIOPHOTOMETER

Over thirty years of continuous design refinements, software development and practical day-to-day usage enable Lighting Sciences Inc. to offer the High Speed Moving Mirror Goniophotometer as the standard of the lighting industry.

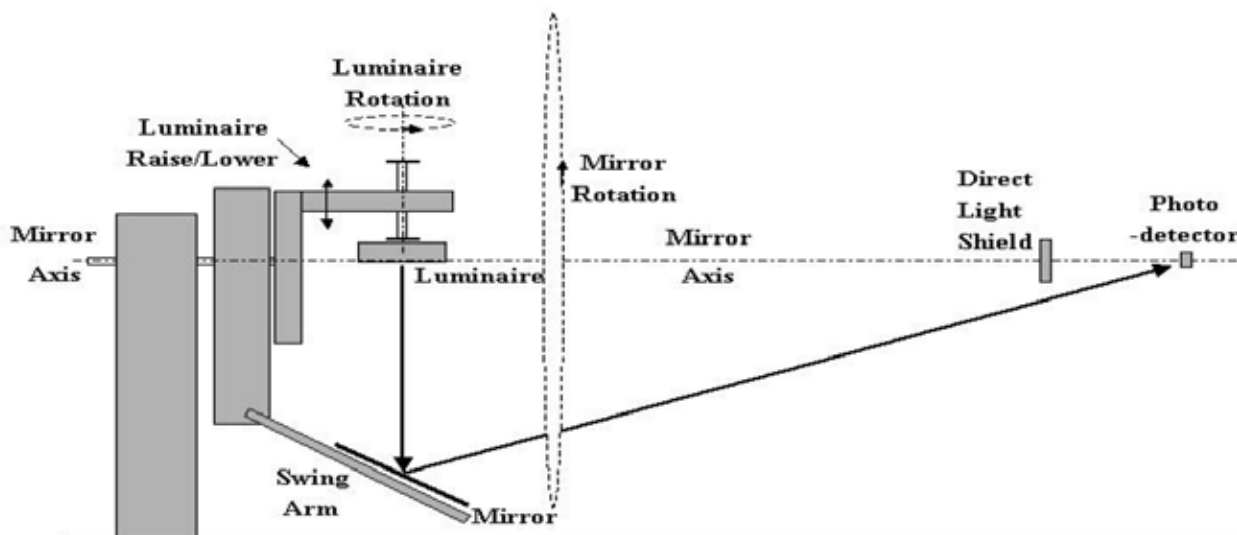
With truly unequaled speed, accuracy and functionality, LSI's photometric equipment is the most sophisticated available. Our clients know this is true, such that every major American lamp manufacturer has acquired Lighting Sciences' goniophotometers.

LSI's High Speed Moving Mirror Goniophotometer delivers fast operation with accurate results no matter what type of lamp or luminaire test may be required. State-of-the-art computer hardware, coupled with sophisticated data collection and analysis software, provide a fully-automated test system. The equipment meets all applicable CIE and IESNA requirements.

The performance of the High Speed Moving Mirror Goniophotometer is dramatically fast. Thanks to the unique electronic characteristics and computerized controls of the system, data collection can be accomplished in a fraction of the time needed by most conventional goniophotometers. (Typically 3 minutes for indoor luminaires, 11 minutes for outdoor luminaires.)



The mirror runs at speeds up to 6 rpm, and readings can be collected at the rate of 10,000 or 12,000 per second. This allows integration over a 50 to 60 Hz (user selectable) waveform to overcome any AC ripple. It also ensures proper capturing of even the narrowest intensity peaks.



GONIOPHOTOMETER COMPONENTS

The CIE type C High Speed Moving Mirror Goniophotometer consists of four basic components:

Mirror Swing-Arm and Support Structure

This component holds the test luminaire or lamp during testing and includes the support tower, mirror, swing-arm and luminaire mounting fixtures. The structure can be manufactured in several sizes, depending on the maximum size of item to be tested.

Photodetector Tower

A specially shielded unit houses the high-sensitivity photodetector used to obtain the photometric data. A rotating aperture mask that is sequenced with the mirror removes stray light. The photodetector is connected to a specially designed “Signal Maximizer” amplifier circuit, which automatically adjusts the system sensitivity or gain settings to ensure the highest possible accuracy throughout the test. A three-amplifier system is provided for exceptional dynamic range. The data are relayed to the computer interface through three 16-bit analog-to-digital converters.

Goniophotometer Integrated Console

This unit contains all of the system’s electric and electronic equipment including main power switches, test lamp voltage adjustment, motor controllers and computer interfaces.

Computer Station

This includes a Windows 7 computer and the photometric software to control the operation and data collection functions of the High Speed Moving Mirror Goniophotometer during testing. (Windows XP upon request) Additional software produces all forms of required reports and graphs (e.g. IES, CIE formats) and custom software packages.

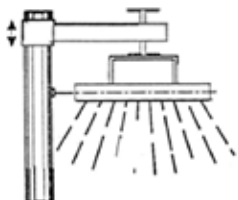


Figure A: Downlight Conversion

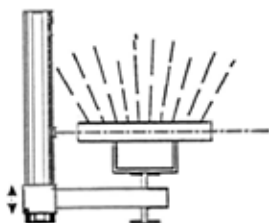


Figure B: Uplight Conversion

BENEFITS SUMMARY

- High-quality construction delivers years of trouble-free performance
- Precision digital drives provide unrivaled accuracy
- Luminaire remains at a fixed height during the test; mirror rotates around luminaire.
- Eliminates errors due to thermal effects in laboratory for temperature sensitive lamps such as fluorescent and LED’s.
- “Signal Maximizer” circuitry with three amplifiers enhances system sensitivity, dynamic range and accuracy
- 16-bit analog-to-digital converters
- Computer system avoids error-prone operator inputs
- Luminaire mounting system lowers to average chest height. Avoids hazardous “step-ladder” operations
- Attention to detail in design and appearance
- Automatic dark current compensation reduces errors, boosts accuracy
- Rotating aperture mask in front of photodetector allows only light from the mirror to enter. Room reflections are almost entirely eliminated
- Unmatched software selection for any test situation with the convenience of using the test data with nearly any design and analysis software
- Luminaire hard-wire power connections eliminate wear and electrical resistance errors inherent with slip-ring systems
- High-speed data collection - needs only a fraction of the time required by competitive systems. Mirror speed up to 6 rpm.
- Backed by the foremost producer of mirror goniophotometer systems in North America
- Compliant with all applicable requirements of IES LM-79-08 and LM-80-08 for LED luminaire testing and Energy Star testing for U.S. Dept. of Energy and EPA.

SUMMARY OF TECHNICAL SPECIFICATIONS

Model 6220 (0.6 m × 0.6 m luminaire size)

- Required ceiling height: Approximately 2.8m (9.1 ft.), plus clearance
- Required room width: Approximately 2.8m (9.1 ft.) for 360° rotation system, plus clearance.
- Required room length: Depends on test distance. Approximately equal to required test distance, most commonly 3 m. (10 ft.).
- Total vertical travel of lamp/luminaire for mounting purposes (motorized): approximately 70cm (2.8 ft.).
- Approximate mirror size: 0.7 x 0.8m. (26 x 30 ins.) for 3 m test distance. Rectangular.

Model 6240 (0.6 m × 0.2 m luminaire size)

- Required ceiling height: Approximately 4.3m (14.0 ft.), plus clearance
- Required room width: Approximately 4.3m (14 ft.) for 360° rotation system, plus clearance.
- Required room length: Depends on test distance. Approximately equal to required test distance, most commonly 8 m. (26 ft.).
- Total vertical travel of lamp/luminaire for mounting purposes (motorized): approximately 1.5m (5.0 ft.).
- Approximate mirror size: 1.1 x 1.4m. (43 x 55 ins.) for 8 m test distance. Octagonal

Model 6440 (1.2 m × 1.2 m luminaire size)

- Required ceiling height: Approximately 5.4m (17.8 ft.), plus clearance
- Required room width: Approximately 5.4m (17.8 ft.) for 360° rotation system, plus clearance.
- Required room length: Depends on test distance. Approximately equal to required test distance, most commonly 8 m. (26 ft.).
- Total vertical travel of lamp/luminaire for mounting purposes (motorized): approximately 1.8m (5.9 ft.).
- Approximate mirror size: 1.3 x 1.7m. (52 x 63 ins.) for 8 m test distance. Octagonal

All Models

- Mirror type: 6mm float glass, protected silver backing. Tilt angle set for desired test distance.
- Rotational speed of mirror: up to 6 revs. per minute.
- Power delivery to test lamp/luminaire: Cable with attachment terminals. (No slip rings required.)
- Maximum luminaire weight: 60 kg (130 pounds) Counterweight: Balances mirror and swing arm.
- Digital stepping motor for mirror drive, resolution = 0.01°. Continuous rotation capability, or move to specific angles.
- Digital stepping motor for test lamp/luminaire drive, resolution = 0.01°. 360° rotation capability with automatic return to starting location at end of test. Manually can move to specific angles by computer command.
- Digital display of electrical power:
 - Yokogawa WT110 or equivalent, with computer interface
 - Frequency range 0.5Hz to 100kHz
 - Range:
 - ▶ Voltage 0-600v
 - ▶ Current 0-20 amps
 - ▶ Power 0-12,000 watts
 - Detailed accuracy specifications available. Additional meter is optionally available for use with calibration standard lamps.
- Electronic Protection: Separation of power electrical system and electronic system for prevention of electrical cross-talk.
- Photodetector Amplifier System: Located next to the photodetector to maximize signal-to-noise ratio.
 - Three simultaneously operating amplifiers with multiple gain (sensitivity) stages, digitally selected via LSI Signal Maximizer circuit and computer software for maximum dynamic range.
 - Amplifier linearity ± 1% over each amplifier gain stage from maximum reading to less than 1% of maximum
 - 16 bit resolution analog-to-digital converter for each of three amplifier channels.
- Silicon photo detector, corrected to CIE V(λ) spectral response curve, f 1' <1.5%. Mounted in housing with black screens to remove stray light and any direct light from the test item. DIN class L.
- Rotating aperture in photo detector housing, synchronized with mirror rotation, to further absorb room stray light. A pivoting collimating tube system is alternatively available – please request details.
- Input power: 120 VAC + 10%, 60 Hertz. Other voltages or 50 Hz available. Power supply details upon request.
- Test time: Data collection time for typical indoor luminaire: approximately 3 minutes.
- Test time: Data collection time for typical outdoor luminaire: approximately 11 minutes.
- Measurement range: At 8m test distance, approximately 10,000,000 candelas to < 1 candela

OPTIONAL EQUIPMENT

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

- SLI-120:** Intensity Standard Lamps. Provided with calibration for both directional intensity and total flux.
- Lighting Sciences maintains equipment directly calibrated by the US National Institute of Standards and Technology. Standard lamps provided by LSI are calibrated in one step to this NIST-calibrated standard.
- Intensity standard lamps are available also with total luminous flux calibration. LSI goniophotometers can be calibrated using either intensity or total flux, software selectable.
Pin base matches LSI Kelvin Socket KS-10
- KS-10:** Kelvin Socket, (four terminal)m for intensity standard lamps. Includes laser target for alignment
- PSDC-120:** Power supply for intensity, standard lamps 0-150 VDC.
- DMM-10:** High precision digital multimeter for standard lamp monitoring. Used in conjunction with PSDC-10 power supply.
- PSAC-1250:** Computer controlled AC power supply for automatic test lamp voltage or power control. Includes computer interfacing, automatic monitoring and adjustment software, and software controlled test lamp warm-up control.
- BR-V-MED:** Mounting bracket for medium screw base lamp, base up
- BR-V-MOG:** Mounting bracket for mogul screw base lamp, base up
- BR-H:** Mounting bracket for screw base lamp, horizontal. Uses medium or mogul socket from vertical bracket.
- B-SL4:** Holding bracket for 1.2m (4 ft.) fluorescent strip lights
- B-FL24:** Holding bracket for fluorescent luminaires, 0.6 x 1.2m (2 x 4 ft.)
- B-FLB24:** Holding bracket for bare fluorescent lamps for use during calibration. Use with B-FL. Up to 4 lamps T5, T8 and T12. Includes black divider screens.
- B-HID:** Multi-purpose machined mounting plate for High Intensity Discharge luminaires.