

LI-250A Light Meter

Instruction Manual



LI-COR®

LI-250A Light Meter

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This manual contains operation and maintenance information for the LI-250A Light Meter. Read the operating instructions before using the LI-250A.

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Section 1.

Operation summary

The LI-250A Light Meter displays measurements from LI-COR radiation sensors, including the LI-190R, LI-191R, LI-192SA, LI-193SA, LI-200R, and LI-210R. It is compatible with all LI-COR light sensors that have a BNC connector. The LI-250A provides high-resolution reading and conversion of microamp signals from the attached light sensor into suitable light measurement units. The LI-250A does not have a specific calibration; calibrations are associated with the attached light sensor.

Configuration mode vs. measurement mode

The LI-250A has two modes of operation: **Configuration Mode**, where you enter calibration multipliers for light sensors, and **Measurement Mode**, where the LI-250A makes measurements. Press the **Cal** key to switch between modes.

Most of the keys on the 5-button keypad have two functions. The active function depends on whether the LI-250A is in measurement mode or configuration mode. In measurement mode, the keys perform the upper function on each button (in green); in configuration mode, the keys perform the lower function (in white).

Making measurements

- 1 Attach the desired sensor.
- 2 Power on the meter.
Press and hold the **ON** key for 2 seconds, and then release. You will be in measurement mode.
- 3 Press **CAL** to enter configuration mode.
- 4 Press **UNITS** until the label on the display matches the sensor type.
 - For **Quantum Sensors**, select μmol (actual units are $\mu\text{mol s}^{-1} \text{m}^{-2}$)
 - For a **Pyranometer**, select W m^{-2} (actual units are Watts m^{-2})
 - For a **Photometric Sensor**, select **Lux** or **Klux** (actual units are Lux or Kilolux)

Readings will be incorrect if the selected units do not match the sensor that is connected to the meter.

- 5 Press the up or down (**▲**, **▼**) key to change the displayed multiplier until it matches the multiplier for your sensor.
Press and hold the arrow key to scroll rapidly. The multiplier is on the calibration sheet under **For use with LI-COR handheld meters and loggers**.
- 6 Press **CAL** again to store the displayed multiplier.
The LI-250A is ready for measurements.

If you want to store a second calibration multiplier (either for a second sensor or the **In Water** and **In Air**

multipliers for the LI-192 and LI-193 Underwater Quantum Sensors) press **CAL**, then press **MULT SELECT** to switch to the second multiplier. Press the arrow key to change the value of the multiplier, and then press **CAL** to save it. *The multiplier in effect is the one displayed when you press **CAL** to exit configuration mode.*

Note: Pressing **MULT SELECT** before pressing **CAL** discards any changes you have made to the multiplier currently shown on the display.

Pressing **CAL** when in measurement mode will display the multiplier in current use. The multiplier displayed when **CAL** is pressed again will be stored as the active multiplier, whether you have changed it or not.

While in measurement mode, press **HOLD** to retain the current reading on the display. Press **HOLD** again to restore live readings. Press **AVG** to begin a 15 second average, which will be displayed until you press the **HOLD** key to resume measurements or the **AVG** key to start a new average. Press and release the **OFF** button to power off the LI-250A. It will automatically shut off after 25 minutes of inactivity in measurement mode.

Caution: The LI-250A is weather resistant. However, protect the meter from immersion or prolonged contact with water, especially in marine environments. Water damage is not covered under the warranty.

Power requirements

Power is supplied by one 9-volt battery. Battery life is in excess of 150 hours. A LO BAT message is displayed when there is less than 20 hours of battery life remaining. The battery should be replaced immediately after the LO BAT message is displayed to ensure reliable operation.

The battery compartment is accessed through a screw-retained panel on the back of the instrument case. Remove the battery by lifting on the end of the battery with the terminals. Insert the new battery by pushing straight down on the battery; do not try to insert at an angle. Instruments are fitted with a snap-on connector; simply align the male and female contacts and snap onto the battery.

Although typical battery life is more than 150 hours of continuous operation, it is dependent upon the storage temperature. Do not store the LI-250A at high temperatures.

In some instances, the internal storage is not retained when the batteries are removed or when the batteries become discharged. If the LI-250A is reading 0.0 after replacing the batteries, check the multipliers stored in the instrument and verify that they are correct for each sensor. Re-enter them if necessary.

Section 2.

Overview of compatible sensors

The LI-250A is compatible with all LI-COR radiation sensors that have a BNC connector (e.g., LI-200R-BNC or older LI-200SA sensors). It is important that the LI-250A be properly configured for the specific sensor used. A quantum sensor measures photosynthetically active radiation ($\mu\text{mol s}^{-1} \text{m}^{-2}$ of PAR), a pyranometer measures solar radiation (W m^{-2}), and a photometric sensor measures illuminance (lux). It is not possible for a pyranometer to read out in units of lux. If you want the LI-250A to display units of lux, you must use the photometric sensor.

Recalibration of all LI-COR radiation sensors is recommended every two years. The LI-250A does not need to be recalibrated.

Overview of radiation sensor calibration

All LI-COR radiation sensors produce a current proportional to the radiation intensity. During factory calibration, sensor output (in microamps) is measured while the sensor is exposed to a standard lamp of known intensity. The sensor output at this intensity has general units of microamps per radiation unit and is called the **Calibration Constant**. Each sensor has a slightly different

output at a given radiation intensity and will therefore have a unique **Calibration Constant**. The LI-250A measures the current output of the sensor (microamps) and converts the measured current to units of radiation.

Understanding the certificate of calibration

The Certificate of Calibration (provided with each light sensor, *not* the LI-250A) includes the model and serial number of the sensor, the date of manufacture, the date of the most recent calibration, and calibration factors that are suitable for a variety of applications. Calibration certificates are available from licor.com/env/support.

The **Calibration Constant** is the relationship between a microamp of sensor current output and photons of radiation. The value is labeled **Output** on the calibration sheet.

The value labeled **For use with LI-COR handheld meters and loggers**: is the negative reciprocal of the calibration constant ($\text{Multiplier} = -1 / \text{Calibration Constant}$). *This is the value you will enter in the LI-250A.*

Since the Calibration Constant is unique for each sensor, it must be entered into the LI-250A each time the sensor is changed or recalibrated. For the LI-192SA and LI-193SA Underwater Quantum Sensors, there are two calibration multipliers (see *Figure 2* on page 8); one for "in air" operation and one for "in water" operation. Use the multiplier that is appropriate for your application.

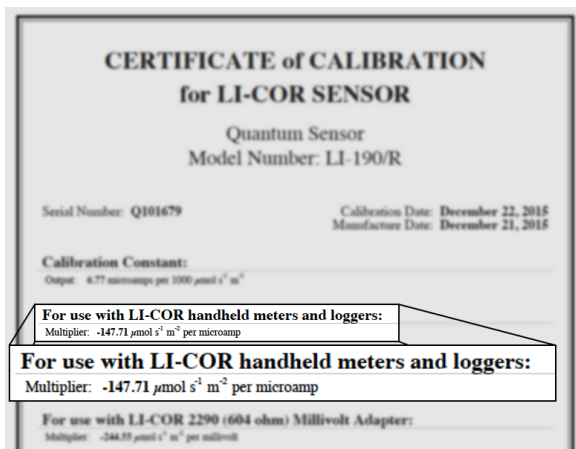


Figure 1. For terrestrial radiation sensors (LI-190R, LI-191R, LI-200R, and LI-210R), the value required by the LI-250A is labeled as **For use with LI-COR handheld meters and loggers:**. The units given will depend on the sensor in use.

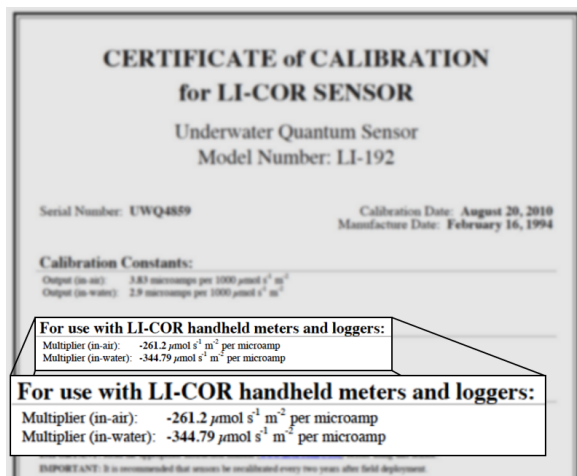


Figure 2. For underwater quantum sensors (LI-192SA and LI-193SA), the values required by the LI-250A are labeled as **For use with LI-COR handheld meters and loggers:**. Two values are given: one for use in air, and another for use in water.

Older radiation sensors

For type ‘SA’ sensors manufactured between September 1985 and March 2015, the calibration multiplier is attached to the sensor cable and provided on the certificate. The time coefficient (*tc_{coeff}*) is used to convert integrated data to the proper units when using the LI-1000 Datalogger to log data with certain sensors. This value can be ignored when using the LI-250A.

Older type 'SB' radiation sensors and new sensors equipped with the millivolt adapter (denoted '-SMV') are also compatible if the Calconnector (Calibration connector) is detached from the BNC connector.

Older type 'SZ' radiation sensors are not compatible with the LI-250A unless they are fitted with a BNC connector. Contact LI-COR for more information.

Calibration certificates for all sensors are available from licor.com/env/support.

Compatible sensors and accessories

The following accessories and sensors are available for the LI-250A. Contact LI-COR for current information.

- **LI-190R-BNC Quantum Sensor:** Measures Photosynthetically Active Radiation (PAR) in natural sunlight, under plant canopies, and in growth chambers and greenhouses.
- **LI-191R Line Quantum Sensor:** Measures average PPFD over its one-meter length for plant canopy PPFD profile studies.
- **LI-192SA Underwater Quantum Sensor¹:** Measures Photosynthetic Photon Flux Density (PPFD) in air or under water incident on a flat plane.
- **LI-193SA Spherical Quantum Sensor:¹** Measures photon flux from all directions under water. This

¹Requires 2222UWB cable.

measurement is called Photosynthetic Photon Flux Fluence Rate (PPFFR).

- **LI-200R-BNC Pyranometer:** Measures global solar radiation (sun plus sky) and provides a typical accuracy of $\pm 5\%$ under unobstructed daylight conditions.
- **LI-210R-BNC Photometric Sensor:** Measures visible radiation and has a spectral response equal to that for the average human eye. Readout of illuminance (in lux) is used for lighting studies or architectural modeling.
- **250-01 Carrying Case:** A padded case for the LI-250A and terrestrial type radiation sensors. Size: 20.3 cm L \times 10.2 cm W \times 9 cm D (8" \times 4" \times 3.5"). Weight: 98 g (0.216 lbs).
- **2003S Mounting and Leveling Fixture:** The 2003S is for use with all LI-COR terrestrial type sensors.
- **2222SB Extension Cable:** For use with all LI-COR terrestrial type sensors. Available in 15.2 m (50 ft), 30.4 m (100 ft), or custom lengths to 304 m (1000 ft).
- **Replacement Battery:** 9 Volt Battery. The LI-250A requires a battery for operation.

Appendix A.

Specifications

Accuracy: 25 °C: Typically $\pm 0.4\%$ of reading [± 3 counts on the least significant digit displayed (all ranges)].

0-55 °C: Typically $\pm 0.6\%$ of reading [± 3 counts on the least significant digit displayed (all ranges)].

Range Selection: Autoranging (3 ranges).

Sensor Calibration: Calibration multipliers for two sensors are stored in memory. Calibration multipliers are entered from the keypad.

Sensor Averaging: Sensor output is averaged for 15 seconds when AVG key is pressed in Measurement mode. Averages are displayed in HOLD mode to retain the average on the display.

Linearity: $\pm 0.05\%$.

Operating Conditions: 0 to 55 °C, 0 to 95% RH (non-condensing).

Storage Conditions: -55 to 60 °C, 0 to 95% RH (non-condensing).

Display: 4 1/2-digit custom LCD display. Updated every 0.5 seconds.

Keypad: Sealed, 5-key tactile response keypad.

Battery Life: 150 hours typical with continuous operation. Automatic shutoff after 25 minutes of inactivity in measurement mode.

Power Requirement: One 9 V alkaline battery or equivalent.

Low Battery Detection: Low battery indicator displayed with approximately 20 hours battery life remaining.

Size: 15 cm L \times 8.2 cm W \times 3.3 cm D (5.9" \times 3.2" \times 1.3").

Weight: 0.26 kg (0.57 lbs).

Compatible Sensors: Any LI-COR sensor with BNC connector; Quantum, Pyranometer, or Photometric.

Warranty: 1-year parts and labor.

Range and resolution

Quantum Sensors

Range	Resolution
0-199 $\mu\text{mol s}^{-1} \text{m}^{-2}$	0.01 $\mu\text{mol s}^{-1} \text{m}^{-2}$
0-1999 $\mu\text{mol s}^{-1} \text{m}^{-2}$	0.1 $\mu\text{mol s}^{-1} \text{m}^{-2}$
0-19999 $\mu\text{mol s}^{-1} \text{m}^{-2}$	1 $\mu\text{mol s}^{-1} \text{m}^{-2}$

Pyranometer

Range	Resolution
0-19 W m^{-2}	0.001 W m^{-2}
0-199 W m^{-2}	0.01 W m^{-2}
0-1999 W m^{-2}	0.1 W m^{-2}

Photometric Sensor

Range	Resolution
0-1999 lux	0.1 lux
0-19999 lux	1 lux
0-199 klux	0.01 klux
0-199 fc	0.01 fc
0-1999 fc	0.1 fc
0-19999 fc	1 fc

Unit conversions

Quantum Sensors

$$\begin{aligned} &= 1 \mu\text{E s}^{-1} \text{ m}^{-2} \\ 1.0 \mu\text{mol s}^{-1} \text{ m}^{-2} &= 6.022 \times 10^{17} \text{ photons s}^{-1} \text{ m}^{-2} \\ &= 6.022 \times 10^{17} \text{ quanta s}^{-1} \text{ m}^{-2} \\ &= 6.022 \times 10^{13} \text{ quanta s}^{-1} \text{ cm}^{-2} \end{aligned}$$

Pyranometer

$$\begin{aligned} &= 1.433 \times 10^{-3} \text{ cal cm}^{-2} \text{ min}^{-1} \\ &= 1.433 \times 10^{-3} \text{ langley min}^{-1} \\ &= 0.100 \text{ mW cm}^{-2} \\ 1 \text{ W m}^{-2} &= 100 \mu\text{W cm}^{-2} \\ &= 1.0 \text{ J s}^{-1} \text{ m}^{-2} \\ &= 1000 \text{ erg s}^{-1} \text{ cm}^{-2} \\ &= 0.317 \text{ BTU ft}^{-2} \text{ h}^{-1} \\ &= 5.283 \times 10^{-3} \text{ BTU ft}^{-2} \text{ min}^{-1} \end{aligned}$$

Photometric Sensor

$$\begin{aligned} &= 1 \text{ lm m}^{-2} \\ 1 \text{ lux} &= 0.0929 \text{ lm ft}^{-2} \\ &= 0.0929 \text{ fc} \\ &= 0.001 \text{ klux} \end{aligned}$$

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18. Assignment. Buyer shall not assign or transfer these Conditions or any rights or obligations under these Conditions, whether voluntary or by operation of law, without the prior written consent of LI-COR. LI-COR may assign or transfer these Conditions to any successor by way of merger, acquisition or sale of all or substantially all of the assets relating to these Conditions. LI-COR or any successor may assign all or part of the right to payments under these Conditions. Any assignment or transfer of these Conditions made in contravention of the terms hereof shall be null and void. Subject to the foregoing, these Conditions shall be binding on and inure to the benefit of the parties' respective successors and permitted assigns.

Standard Terms and Conditions

19. Entire Agreement. These Conditions of Sale take precedence over Buyer's additional or different terms and conditions, to which notice of objection is hereby given. Acceptance by Buyer is limited to LI-COR Conditions of Sale. Neither LI-COR commencement of performance nor delivery shall be deemed or construed as acceptance of Buyer's additional or different terms and conditions. These Conditions supersede all prior communications, transactions, and understandings, whether oral or written, and constitute the sole and entire agreement between the parties pertaining to the referenced quotation or purchase order, provided that: (1) these Conditions shall not, without LI-COR prior written consent, supersede any conflicting terms of: (a) prior written agreements duly executed by LI-COR, or (b) governmental purchase orders, terms of purchase, requests for quotation or acquisition regulations relative to governmental purchasers; and (2) to the extent not in conflict with any such prior or governmental terms, these Conditions shall supplement them. No modification, addition or deletion, or waiver of any of the terms and conditions of these Conditions shall be binding on either party unless made in a non-preprinted agreement clearly understood by both parties to be a modification or waiver, and signed by a duly authorized representative of each party.

20. Entire Agreement. These Conditions of Sale take precedence over Buyer's additional or different terms and conditions, to which notice of objection is hereby given. Acceptance by Buyer is limited to LI-COR Conditions of Sale. Neither LI-COR commencement of performance nor delivery shall be deemed or construed as acceptance of Buyer's additional or different terms and conditions. These Conditions supersede all prior communications, transactions, and understandings, whether oral or written, and constitute the sole and entire agreement between the parties pertaining to the referenced quotation or purchase order, provided that: (1) these Conditions shall not, without LI-COR prior written consent, supersede any conflicting terms of: (a) prior written agreements duly executed by LI-COR, or (b) governmental purchase orders, terms of purchase, requests for quotation or acquisition regulations relative to governmental purchasers; and (2) to the extent not in conflict with any such prior or governmental terms, these Conditions shall supplement them. No modification, addition or deletion, or waiver of any

of the terms and conditions of these Conditions shall be binding on either party unless made in a non-preprinted agreement clearly understood by both parties to be a modification or waiver, and signed by a duly authorized representative of each party.

21. Force Majeure. Shipping dates are approximate and may be delayed absent prompt receipt from Buyer of all necessary information. LI-COR shall not be responsible for any failure to perform or delay attributable in whole or in part to any cause beyond its reasonable control, including but not limited to Acts of God, government actions, war, civil disturbance, insurrection, sabotage, labor shortages or disputes, failure or delay in delivery by LI-COR suppliers or subcontractors, transportation difficulties, customs clearance, shortage of energy, raw materials or equipment, or Buyer's fault or negligence. In the event of any such delay the date of delivery shall, at the request of LI-COR, be deferred for a period equal to the time lost by reason of the delay.

22. Governing Law and Venue. These Conditions and performance by the parties hereunder shall be construed in accordance with the laws of the State of Nebraska, U.S.A., without regard to provisions on the conflicts of laws.

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The LI-COR logo is displayed in a bold, italicized, white sans-serif font against a solid blue background. The letters 'LI-COR' are connected, with a registered trademark symbol (®) positioned to the right of the 'R'.