LI-250A Light Meter

Instruction Manual

LI-COR®

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Notice

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

The information contained in this document is subject to change without notice.

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Contents

Section 1. Operation summary

Section 2. Overview of compatible sensors

Appendix A. Specifications

Appendix B. Warranty

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 µmol s^{-1} 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. 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 (µmol s^{-1} 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 (Multiplier = -1 / 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.

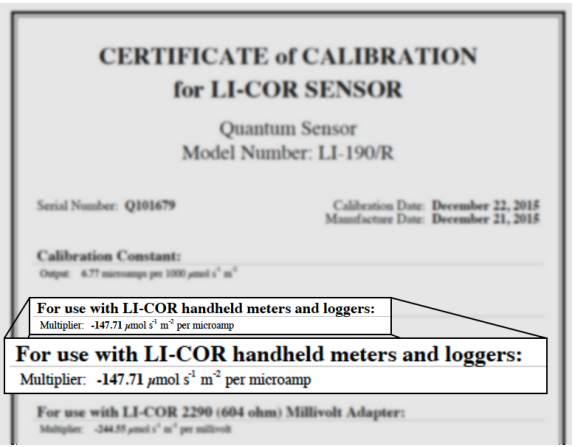

Figure 1. For terrestrial radiation sensors (LI-190R, LI-191R, LI-200R, and LI-210R), the value required by the LI-250A is labeled as **For use with LI-COR handheld meters and loggers:**. *The units given will depend on the sensor in use.*

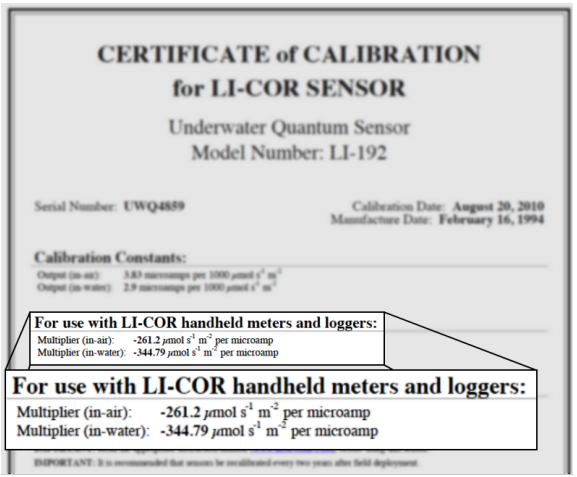
CERTIFICATE of CALIBRATION
for LI-COR SENSOR
Underwater Quantum Sensor
Model Number: LI-192
Serial Number: UWQ4859
Calibration Date: August 20, 2010
Manufacture Date: February 16, 1994
Calibration Constants:
Output (in-air): 3.83 microamps per 1000 μmol s-1 m-2
Output (in-water): 2.9 microamps per 1000 μmol s-1 m-2
For use with LI-COR handheld meters and loggers:
Multiplier (in-air): -261.2 μmol s-1 m-2 per microamp
Multiplier (in-water): -344.79 μmol s-1 m-2 per microamp
IMPORTANT: It is recommended that sensors be recalibrated every two years after field deployment.

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 (*tcoff*) 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 Sensor[1]:** 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 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 ±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 × 10.2 cm W × 9 cm D (8" × 4" × 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.

[1]Requires 2222UWB cable.

Appendix A.
Specifications

Accuracy: 25 °C: Typically ± 0.4% of reading [± 3 counts on the least significant digit displayed (all ranges)].
0-55 °C: Typically ± 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: ± 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 × 8.2 cm W × 3.3 cm D (5.9" × 3.2" × 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 µmol s^{-1} m^{-2}	0.01 µmol s^{-1} m^{-2}
0-1999 µmol s^{-1} m^{-2}	0.1 µmol s^{-1} m^{-2}
0-19999 µmol s^{-1} m^{-2}	1 µmol s^{-1} 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	
1.0 µmol s^{-1} m^{-2}	= 1 µE s^{-1} m^{-2}
	= 6.022×10^{17} photons s^{-1} m^{-2}
	= 6.022×10^{17} quanta s^{-1} m^{-2}
	= 6.022×10^{13} quanta s^{-1} cm^{-2}

Pyranometer	
1 W m^{-2}	= 1.433×10^{-3} cal cm^{-2} min^{-1}
	= 1.433×10^{-3} langley min^{-1}
	= 0.100 mW cm^{-2}
	= 100 µW cm^{-2}
	= 1.0 J s^{-1} m^{-2}
	= 1000 erg s^{-1} cm^{-2}
	= 0.317 BTU ft^{-2} h^{-1}
	= 5.283×10^{-3} BTU ft^{-2} min^{-1}

Photometric Sensor	
1 lux	= 1 lm m^{-2}
	= 0.0929 lm ft^{-2}
	= 0.0929 fc
	= 0.001 klux

Appendix B.
Warranty

Each LI-COR, Inc. instrument is warranted by LI-COR, Inc. to be free from defects in material and workmanship; however, LI-COR, Inc.'s sole obligation under this warranty shall be to repair or replace any part of the instrument which LI-COR, Inc.'s examination discloses to have been defective in material or workmanship without charge and only under the following conditions, which are:

1. The defects are called to the attention of LI-COR, Inc. in Lincoln, Nebraska, in writing within one year after the shipping date of the instrument.
2. The instrument has not been maintained, repaired or altered by anyone who was not approved by LI-COR, Inc.
3. The instrument was used in the normal, proper and ordinary manner and has not been abused, altered, misused, neglected, involved in an accident or damaged by act of God or other casualty.
4. The purchaser, whether it is a DISTRIBUTOR or direct customer of LI-COR or a DISTRIBUTOR'S customer, packs and ships or delivers the

instrument to LI-COR, Inc. at LI-COR Inc.'s factory in Lincoln, Nebraska, U.S.A. within 30 days after LI-COR, Inc. has received written notice of the defect. Unless other arrangements have been made in writing, transportation to LI-COR, Inc. (by air unless otherwise authorized by LI-COR, Inc.) is at customer expense.

5 No-charge repair parts may be sent at LI-COR, Inc.'s sole discretion to the purchaser for installation by purchaser.

6 LI-COR, Inc.'s liability is limited to repair or replace any part of the instrument without charge if LI-COR, Inc.'s examination disclosed that part to have been defective in material or workmanship.

There are no warranties, express or implied, including but not limited to any implied warranty of merchantability of fitness for a particular purpose on underwater cables or on expendables such as batteries, lamps, thermocouples, and calibrations.

Other than the obligation of LI-COR, Inc. expressly set forth herein, LI-COR, Inc. disclaims all warranties of merchantability or fitness for a particular purpose. The foregoing constitutes LI-COR, Inc.'s sole obligation and liability with respect to damages resulting from the use or performance of the instrument and in no event shall LI-COR, Inc. or its

representatives be liable for damages beyond the price paid for the instrument, or for direct, incidental or consequential damages.

The laws of some locations may not allow the exclusion or limitation on implied warranties or on incidental or consequential damaged, so the limitations herein may not apply directly. This warranty gives you specific legal rights, and you may already have other rights which vary from state to state. All warranties that apply, whether included by this contract or by law, are limited to the time period of this warranty which is a twelve-month period commencing from the date the instrument is shipped to a user who is a customer or eighteen months from the date of shipment to LI-COR, Inc.'s authorized distributor, whichever is earlier.

This warranty supersedes all warranties for products purchased prior to June 1, 1984, unless this warranty is later superseded. To the extent not superseded by the terms of any extended warranty, the terms and conditions of LI-COR's Warranty still apply.

DISTRIBUTOR or the DISTRIBUTOR's customers may ship the instruments directly to LI-COR if they are unable to repair the instrument themselves even though the DISTRIBUTOR has been approved for making such repairs and has agreed with the customer to make such repairs as covered by this limited warranty.

Further information concerning this warranty may be obtained by writing or telephoning Warranty manager at LI-COR, Inc.

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