

LI-6400/6400XT Portable Photosynthesis System

6400-02B LED Light Source

Product Bulletin

- Utilizes blue LEDs, in addition to red LEDs.
- No external controllers or power sources to carry.
- Software adjustable intensities and automated light response curve protocols.
- Spatially uniform, carefully calibrated output.

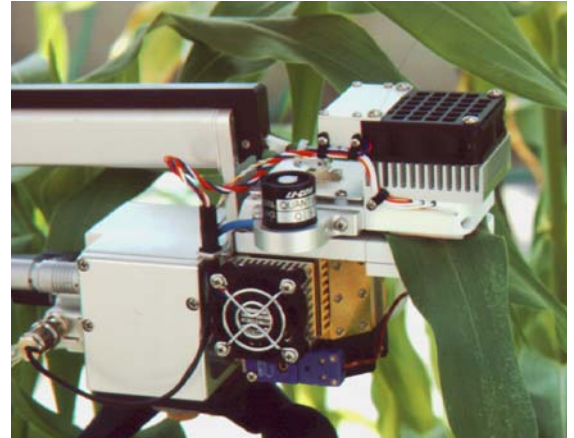
Description

The 6400-02B LED Light Source is totally integrated with the hardware and software of the LI-6400/6400XT Portable Photosynthesis System, providing maximum ease-of-use and application flexibility.

The LED Light Source can produce any light intensity from 0 to 2000 $\mu\text{mol m}^{-2} \text{s}^{-1}$. The use of LEDs with low power consumption makes the 6400-02B a practical light source because of its small size and its ability to operate from the instrument's main battery. LEDs also minimize the influence of the light source on the leaf environment because they have low heat generation compared to other light sources.

Blue and Red LEDs

The 6400-02B not only provides an actinic light source to drive photosynthesis, but also provides a blue component to control stomata. Red LEDs are used to provide radiant output at 665 nm (nominal), while blue LEDs provide output at 470 nm. The output of the blue LEDs is crucial for studying stomatal kinetics (Zeiger, et al., 1987).



The 6400-02B is designed for easy field operation. Mounting is as simple as replacing the upper half of the standard leaf chamber with the light source. The 6400-02B is controlled by the LI-6400/6400XT software and powered by the system batteries, so there are no extra boxes, cables or power sources to carry.

Software Automation

Since the 6400-02B is continuously variable over its entire measurement range, you can specify any light level without needing to make adjustments or change filters. For applications like A-Ci curve generation, the light source can provide a constant output while the user controls the other environmental conditions via the LI-6400/6400XT. Light levels from the 6400-02B are automatically cycled through user-entered setpoints when using the system's "Light Curve" AutoProgram. Light curve generation is automatic and can be performed unattended.

Careful Design and Calibration

The LED Light Source is easily installed, since it replaces the upper half of the standard LI-6400/6400XT leaf chamber. Having the light source as part of the leaf chamber assures you that the geometry between the leaf sample and the light source will be the same for every measurement.

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Careful placement of the LEDs in an array also ensures uniform light distribution at the leaf surface.

Calibration is an important part of any light source design. LI-COR has used its 36 years of optical design expertise to design both an accurate factory calibration method and an on-board monitoring method in the LI-6400/6400XT. During factory calibration, the LED Light Source is connected to an integrating sphere, and a spectroradiometer is used to measure total output and spectral quality. Total output is used to calibrate a silicon photodiode that is built into the light source. Accuracy during operation is assured by feedback circuits that read the output of the photodiode and adjust the light source, if necessary, to make sure the output matches the specified value.

During calibration the temperature correction and linearization circuitry is calibrated to ensure the accuracy of radiant output at all rated operating temperatures and intensities.

References

Eduardo Zeiger, Moritoshi Iino, Ken-Ichiro Shimazaki, and Teruo Ogawa, 1987. The Blue-Light Response of Stomata: Mechanism and Function. In: *Stomatal Function*. (Eds. E. Zeiger, D.D. Farquhar and I.R. Cowan). Stanford University Press, Stanford, California. 209-227.

Specifications

Output Range: 0 to 2000 $\mu\text{mol m}^{-2} \text{s}^{-1}$ at 30°C.

Minimum Fraction Blue: 5% (photon basis).

Typical Fraction Blue: 100 $\mu\text{mol m}^{-2} \text{s}^{-1}$, 13%; 1000 $\mu\text{mol m}^{-2} \text{s}^{-1}$, 10%; 2000 $\mu\text{mol m}^{-2} \text{s}^{-1}$, 7%.

Red Peak Wavelength: 665 nm \pm 10 nm at 25°C.

Red Peak Wavelength Temperature Dependence: + 0.2 nm/°C, typical.

Red Full Width Half Max (FWHM): \leq 30 nm at 25°C.

Blue Peak Wavelength: 470 nm \pm 10 nm at 25°C

Blue Peak Wavelength Temperature Dependence: + 0.05 nm/°C, typical.

Blue Full Width Half Max (FWHM): \leq 40 nm at 25°C.

Output Spatial Uniformity:

Red: Coefficient of variation \leq 6%; maximum deviation from mean \leq 9%, corner to corner, typical.

Blue: Coefficient of variation \leq 13%; maximum deviation from mean \leq 18%, corner-to-corner, typical.

Coefficient of variation \leq 9%; maximum deviation from mean \leq 14%, excluding corners, typical.

Accuracy: 5% of reading at 25°C with a leaf reflectance $R < 10\%$.

Power Consumption At 2000 $\mu\text{mol m}^{-2} \text{s}^{-1}$: \leq 8 W.

Operating Temperature Range: 0-50 °C.

Operating RH: 0-100%, non-condensing.

Size: 5.2H 5 5.6W 5 7.3D cm (2.0 5 2.2 5 2.9 in.).

Weight: 0.2 kg (0.44 lb).

Ordering Information

6400-02B LED Light Source: Includes light source, twenty leaf chamber gaskets, mounting screws, and O-rings.

6400-33 Leaf Chamber Gaskets for 6400-02B: Twenty white polyethylene foam upper gaskets, five black neoprene lower gaskets and five air passage gaskets.

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