Daylight Indicator - Light Meter
Light-DLI-W

The Daylight Indicator - Light Meter is a simple and easy step in measuring the light intensity levels affecting your turf or crops and can be used outdoors, on golf greens, stadiums or inside a greenhouse or other structure. This water-resistant unit will compare light level intensities within or outside your greenhouse. Simply place it on the area to be tested and 24 hours later, it will display your Daily Light Integral (DLI). With a push of a button, the Daylight Indicator records light intensity for a 24-hour period and then calculates the Daily Light Integral (DLI). Real-time intensity levels are shown every 4 seconds in µmol $\bullet m^{-2} \bullet s^{-1}$ (or footcandles). Battery included.

Specifications:

- Plastic Spike
- Button on the face
- Uses three A76/LR44/L1154 batteries (included)
- Simple, one button operation
- An affordable, first step in measuring light
- Measure PAR light (Photosynthetically Active Radiation) (the range between 400 and 700 nm)
- With the push of a button, the meter runs for 24 hours and calculates your Daily Light Integral (DLI)
- Real-time intensity levels are shown every 4 seconds in µmol$\bullet m^{-2} \bullet s^{-1}$ (or footcandles)
- Approximate battery life: 100 DLI calculations

Daylight Indicator
Quick Start Guide

1. **Place unit in desired location**
The unit needs to be placed in the location you require measurement. Once the unit is in the desired location you can compare the amount of light.

2. **Once in place the unit will start measuring**
Press the button on the shoulder of the Daylight Indicator. The LEDs will light upward and will blink every 4 seconds to show the current light intensity. Read the value from the right side of the LEDs.

3. **Wait 24 hours**
The Daylight Indicator will sum the light measurements for 24 hours and compute the Daily Light Integral (DLI).

4. **Read the Daily Light Integral (DLI)**
After 24 hours the Daylight Indicator will blink every second for the next hour to show the DLI value. Use the numbers to the left of the LEDs. If the display is dark, press the button to wake it and see the value for 10 seconds.

5. **Repeat with any and all areas requiring light measurements**
Choose other areas and repeat the process for maximum benefit.

Important
*The Daylight Indicator **does** have a sharp spike so handle with care.*
Do not store the Daylight Indicator upside-down.
Possible damage can occur from irrigation water that can gather in the screw holes, enter the unit, and damage the circuit board.

Where to Measure?

Position the meters throughout your location,
and compare differences in light levels and the effect on plant growth and quality

Use a "Control"

Use the Daylight Indicator to measure the location of primary interest—on a greenhouse bench, or on a shaded green or tee box at a golf course. Use can also use it as a "control" - let it receive the maximum light, either outside your greenhouse, or in full sun, far from the trees.

In a Greenhouse

Place Daylight Indicator where you can compare light levels and DLI (Daily Light Integral) with and without hanging plants and shades. Use pots with soil or media to hold the Daylight Indicator upright. Place the Daylight Indicator outside to measure transmission loss through the structure.

Shaded Tees, Sports Stadiums and Greens

Use the Daylight Indicator to compare the light received by healthy and stressed areas of tees, stadiums and greens. By placing unit in the stressed area, followed by a healthy area, and then nearby with full sun, areas of destructive shade can be documented, and the minimum light level necessary can be determined.

In the Crop Canopy

To measure the incident light and/or DLI at, in, or below the crop canopy, secure the Daylight Indicator at the proper location and height. For low plants, this can be as simple as inserting the spike into the ground or into a container filled with soil or media. For taller crops, set a plastic or metal pipe into the ground, and slip the Daylight Indicator spike into the top to hold it at the desired height.

Using the Daylight Indicator

Place the Daylight Indicator in the ground at the desired location for evaluating the amount of available sunlight. In a greenhouse insert the meter into a container of similar size (containing substrate only) to that of the crop being grown, so that the meter receives the same amount of light at the same height as the growing crop. Ensure that the face of the unit is generally parallel to the ground.

Light Gathering Mode

To turn On the Daylight Indicator, press the power button located on the face of the device. When the power is applied, the four LEDs will illuminate sequentially from bottom to top. Thereafter, one or more LEDs will flash every 4 seconds, indicating the amount of light currently being received.

The Daylight Indicator measures the actual light intensity every 20 seconds, then displays that value every 4 seconds until the next measurement is made.

Please Note

While the Daylight Indicator is gathering data, pressing the power button will turn off the unit (the four LEDs will illuminate sequentially from top to bottom), and the measurement process will be cancelled. Pressing the button again will start a new 24-hour measurement period.

DLI Display Mode

After 24 hours of continuous operation, the device will stop accumulating light measurements. One or more LEDs will flash every second for one hour to indicate the Daily Light Integral (DLI) for that location. The device will shut itself off after displaying the DLI value for one hour, but the DLI measurement will be retained in memory.
The last DLI value computed can be retrieved from memory by pressing the power button to turn on the unit. The DLI value will flash every second for 10 seconds.

Important

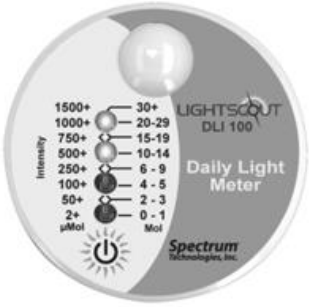
After 10 seconds the Daylight Indicator value will be erased, and a new 24 hour measurement period will begin. Pressing the button again before 10 seconds has elapsed will turn the unit off and save the DLI value.

Reading the Display

The Daylight Indicator - Light Meter has 4 LEDs that are used to indicate different levels of light - both intensity and Daily Light Integral (DLI). The LEDs flash once every four seconds during the Light Gathering Period. Numbers to the **left** of the LEDs indicate the current light intensity in $\mu mol \bullet m^{-2} \bullet s^{-1}$ (micromoles). A sunlight approximation of foot candles can be obtained by multiplying the value by 5. Numbers to the **right** of the LEDs are used to display the DLI value in $mol \bullet m^{-2} \bullet d^{-1}$. The LEDs flash once per second.

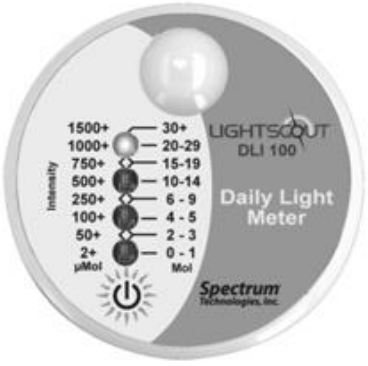
One LED

When one LED is flashing, read the number next to it. The light level will be *at least* that number. In the image to the right:



During the Light Gathering period, by reading the left numbers, the light intensity would be in the range 1000- 1499 $\mu mol \bullet m^{-2} \bullet s^{-1}$ (“1000” is lit, and the top of the range is less than
1500, the next number up). In DLI Display mode, by reading to the right, the DLI value would be in the range 20-29 $mol \bullet m^{-2} \bullet d^{-1}$

Two LEDs



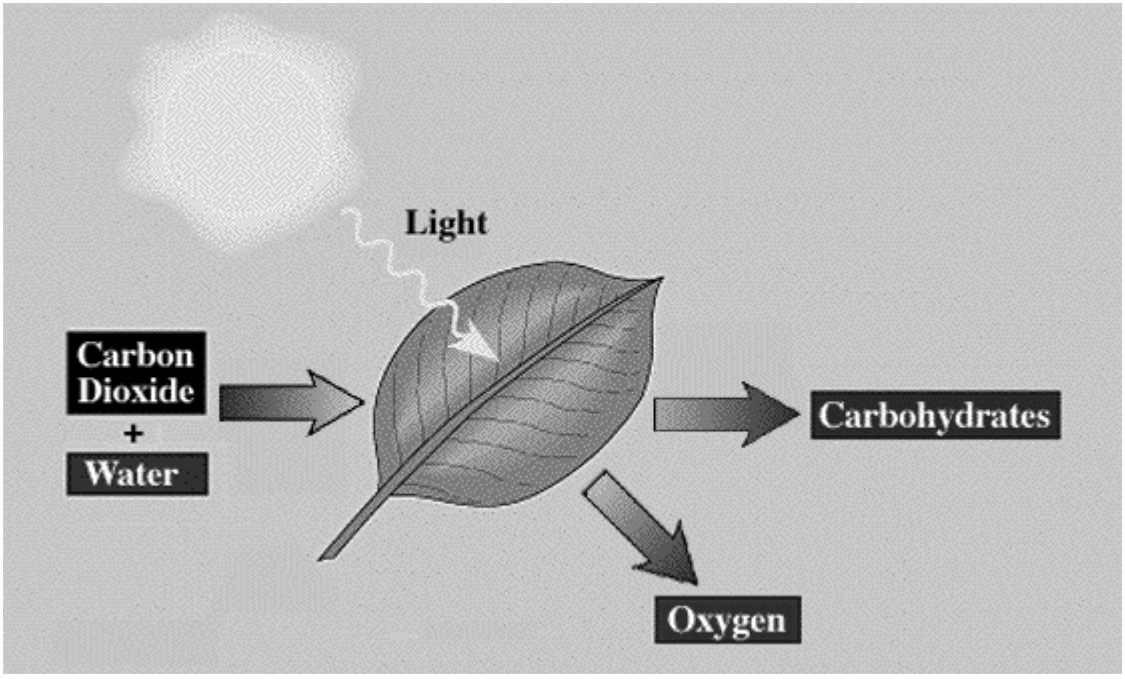
If the light level is between two LEDs, then
both flash. In this case, use the number between them.

For the image to the left:
During the Light Gathering period, by reading the left numbers, the light intensity would be in the range 750-999 $\mu mol \bullet m^{-2} \bullet s^{-1}$ (“750” is between the two lit LEDs, and the top of the range is less than 1000, the next number up).
In DLI Display mode, by reading to the right, the DLI value would be in the range 15-19 $mol \bullet m^{-2} \bullet d^{-1}$

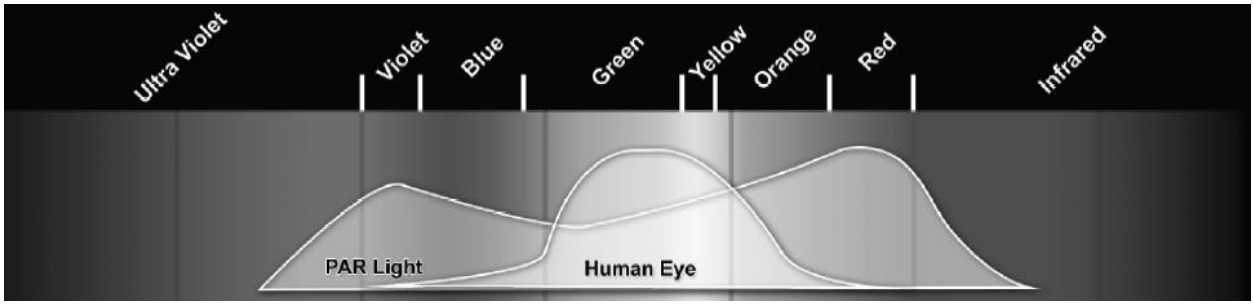
Four LEDs

Under the highest light levels, all four LEDs flash. The numbers at the top of the display (1500+, 30+) provide the “at least” values for these light levels.

Light Intensity



The light that drives photosynthesis in plants is Photosynthetically Active Radiation, or PAR light. This is also referred to as Quantum light, because it is measured in units of moles striking an area over time. Though PAR light ranges from 400 to 700nm, the region brightest to human eyes is the area of least effect on plants.



Light meters measure light intensity – the instantaneous amount of light delivered to an area. During the 24-hour Light Gathering period, the Daylight Indicator functions as a light meter.

Cumulative Light (DLI)

If photons were raindrops, light meters would show the intensity of a rainstorm. A five-minute rainstorm may look impressive, but often provides less water than an all-day drizzle. As cumulative rainfall is measured with a rain gauge, the cumulative quantity of light is measured using the Daylight Indicator, or a light sensor, with a data logger. The daily total of Quantum light is called the Daily Light Integral, or DLI, and is measured in units of $mol \bullet m^{-2} \bullet d^{-1}$ (commonly, moles/day). DLI quantifies the light available to plants to perform photosynthesis. On a sunny winter day in the middle latitudes, a plant receives about 9 moles/day. If it is cloudy, the DLI drops to 3 moles/day. In the summer, the DLI for a sunny day is about 26 moles/day and 12 moles/day for a cloudy day. Each type of plant has a different DLI range for optimal growth. DLI is directly correlated with plant quality, and a minimum amount of light is required for healthy plants.

Effect of Light Intensity on Plant Growth and Quality

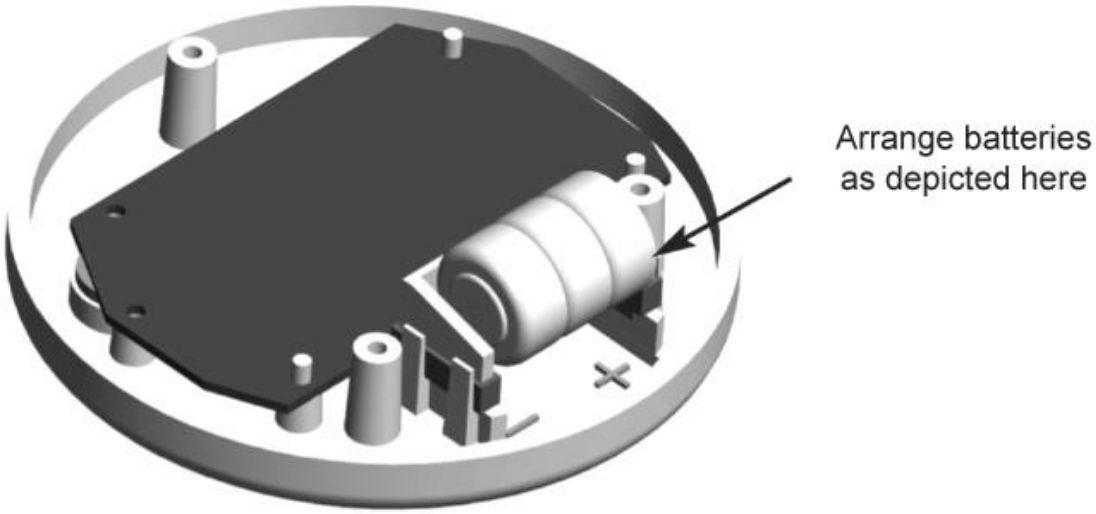
Relative Light Level	**Daily Light Integral (DLI)** $mol \bullet m^{-2} \bullet d^{-1}$	**Light intensity at Noon** $\mu mol \bullet m^{-2} \bullet s^{-1}$	**Generalized Plant Growth Response**
Very Low	2 to 5	100 to 200	Poor quality
Low	5 to 10	200 to 400	Minimum acceptable quality
Medium	10 to 20	400 to 800	Good quality
High	20 to 30	800 to 1200	Excellent quality
Very High	30 to 60	1200 to 2000	Excellent quality

Table 1. Generalized plant responses to different light levels. Please note that it is not possible to convert a single light intensity reading to DLI. Additionally, temperature is an important factor of plant growth and quality (table adapted from Hamrick, Debbie ed. Ball Red Book. Batavia, IL: Ball Publishing.2003).

Replacing the Battery

The Daylight Indicator uses three cell batteries A76/LR44/AG13/L1154. To change the battery:

1. Remove the three screws from the underside of the unit.
2. Lift off and turn over the top of the Daylight Indicator.
3. Remove the batteries.
4. Clean the battery contacts prior to installing batteries.
5. Batteries must be installed in the correct direction and polarity (see image below).
6. Re-align the top of the Daylight Indicator with the base. Replace and tighten the screws.



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