

Measuring Daily Light Integral with the LI-1500 Light Sensor Logger

The LI-1500 allows for simple configuration of automated sampling to compute daily light integral (DLI) from PAR readings captured by LI-COR quantum sensors. This quick start guide demonstrates DLI calculation using the LI-1500 with the LI-190R Quantum Sensor.

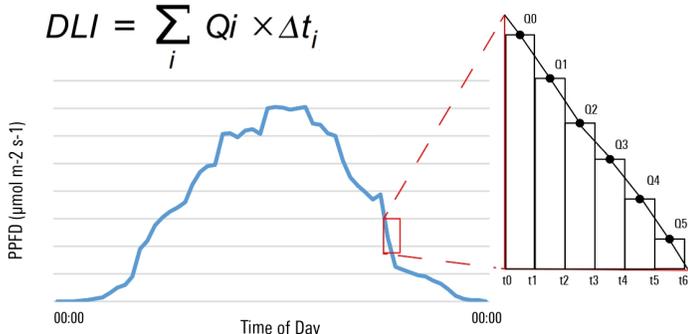
What is DLI?

DLI is a measure of the total amount of light received in a single day in a particular area. DLI can be used to quantify photosynthetically-active radiation (PAR) as moles of photons per square meter per day. DLI varies depending on latitude, time of year, and cloud cover, and ranges from 5 to 60 mol m⁻² d⁻¹ in the United States (Korczynski, et.al., 2002).

Quantum sensors are designed to directly measure the instantaneous number of moles of PAR (in units of PPFD - photosynthetic photon flux density). DLI is calculated as the time integral of the series of instantaneous PPFD readings (Q_i) taken at regular intervals (Δt_i). As long as the instantaneous measurements are taken at regular intervals, Δt_i is the same for all terms in the summation.

$$\Delta t_i = t_{i+1} - t_i$$

$$DLI = \sum_i Q_i \times \Delta t_i$$



Depending on the application or research question, the time integral of incident light may be a more useful tool than the instantaneous flux of light.

Using the LI-1500 to Calculate DLI

This tutorial assumes you have read sections 1 and 3 of the LI-1500 user manual and have basic familiarity with your instrument.

Note: you should connect your LI-1500 to AC power when collecting data over extended periods of time. Leave the power on and do not enable sleep mode.

Add a New Configuration

Before logging measurements, you must create a new configuration for DLI. This will allow you to reuse the same configuration with new log files each time you want to take DLI measurements. The sampling rate and logging interval parameters can be modified for your individual research needs, but the configuration below is a good starting point.

- 1 Press **Menu** and navigate to **Configurations**. Select **<Add New Config>** at the top of this menu. Press **OK** and name your configuration "DLI." Press **OK**.
- 2 Leave the default **Active** value as **Yes**.
- 3 Scroll down and select **Inputs**, then **IN1**. This launches the **Select Light Sensor** menu. If you have previously added your sensor, select it from this menu. If not, add it by selecting **<Add New Sensor>**. Choose the sensor type and enter the serial number and multiplier value. Press **Exit**, and **Exit** again to return to the configuration details menu.
- 4 Update the **Samp Rate** (sampling rate) to 0.1 Hz.
- 5 Leave the default **Range** as **Auto**.
- 6 Scroll down and select **Outputs** and **<Add New Output>**. Scroll down to **Math** and name the output as "DINT" (or "DLI," or something else you will recognize in the data file). Press **OK**. In the next screen, press **OK** on **Operation**. Scroll down and select **Daily Light Integral**. Press **OK**. Scroll down to **Param:** and choose **INPUT1 Light**. Press **OK**. Press **Exit**, and **Exit** again to return to the configuration details menu.

- 7 Scroll down to **Routine**, press **OK**, and select **Daily**. Here, you will program your measurement interval. Change the default **Log Every** option to **15 Min**. Enter your **Start** and **Stop** times. This configuration routine will take one measurement every fifteen minutes for your specified sampling interval to generate the PPF/D/Time curve from which DLI is calculated.
- 8 Press **Exit** until you have returned to the initial display screen. Among other display items, you should be seeing real-time PAR readings from **INPUT1**, **CONFIG** should read **DLI**, and **STATUS** should be read **Not Logging**.

Set Up File, Start, and Stop Logging

Once you have created your DLI configuration, you should follow these steps to use this configuration for data logging.

- 1 From the initial display screen, press **START STOP** from the LI-1500 keypad and choose **New File**. Name your file and enter a remark if necessary for your records.
- 2 Press **OK**. You will be returned to the initial display screen, and **Display** should read **Logging**.
- 3 When your measurement interval is finished, press **START STOP** to stop logging measurements. On the initial display screen, **STATUS** should read **Not Logging**.

Access Your Data Files

The DLI data that are computed by the LI-1500 are stored in files that can be opened on the LI-1500 console or downloaded for viewing on your PC.

- 1 To view the file on the LI-1500, press **MENU** and select **Data** and then **Files**. Select **View** to open your file. **Session Info** displays the file metadata, while **Records** shows individual measurement details.
- 2 To view your data on your PC, first connect the LI-1500 to your computer via USB. It will appear as a mass storage drive named **LI-1500**. Open the **Data** folder on the LI-1500 drive, locate the desired log .txt file, and drag a copy of it to a known directory on your PC.

Recall that you named the output **DINT** in the **Math** option of the **Add New Output** window. This is where DLI values are placed in the dataset.

	A	B	C	D	E	F	G
1							
2	Model:	LI-1500 Light Sensor Logger					
3	Config:	DLI2					
4	Session Remark:						
5	Software Version:	1.1.1					
6	Timestamp:	20181001 10:58:16					
7	DATAH	Record	Date	Time	INPUT1	DINT	
172542	DATA	219376	10/3/2018	11:58:45 PM	1.9303	1.6179	
172543	DATA	219377	10/3/2018	11:58:46 PM	1.9312	1.6179	
172544	DATA	219378	10/3/2018	11:58:47 PM	1.9294	1.6179	
172545	DATA	219379	10/3/2018	11:58:48 PM	1.9295	1.6179	
172546	DATA	219380	10/3/2018	11:58:49 PM	1.9293	1.6179	
172547	DATA	219381	10/3/2018	11:58:50 PM	1.9362	1.6179	
172548	DATA	219382	10/3/2018	11:58:51 PM	1.9303	1.6179	
172549	DATA	219383	10/3/2018	11:58:52 PM	1.925	1.6179	
172550	DATA	219384	10/3/2018	11:58:53 PM	1.9334	1.6179	
172551	DATA	219385	10/3/2018	11:58:54 PM	1.933	1.6179	
172552	DATA	219386	10/3/2018	11:58:55 PM	1.9275	1.6179	
172553	DATA	219387	10/3/2018	11:58:56 PM	1.9293	1.6179	
172554	DATA	219388	10/3/2018	11:58:57 PM	1.935	1.6179	
172555	DATA	219389	10/3/2018	11:58:58 PM	1.9307	1.6179	
172556	DATA	219390	10/3/2018	11:58:59 PM	1.937	1.6179	
172557	DATA	219391	10/3/2018	11:59:00 PM	1.9305	1.6179	
172558	DATA	219392	10/3/2018	11:59:00 PM	1.9305	1.6179	

If you capture measurements for more than one day, the DLI value will reset to zero and start again at the next configured start time.

References

P.C. Korczynski, J. Logan, and J.E. Faust. 2002. Mapping monthly distribution of daily light integrals across the contiguous United States. Hort. Tech. 12:12-16.



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