

ILT2500

Operation Manual



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TECHNOLOGIES

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1. Introduction:

Thank you for choosing the ILT2500. The ILT2500 internal Datalight software was designed to be simplistic enough for easy touch screen operation and advanced enough to meet the needs of researchers and scientists. The ILT2500 works with hundreds of sensor/filter/optic combinations and can be run using internal or PC software making it extremely versatile.

The ILT2500 System includes:

- A. ILT2500 Meter** – Auto ranging meter.
- B. USB Cable** - Micro and Mini USB cables for charging, software control and data retrieval.
- C. CC200 Case**– Protective carrying/shipping case.
- D. Electrical Calibration Certificate** – N.I.S.T. Traceable/ISO17025 accredited.
- E. Datalight III PC/Mac computer software-Free download on ILT website:**
<https://www.intl-lighttech.com/support/software>
- All systems should be run using FW 3.1.4.7 or higher.**
- F. Sensor /detector (separate purchase required/sold separately).**

Note: Instructions manuals and Datalight III software downloads are located on the ILT website:
<http://www.intl-lighttech.com/support>.

2. System Specifications:

- A. Dynamic Range:** 1 pA to 1 mA, **Calibrated Range:** 5 pA to 1 mA(*pending final QC*)
- B. Display:** 4.3", 480x272, TFT Color LCD, Touch enabled, Backlit
- C. Operating Temperature:** 0-40 Deg C
- D. Storage Temperature:** -10 – 45 Deg C
- E. Memory:** 4GB microSD
- F. USB Current Draw:** Typical: 500mA Max:900mA (USB 3.0)
- G. Bias:** Programmable 5V bias
- H. Time:**
 - H1. Sample Time:** Select Auto, Fast, .1sec to 5 seconds or use Auto (based on light level)
 - H2. Recording Interval:** Select from stream(500 samples a second), "Sample" to match the "Sample Time" noted above or select from 1 second up to 1 hour intervals
 - H3. Chart Update Time (Trend):** Select from .1 seconds up to once per hour
 - H4. Flash sample time:** Integrates up to 3000 readings per second
 - H5. Beacon:** Frequency .3-1.4 Hz
- I. Dimension and Weight :** 3 x 6 x 1.5", .8 lbs

3. Quick Reference Guide:

3A. Front: The front panel of the ILT2500 is a full color 4.3" capacitive TFT touch screen display. The display is a sensitive electronic device. It should not be exposed to sharp objects, harsh environments, chemicals, liquids etc.

3B. Rear: On the back of the ILT2500 is a stand which is opened by grasping at the two finger slots and gently lifting the stand up. The stand has small posts that slide along the housing to open and close. No force should be applied to the stand during opening and closing. When the stand is in use, no pressure should be applied to the



meter as this can bend the small post holding the stand into the housing.

3C Side: The right side of the meter includes:

- A. USB A female port** – For firmware and system updates (requires a USB stick).
- B. Micro USB female port** – For charging and extraction of saved data.
- C. Mini USB female port** – For charging the battery & running external Datalight II software.
- D. Charging LED** – Light when device is charging (off when not charging)
- E. On/Off – Fast Charge:** Turns meter on for use. Turn off to conserve battery or for faster charging.



3D. Top: Contains the sensor mount, a 15-Pin D-Sub connector and posts for securing the sensor to the device. The ILT2500 is backwards compatible with all “D” style sensors with the exception of PMT's and SHD Low light level sensors. To connect the sensor, align the sensor’s male 15 pin connector to the meter’s female connector and apply slight pressure to insert. To assure proper connection is maintained during testing, tighten screws on each side of sensor connector.



3E. Quick Setting Guide: If your meter and sensor were purchased together along with optical calibrations, your device(s) will arrive with the cal factors pre-programmed

1. Plug in your sensor (activates the smart sensor in sensors mfg 2018 or later)
2. Turn on the meter by pushing the On/Off button down into the (I) position.
3. After a short start up menu the Home Screen will appear.
4. Check the power monitor window in the upper right hand corner to assure batteries have enough charge to complete testing. (see Section 4 for charging instructions)
5. Select your display style based on user preference (touch ICON to select)
 - Meter: Larger numerical values and no graph
 - Trend: Smaller control buttons with optional bar or line graph(see 15I for swap chart type)
 - Tall: Portrait mode (usb ports and on/off switch on the right)
 - Wide: Landscape mode (usb ports and on/off switch on the top)
 - Flash: for testing pulsed light sources such as xenon lamps
 - Beacon: for testing slow pulses such as beacons, Warning lights. Etc.
 - Spectrometer: For use with MEMS880 spectrometer head release TBD
6. To change the display app., use the home button and touch the preferred app icon.
7. The reading window will open in current mode and begin displaying measurements in amps. Users can program their own settings to allow the window to open with the preferred display.
8. The display will darken after a few minutes of inactivity to conserve battery power. Touching the screen will return the screen to full brightness based on the brightness settings.(see 15N & 15O to change display dimming/off settings)

3F. Quick Start – Common Problems: The two most common causes of error are incorrect calibration factor use and improper zero. It is a good practice to verify the correct calibration factor is in use before taking measurements. It is equally as important to assure a proper zero has been performed.

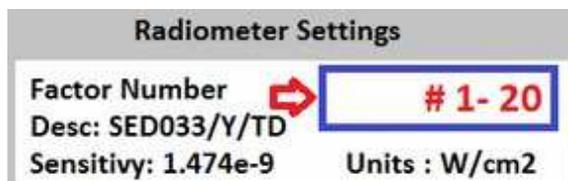
3F1. Calibration Factor Verification. Locate the calibration factor on the detector calibration certificate below the model and serial number fields in the top third of the report.

Example:

(YIS)PHOTOPIC ILLUMINANCE RESPONSE SENSITIVITY FACTOR AS CALIBRATED ON: 25-Feb-2016

 1.587E-8 (A)(ft2)(lm-1) assuming 3215 K Color Temperature
1.474E-09 (A)(lux-1) assuming 3215 K Color Temperature

From the home screen select settings, scroll to the second setting window labeled Factor Number. Verify the sensitivity factor and factor units are correct. If not touch the selection window and a scroll menu will appear, select a new channel until you find the correct sensitivity factor as noted on your certificate. (If you do not locate your calibration factor and units from the certificate, go to 5D to learn about adding/changing calibration factors)



Touch the back button to return to the home screen.

3F2. Zero: There are two kinds of zero that can be used to improve accuracy. A **dark zero** is used to remove small ambient noise caused from the environment. With the sensor plugged in and covered with an opaque object, press the zero button. This reading will be subtracted from all future readings to provide a zero reading. An **ambient zero** is used to subtract small background light levels that are not coming from the test source. With the test source off or blocked and the sensor exposed to the environment/ambient light, press zero. (An example of an ambient zero source is a computer display that is needed during testing.) Place the un-covered sensor in the test location. Cover the test light source, or turn it off. Press Zero. The ILT2500 will take a measurement and subtract that value from all future readings until zero is pressed again.

3G. Quick Start Feature Overview: The first time you turn on your meter you will most likely open in the home screen. If not, you can use the home button to access the home screen. Select an application such as Meter or Trend to familiarize yourself with the functionality. The App you are running (ie Meter Tall) will be displayed in the upper left and the battery life indicator will be displayed in the upper right. In the second line you will see the units of measurement and the selected calibration factor Channel.

3G1. Display resolution: The < - and- > buttons below the display will allow the user the control how many digits are displayed. Ie. 0.11 changes to 0.1111.

3G2. Display Units: Toggles between the available fields; current, light level, OD, and % trans. To take calibrated light level readings, press display units until light level is selected.

Note: If light level is selected prior to selecting a calibration/sensitivity factor, an error

message Set Factor will appear in place of light level readings (see 15P1 for selecting factors).
If OD and % Trans, are selected and no baseline 100% value has been set and error Set 100% will appear see 3G8 below to learn more about setting 100%)

3G3. Integrate:(Requires Display Units set to light level) Summation of data, records exposure/dosage (ie. W/cm² becomes J/cm² in integrate mode).

3G4. Min-Max: Holds the display at the present value until a new minimum (lower reading) or new maximum (higher reading) is measured, then updates the display accordingly.

3G4a. Note: Min-Max also serves as a Peak FW. See section 15F. Min/Max (and FW Peak)

3G5. Record: Starts and stops (toggles between) continuous recording of readings and creates a new file with time, instantaneous, min, max and average measurements.

3G6. Zero: Takes a measurement and creates a zero value by subtracting the zero measurement reading from all future readings. (see 3F2 above to learn more about assuring an accurate zero)

3G7. Hold: Freezes the numerical display value on screen.

3G8. 100%: Takes a measurement and saves it as the 100% baseline for transmission and O.D.

3G9. Capture: Takes a single measurement. Captured measurements are appended to the single sample file.

3G10. Quick Start Care and Handling:

- Always store the meter in the carrying case when not in use and only ship in a carrying case with protective packing to prevent shock and damage. No items should be placed above or under the meter inside the carrying case.
- Do not expose meter to direct sunlight or high heat sources as the internal temperature can rapidly increase and cause erroneous readings and damage.
- Standard operating temperature is rated at 0-40^o C.
- Do not apply any force to the display.
- Do not apply pressure to extended stand.
- Opening the housing voids warranty, Housing is not water tight, avoid moisture, liquids and chemicals.

Contact ILT for repair and calibration prior to shipment and obtain an RMA:

<http://www.intl-lighttech.com/services/return-material-authorization>

4. Internal Battery Pack:

4A. About: Inside the ILT2500 is a 3.7V 5500mAh rechargeable lithium-polymer battery pack. A new fully charged battery pack typically last for 4-8 hours of continuous use (depending on display brightness settings and other feature settings).

4B. Charging: Charging the battery is done through the USB 3.0 mini or micro port.

WARNING: The battery pack in the ILT2500 is expected to last for many years. (up to 500 charge cycles). Batteries should only be charged, stored and used in temperature between 0-45 degrees, or expansion and damage can occur. Battery packs should only be replaced by trained personnel. Changing of the battery pack by non ILT personnel voids the warranty and can cause damage to the pc board.

The power source can be supplied from a computer, a power bank, a charging hub, a wall-wart or any USB 2.0 or 3.0 device. A full charge is obtained in approximately 12 - 14 hours. Meter will charge the fastest when the power button is in the off position. The ILT2500 circuit is design to prevent over charge. The ILT2500 has a low power indicator that will advise when the battery needs recharging.

5. Sensor Connector and Wiring:

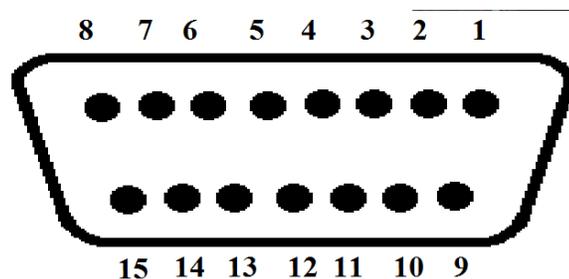
The 15 pin D Sub miniature connector on the top of the ILT2500 was selected to allow backwards

compatibility with ILT1700 (and IL1350) sensors. Future ILT2500 sensors will be supplied with an internal memory chip inside the D-sub connector that includes the model and serial number of the sensor as well as calibration information. The ILT2500 will have the ability to read the smart detector information and apply the proper calibration factor to be used during testing.

The D-sub not only receives the current generated by the sensor after exposure to light, it also supplies bias to sensors requiring bias for power and/or to improve response time. The D sub connector is not limited to only measuring devices manufactured by ILT. Any solid state device that generates current from 50 pA to 1 mA can be connected to the ILT2500 for measurement of current. Please see wiring diagram below:

Wiring diagram for D sub:

Pin Description	Pin	Description
Pin1:	-9Volts	Pin9: Shield
Pin2:	I2C SCL	Pin10: SODIMM_85
Pin3:	I2C SDA	Pin11: SODIMM_97
Pin4:	3.3Volts	Pin12: PWM_B
Pin5:	GND	Pin13: External Analog In 1
Pin6:	Det. Cathode	Pin14: External Analog In 2
Pin7:	Det. Anode	Pin15: N/C
Pin8:	5Volts	



Warning: please consult with an ILT technician before connecting a current generating device that could exceed 1 mA of current to prevent risk of damage to the sensitive measurement circuitry.

6. USB Ports: There are three USB ports on the side of the ILT2500 device



- **UPDATE:** Is used for code updates and requires the use of a memory stick. (not included)
- **DATA:** Accesses the internal 4 Gb memory device where data is saved and to charge the battery. The Micro USB is used to download stored data and to erase data from the memory device. This port can also be used the charge the battery.
- **PC:** The Mini USB port is used to connect to a computer and to charge the battery. Datalight software is available for download on the website: <https://www.intl-lighttech.com/support/software>, or request an emailed copy by emailing ilsales@intl-lighttech.com

7. Display:

The Display is a full color 4.3" Capacitive TFT Touch screen display. Contact with sharp objects will damage the display. A stylus or finger is recommended for changing settings on the display. Care

should be taken when packaging and storing the meter to assure no pressure is applied to the surface of the display. **Do not expose the Heat Sources, Strong UV Sources, liquids or Chemicals.**

8. Current Measurement and Limitations:

The ILT2500 provides accurate/calibrated measurements in the 5 pico-amp to 1 milli-amp range and can be manually fixed to a specific range, or automatically change to the correct range as the light level changes, using the auto range feature.

8A. Low Level Current Measurement: Though the system can measure as low as 1 pico-amp of current with a resolution of 0.61 pA measurements in this range will have a much greater uncertainty and should be considered as relative measurements due to the potential for noise and instability. To determine the current range prior to or during test, user can select current in the **display units** feature. To determine the current range post measurement, user can multiply the reading by the calibration factor to calculate the current level used.

IMPORTANT NOTE: When measuring below 100 pA customer should:

- Use the “User Dark” (aka “Zero”) function to ensure the unit is properly zeroed in the same environment where measurements will be taken.
- Allow extended settling time.
- Limit noise and temperature changes in the environment.

8B. Saturation: The ILT2500 provides an autorange mechanism allowing it to measure over 8 decades of current and/or light levels. While autoranging the ILT2500 can experience saturation. When this condition occurs the display will provide a “SATURATION” warning. To prevent saturation, neutral density filters or apertures can be added to the sensor, or a greater distance between the sensor and the source can be used.

NOTE: ILT “D” type sensors have been designed to assure a safe current value is supplied to the ILT2500 so no damage will occur to the meter during saturation.

8C. Dynamic / Measurement Range With ILT detectors: The ILT2500 can measure current from 1 pA to 1mA however the recommended range for calibrated readings is 50 pA to 1mA. This range does not take into account the range of current the sensor is capable of supplying to the meter. Not all sensors allow linear calibrated measurements over this range. Below is a list of the dynamic range based on detector type.

- SED033/SED100 UV-IR Silicon sensors: 5 pA to 1 mA
- SED005 UV-VIS GaAsP Sensor: 5 pA to 1 mA
- SED007 IR InGaAsP Sensor: 5 pA to 1 mA
- SED623, SED624 & SED625 Thermopiles UV-IR(Typically IR measurements): 18nA to .1mA
- SED240, SED220 & SED185 Vacuum Phototubes (UV measurements) 50 pA to 1 μ A

To determine the operating range for a specific sensor divide the Min and Max current measurement ranges, as noted above, by the sensors calibration factor from the ILT calibration certificate. (see 15P for information on calibration factors). For example: SED240/TD is a vacuum Phototube with a working current range of 50 pA to 1 μ A and a typical calibration factor of 1.21 e-3.

Min current of 5 pA / cal factor 1.21 e-3 (A)(cm²)(W-1) = min reading of 4.13E-09 W/cm²

Max current range of 1 μ A / cal factor 1.21 e-3 (A)(cm²)(W-1) = max reading of 8.26E-04 W/cm².

9. Sample Time and Limitations: There are multiple factors that affect the sampling time including the sensors rise time, software selection, software settings and the method used to store, transfer or display the data and the light levels.

The ILT2500 can take readings as fast as 10 μsec. And when using the flash app on a PC, it can provide a sample as fast as 20 uS (Flash allows up to 4096 data points over a sample time range of 80 msec to 40 seconds)

When using the internal computer and display, the device can update as fast as 50 samples per second assuming the light intensity is strong enough to allow valid measurements at the fastest settings.

Device Sampling and Data Transfer Rates

Software Package	Device Sample Period	Minimum Application Sample Period	Maximum Application Sample Period	Minimum Application Sample Frequency	Maximum Application Sample Frequency	Max On-Device Data/sample Storage	Approximate Data Transfer Rate to Computer Storage (over USB or to on-device SD drive)
Flash App DataLight III & II	10uS	20 uS	10 ms	100 Hz	50 KHz	4096	270 samples/sec
DataLight III Meter(USB & WiFi)	10us	20 ms	5 sec	0.2 Hz	50 Hz	N/A	50 samples/sec
MAC Meter(USB & WiFi)	10us	20 ms	5 sec	0.2 Hz	50 Hz	N/A	50 samples/sec
Datalog	10uS	10 ms	1 day	N/A	100 Hz	16380(2)	270 samples/sec
ILT2400	10uS	20 ms	5 sec	0.2 Hz	50 Hz	>10M(4GB)	50 samples/sec
DataLight II Meter(USB)	10uS	10 ms (4)	2 sec	0.5 Hz	100 Hz (1)	N/A	100 samples/sec (4)

Notes:

- DL II Meter version 2.3.8 or greater required to sample current or irradiance at 100 Hz, including capture to disk.
 - Requires [Device Manager...USB Serial Port]->Port Settings->Advanced->Latency Timer = 1ms
- 16380 data points without real-time timestamp, 8190 with real-time timestamp

10. 5V Bias:

The ILT2500 can supply a 5V bias to silicon sensors to increase the response time. ILT silicon sensors are often biased when used for flash/pulsed light measurements.

Warning: The 5V bias can cause a decrease in sensor stability and possibly damage other sensor material. ILT silicon sensors include: SED033, SED100, SCD110, XSD140B, XSD340B, XSD140A, and XSD340A.

11. Home Screen: When the meter is turned on it will take a few moments for the software to initialize. Upon completion the home screen will be displayed. To return to the home screen at any time, simply touch on the < Back arrow in the top left of the display in settings screens, or touch on the home icon within a measurement screen. (note customers can skip the home screen by changing the start up app in settings)



12. Display Style Selection: Select The measurement app:

Meter Tall: Meter displays the data in numerical format with NO GRAPH. Tall sets the display to Portrait mode(usb ports on the right).

Meter Wide: Meter displays the data in numerical format with NO GRAPH. Wide sets the meter to landscape mode (usb ports on the top).

Trend Tall: Trend displays the data in numerical format along with a chart containing a bar or line graph. (see 15I & 15J to make changes to the chart settings)Tall sets the display to Portrait mode (usb ports and on off switch on the right).



Trend Wide: Trend displays the data in numerical format along with a chart containing a bar or line graph. (see 15I & 15J to make changes to the chart settings). Wide sets the meter to landscape mode.

Survey: For mapping /recording results based on pre-programmed locations.

Light Stack: Light stack fills the majority of the display with a color indicator. Red for error, yellow as a warning and green for all is well.

Note: for error message “Light Stack is not configured” see section 15K for set up.

Beacon: Used for eff candela and other pulsed light applications

Spectrum: requires use of MEMS880 Spectro head, Coming soon.

Flash: provides integrated irradiance and a graphical profile of pulsed/flashing sources

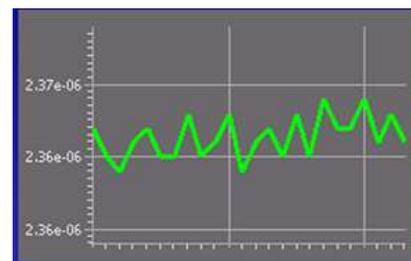
13. Display Content and Controls:

13A. Indicator Line: Indicates which program is running, ie. Meter Tall, and the battery life condition in percentage.

13B. Display content: The content note, located above the display, indicates which display units have been selected by the display units button, followed by the units of calibration and on the far right is the settings access icon.

13C. Resolution Adjustment: The Left button ←.000 increases the number of digits shown in the numerical display the right button →.00 decreases the number of digits.

13D. Display Graph: In trend, the graph displays the average light level since the last reading. The graph continues to update even when Hold is pressed. Graph can be set to update as fast as .1 seconds or as slow as once per hour. Note: See see 15I & 15J for setting bar or line graph.



14. Feature Buttons:

14A. Display Units: Toggles between the available fields; Current (output is in amps),

Optical Density: compares the incoming signal to the saved 100% reading to provide an OD between 1 and 4,

Transmission: compares the incoming signal to the saved 100% reading to provide a reading of % transmission.

Light Level: converts the incoming current from the sensor to calibrated readings in appropriate units such as lux, fc, W/cm2, Watts etc . Based on the user selected calibration factor. (see 15B for selecting calibration factors and 15P for adding/programming calibration factors.)

14B. Zero: Takes a reading in amps and subtracts that current value from all future readings. Any value below the stored value will be shown as a Zero reading. When measuring small light or current levels, it is a good practice to zero in the environment of the testing and perform period zero validation or re-zero when the conditions in the environment fluctuate(temperature, noise, ambient lighting)

14C. Integrate: Is used to measure dosage or exposure. When toggled on, the ILT2500 will take the present reading and add it to the previous value, once per second, creating a sum of light measurements over time. When in integrate mode the units of the readings change to include *seconds. For example, Lux becomes lux*seconds, W/cm2 becomes W/cm2*seconds or J/cm2, W/m2 becomes J/m2.

14D. Hold: Freezes the value on the numerical display(not the graph) to allow manual recording.



14E. Min/Max: Toggles the numerical display to only record a value that in Min, Is less than the existing value on the display or in Max is greater than the existing value on the display.

14E.1 Min/Max: also doubles as a **Peak FW** button. Peak FW is similar to Max, except it pushes the limits of the system's rapid measurement capability and uses the firmware speed to scan for changes that occur very fast.

14F. 100%: Records the baseline value for 100%. This does not impact the display. To readout in percentage you must use the display units button to select percentage.

14G. Record: Toggles the record data to on and off. When on, the meter stores all readings internally. When off the meter stops saving readings to the internal memory. Recorded measurements generate a new file each time the record start button is touched. The format for naming recorded files is ILT day-mon-year. Record creates a five column .csv file with Time, Instantaneous, min, max and average results.

14H. Capture: Records a single reading at the time the capture button is pressed. Captured measurements are appended to the single sample file, in the format date/time, instantaneous value.

14I. Home Returns to the home screen.

15 Settings:

The settings icons open the settings display which allow user customization. Settings can also be access by clicking on the setting drop down menu in the display  screens.



15A. Display Brightness: Brightness selection ranges from 1-Dim with lowest battery consumption, to 10-Brightest with highest battery consumption.

Radiometer Settings

15B Calibration factors:

15B1. Meter Factor : Selects calibration factors from the pre-programmed/available list ranging from 1 – 20. Factor selection allows readings in calibrated units such as W, W/cm², Lux etc.

15B2. Smart Detector Factor: Smart detectors can also store up to 20 calibration factors. In order to use, or create cal factors that are saved in the sensor connector, Use Smart Detector Factor must be enabled, in 15B3.

15Be. USE Smart Detector Factor: ON/OFF ON enable the use of the sensors cal factors. Off only allows customer to use factors save in the ILT2500 meter.

15C. Sample Time: Allows the user to program how fast the meter takes a reading ranging from 100 milliseconds to 5 seconds with the default set to Auto.

Auto will review the incoming signals intensity and apply the best settings. (faster with higher light levels, slower for smaller signals for better averaging)As a general rule of thumb, If current $\geq 1\mu\text{A}$, 0.5sec is used, else if current $<1\mu\text{A}$, 1.0sec

FAST samples at 20ms (50Hz)

Note: Using trend at fast speeds taxes the CPU with processing both measurements, numerical updates and graph updates. This can be seen as a slight flicker on the display. If this problem occurs, use Meter (no graph) or connect to the computer and use Datalight III Meter or Flash.

15D. Auto Gain Range: On or off. The ILT2500 has 3 relays that it cycles through when auto ranging from the lowest signals in the Pico amp range to the higher signals in the micro amp to 1 milli amp range. Auto allows the software to control when the device will change from one relay to the next to allow the most accurate results based on incoming current levels. Auto gain range- off requires the

user to set the range they will stay in during measurement.(see 15E below for information on setting the range.)

15E. Gain Range: When Auto Gain Range is set to off in section D above, Gain Range becomes accessible. The user can select the range based the max current to be measured. Ie; 1 mA, 3uA or 300 nA. Each relay allows the ILT2500 to measure approximately 3-4 decades with the max being the saturation point and noise become problematic as the reading approaches .0005 from the max.

To determine the range of current that applies to a specific light level reading, the user can select current in the display units (see section 14A for instructions) or multiply a previous reading by the calibration factor used to obtain the reading. Ie. 1mW/cm^2 ($1\text{e-}3$ mW/cm²) with a calibration factor of $1\text{e-}3$ (A)(cm²)(W⁻¹) = .000001 amps, $1\text{e-}3 * 1\text{e-}3$.

15F. Min-Max (and FW Peak): The min-max settings allows the user to change the functionality of the min-max button.

When in Min/Max mode, the reading will only change for Max when a reading that is higher than the displayed value is read, and for Min when a reading that is lower than the displayed value is read. When FW peak is displayed the min-max button will change to a FW Peak button. FW Peak uses the fastest scanning speeds to see rapid changes in light intensity and uses less averaging. For Very Fast moving light sources such as scanning lasers or pulses of light, use FW peak. For better averaging we recommend using min-max when speed is not a factor.

15G. 5V Bias On or Off: The defaults setting is off as there are numerous sensors that can be damaged or read incorrectly if bias is applied. When turned on, the meter will supply reverse bias to any sensor plugged into the device. (See section 5 for pin out information pertaining to bias) Silicon sensors such as the SED033, SED100, SPD025Y, and the XRL series can be biased when measuring flashing or rapidly changing values to increase response time. SED240, SED220 and SED185 Vacuum phototubes require the bias to be turned on to obtain the needed power.

WARNING: Sensors can provide inaccurate readings or be damaged if inadvertently biased. The ILT SED005 (GaAsp), and SED623, SED624 and SED625 (thermopiles) should not be supplied with 5V bias.

Recording to File Settings

15H. Recording Interval: Ranges from 1 second to 1 hour, or sample for faster speeds.

Sample: when selected, the record interval and sample time are synched. Ie if sample time is set .1, the meter will record a value every .1 seconds.

Trend Chart Settings

15I. Chart Type: Select a bar graph or line graph.

15J. Update Interval: Select the time between updates to the display from .1 sec to 1 hour.

Error and Warning Level Settings
15K. Light Stack Setting: Settings for light stack will determine when the screen turns Red, Yellow, and Green.

Trigger Type: There are three available triggers to initiate a change in the



indicator color.

Not used: An error will appear if light stack is selected when not used is applied.

Low: Used when a reduction in light output causes an error, ie phototherapy, under cure of product, Display testing, QC.

High: Used when an increase in light output could cause an error. Ie optical hazard, over curing, photodegradation, LED lamps QC.

Range: For when both a rise or fall of light level can be problematic. Ie binning of LED's, lamp QC.

Warning Level: Threshold for turning the display Yellow

Error Level: Threshold for turning the display Red.

Set up error messages:

1. The target/warning /error levels need to be numbers.

2. For Low trigger, the error level must be less than the Warning level

ie. target is 1 mW/cm² or higher (1e-3), a warning level (5e-4) (display turns yellow) when the light level decreases to .5mW/cm²(5e-4) or less, and an Error Level (8e-5) (Display turns red) will occur when the light falls below .08 mW/cm²(8e-5)

3. For High and Range, the error level must be greater than the warning level.

Ie target is 1 mW/cm² (1e-3) the warning must be larger than 1e-3 ie 3e-3 or 3 mW and the error must be larger than the warning and target ie .5 mW/cm².

Other Settings

15L. Start-Up App: Allows the user to change the display style from the default "Home Screen" to Meter, Trend, Cloak, Survey or Light stack automatically when the device turns on.

15M. Use Scientific Notation: ON / OFF

Scientific notation ON uses an exponent to show the decimal place, when off, a prefix is used.

examples:

On (1.35 e-3 W/cm²), Off (.1.35 mW/cm²)

On (4.78e-6 W/cm²) Off (4.78 uW/cm²)

On (8E+2 lux) Off (800 lux)

Prefix	Scientific Notation	Shorthand Symbol	Example
femto-	1×10^{-15}	f	100fA = 100 Femtoamps
pico-	1×10^{-12}	p	10 pW = $1e-11$ W
nano-	1×10^{-9}	n	1 nW/cm ² = $1e-9$ W/cm ²
micro-	1×10^{-6}	μ	50uA = $5e-5$, or $50e-6$
milli-	1×10^{-3}	m	8 mlux= $8e-3$ or .008 lux
Base	1×10^0		= 1
kilo-	1×10^3	k	1000 cd/m ² = $1E+3$ cd/m ²

15N. Dim Display After time settings: Sets the time in minutes before the display will dim to save on battery life. Times range from 5 min- 60 min and also includes Never.

15O. Turn Off Display After time settings: Sets the time in minutes before the display will shut off to save on battery life. Times range from 5 min- 60 min and also includes Never.

Maintenance

15P. Set Date and Time: Allows the user to set the date and time which are then used to create file

Click Update (system will automatically re-boot)

Warning: be sure the device is connected to power or has at least 20% battery life prior to performing an update. Do not disconnect the USB memory device until the update is complete. Do not turn off during a system update.

15T. Save Settings: Permanently saves all settings to memory (until Save Settings is pressed again) When applied a box will appear around the button to indicate completion.

15U. Restore Defaults: Returns all datalight software settings back to the factory default values. (Restore does not erase or alter calibration factors or any save data within the device)

16. Files:

The .csv files saved in the Files folder can be accessed using both internal software which will display a graph of the results or downloaded using the USB micro port.

16A. Viewing Stored Readings: Click on the Files icon. The newest recording file will automatically open in the graph. Use the drop down menu to select a different file. If the recording is still ongoing you can click in and out of the file (view a different file then return the ongoing measurement file) to update the graph results in the view window. To view files created using the survey app, scroll down to survey_data_file, to view files created using capture, scroll down to single_sample_file.

16B. Downloading Stored Readings: When the ILT2500 is connected to the computer using the USB micro cable, the computer will register the ILT2500 as a device with removable storage, allowing access into the Files folder. To access saved Files using a PC, click on Start, Computer and then click double click on the “ Removable Disk ...” within “Devices with Removable Storage”.

To open in excel, you will need to select tab or space delimited



16D. Deleting Stored Readings: To delete files, access the files through the USB micro port. Selected the file to highlight the then press delete.

17. Light Calc:

Includes some basic light measurement formulas for converting between units of measurement such as foot-candles to lux, lux to candela, W/m² to W/cm² etc.

le Enter 1.11 W/cm² reading obtain a calculated reading of 1.11e+4 W/m².

For lux to Candela, enter lux value and the distance in meters.

Additional formulas may be added over time, if you have a formula you would like ILT to add, please email ilsales@intl-lighttech.com.

18. Light Stack: Settings for light stack will determine when the screen turns Red, Yellow, and Green. See section **15K. Light Stack Setting** to configure your system.

RED is typically used to indicate an error-unacceptable level that does not meet the customer's requirements. For hazard measurements, this level could be when the light level recorded is unsafe. In other cases the level can be used as a go/no go level indicating the a risk of product failures when

intensities are too low or too high.

YELLOW is typically used as a warning stage indicating the range has changed and is approaching the “Red” error indicator level.

GREEN indicates the readings are in the desired range.

The light level display and buttons are much smaller in the Light stack to allow a greater viewing area for the color indicators.

19. Survey:

ILT's built in survey application allows customers to apply an address or note, which will be added to the date and time stamp for captured readings. Captured readings will be used to create a .csv file which can be downloaded and used to create a light survey report.

1. To start a survey, touch the survey icon. Survey opens in Portrait mode and automatically displays readings based on user programmed parameters. (Similar to Meter Tall).
2. Touch the “Select Location” box to open the drop down selection window.
3. To choose an existing address: Use the scroll bar to highlight the address. Touch the address to apply. The address will not show in the Select Location box.

Note: Addresses can also be imported into the ILT2500, by creating a custom Survey-locations.txt and uploading through the USB micro port.

4. To Add or Delete of the addresses list and touch Add/Delete location.
5. To Delete: Touch inside the grey the drop down menu from the top box, Cursor to the location that is to be removed, Touch the location to apply, With the box showing the location, touch the “Del” delete button. The Delete buttons border will turn blue to indicate completion. If you want to back out of Delete, scroll to the top and select the blank line above the addresses.
6. To Add: Touch inside the white add box. Use the keyboard to add an address or a note. Touch the Add. The add border will turn blue to indicate the new address has been saved.
7. When done adding and deleting addresses, touch the < Back button.
8. To apply an existing location click in the Select location box. Use the scroll bar to highlight the address. Touch the address to apply. The address will now show in the Select Location box.
9. To save reading(s) touch the capture button. Readings will be saved to the Survey_data_file.csv file, accessible via the usb micro port.

20. Flash: The Flash app was designed to measure pulsed /flashing xenon light sources and other rapid pulsed light sources.

Key features:

- Flash profile
- 5V bias switch
- Flash integration
- Flash counter
- Pre integrate zero option
- Integrates up to 3000 readings per second, with flash slow down circuitry to measure flashes in the μ S range
- High and low range

To use Flash, select the Flash app icon on the home page. Use settings to apply the 5V bias to speed up the response time of silicon sensors (SED100, SED033, SED270 and XSD140/340 sensors). Verify the correct calibration factor (if multiple calibration factors are available). Use the Zero button and/or set Auto-Zero before integrate to ON. Select the correct



working range (high or low light) Press the integrate button to start a measurement. Press the integrate button a second time to complete the test and view the results. Press the Profile button and expose to a flash of light to generate a graph. Flash does not save or export the results. (Note: For silicon sensors, use settings to turn on the 5V bias and increase the sensors measurement speed)

About Flash:

Typical Measurement Range:

High Light: (3 uA to 1 mA), Frequency 0-250 Hz

Low Light: (0 to 3 uA) Frequency 0-25 Hz

To determine your working range in light level (calibrated units ie W/cm², lux...) take the current range noted above and divide by the calibration factor for your sensor combination. For example SED270QT has a typical cal factor of 1.65e-4. 300nA equates to .000018 W/cm²
 3uA equates to .018 W/cm²
 1mA equates to 6 W/cm²

The Flash app display:

The top row states the application and shows the battery life. The 2nd row shows the units of measurement and the cal factor in use. Cal factor selection is done in Settings.

The white display box shows the flash count in the upper left, (Note: Counts was designed for rapid rises in light intensity and increases when the signal rises 4x between 100uS samples)

the working range in the upper right (1mA for High Light and 3uA for Low Light) and the readings (ie W/cm² instantaneous, J/cm² after integration is complete).

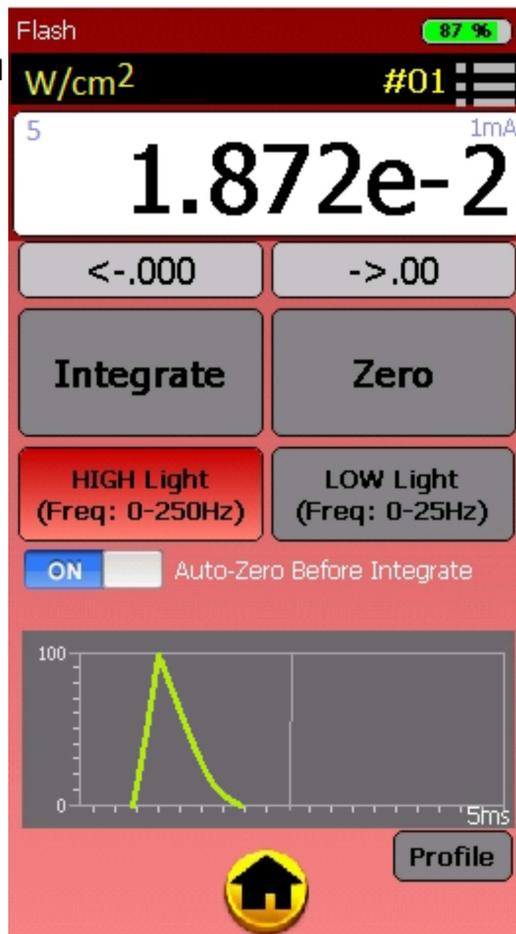
(reading of display can be set to Scientific notation on/off in settings. 1.872e-2 becomes 18.72 mW/cm² when set to off)

Below the display are the resolution controls. The Left button ←.000 increases the number of digits shown in the numerical display the right button →.00 decreases the number of digits.

The zero button is used to measure and subtract environmental noise and/or ambient lighting. The system should be warmed up, and the source to be measured should be off or blocked from the sensors view during zero.

The integrate button is used to take a measurement and toggles between start and stop each time it is pressed.

The auto zero before integrate allows the meter to re-zero before every test which assures a correct ambient and noise subtraction. Note that the auto-zero operation takes approximately 0.5s so



appropriate time should be allowed between pressing the Integrate button and the start of the first flash. Failure to do so will cause part of the flash to be included in the zero.

The gray window is the profile display graph. Press the profile button (it turns black when toggled on) and apply a pulse of light to the sensor. Note: For rapid pulses, due to analog “front-end” signal processing, the profile is not representative of the actual pulse shape. For such signals, the rise and decay (more pronounced) will appear slower than the actual flash of light.

The y axis of the Profile shows the peak and the X axis shows the time form start of the flash to completion of testing. The flash profile mechanism captures 5 msec of signal duration.

Flash App Warnings:

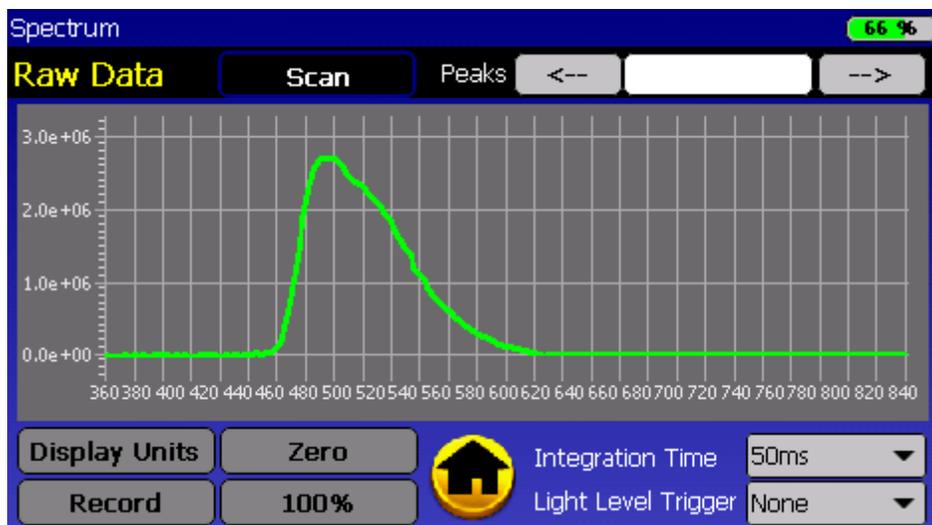
Saturated: Saturated in display box Saturated indicates the current generated (light level measured) exceeds the measurement capabilities of the system. Increase the distance, add attenuation filters, or add an aperture to the sensor to allow measurement of stronger signals.

Low: Low in display box : The signal is too small try switching to low light, or decrease the distance between the source and sensor.

Time out looking for peak; Time out warning above profile graph indicates that a measurable flash was not detected within approx 5 seconds of pressing profile, or the light source may not rise fast enough to register. Press profile again and apply light within 5 seconds. If no graph is displayed, try an integration. Is the pulse count accurately counting the amount of flashes? If not, the light source may not rise fast enough to register as a pulse and only integrations can be measured.

21. Spectrum: The ILT2500 can function as a spectrometer when used with the MEMS880 mini spectrometer head (Not yet released)

COMING SOON



22. Beacon:

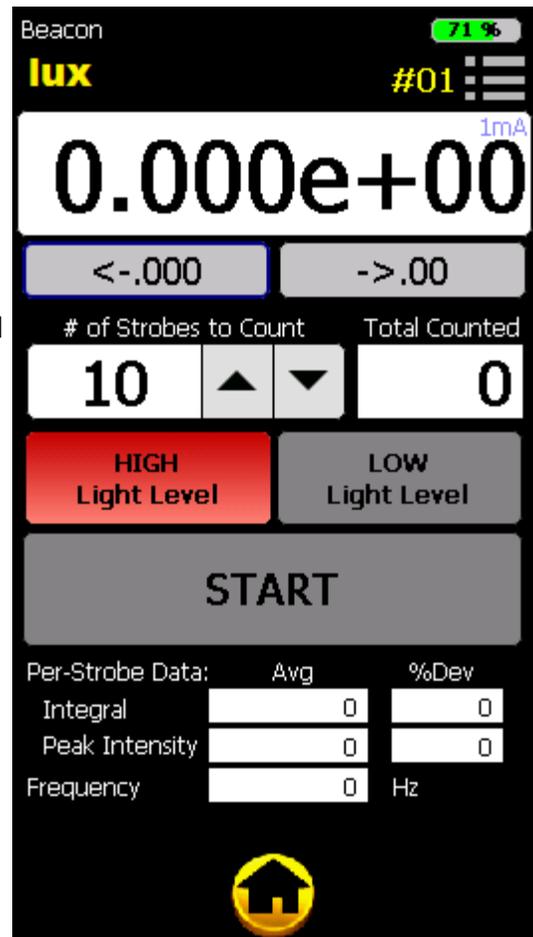
The App was created for testing pulsed light sources such as beacons, optical warning systems(as specified by NFPA72 and ANSI/UL1971), obstruction lighting, emergency exit lighting, airport lighting, and visual approach slope indicators (VASI). The Beacon app frequency range is approximately 0.3Hz to 1.4Hz with a fixed 600 uSec per flash integration time.

Set up: Use settings to apply the 5V bias to speed up the response time of silicon sensors(SED100, SED033, SED270 and XSD140/340 sensors). Verify the correct calibration factor is selected if multiple calibration factors are available.

Beacon Display

The row above the display shows the units of display readout and the channel of the calibration factor that is being applied. In the upper right of the display is the working range ie 1mA The numerical readout of the display is in the units noted above the display. The readout is supplied in scientific notation as shown.

Below the display are the resolution controls. The Left button $\leftarrow .000$ increases the number of digits shown in the numerical display the right button $\rightarrow .00$ decreases the number of digits. # of strobes to count $\wedge \vee$ is a programmable value of how many flashes to be measured.



Level selection:

High Light level: (3 uA to 1 mA), Frequency .3-1.4 Hz

Low Light: (0 to 3 uA) Frequency .3-1.4 Hz

To determine your working range in light level (calibrated units ie W/cm², lux...) take the current range noted above and divide by the calibration factor for your sensor combination.

For example SED033/Y4/L30 with a cal. factor of 1.65e-4 fc at 8 feet

3uA equates to .018 eff. cd

1mA equates to 6 eff. cd

Taking a measurement; Use the arrow buttons $\wedge \vee$ to select the number of flashes to be integrated. Set your level to high or low. Click the start button to begin a measurement. The system automatically determines the ambient/zero level during the measurement. The display will update showing each flashes intensity during the testing. When complete, the large display window will show the final flash intensity and the Per strobe data analysis will be displayed at the bottom of the screen and saved to the under files, Beacon_data.csv for downloading.

Timeout error: You have approximately 5 second from the time you press start until the first flash must be measured. To clear a time out error, press start again.

23. Info:

Lists product and software settings including model no, serial no, calibration information, software and firmware information and user programmable selections such as sample time, range selection etc.

24. Sleep:

Manually sets the screen to dark to conserve battery. Simply touch the display at any time to turn off sleep mode and re-illuminate the display.

25. Upgrades:

ILT offers software and firmware upgrades at no additional cost as they become available. Though extensive testing on the internal and external datalight software has been done, there is a chance we may find a small bug or an area that we can improve upon over time. ILT will add both software and firmware upgrade to our website as new releases become available. Software updates will be provided on the website: <http://www.intl-lighttech.com/support/software>.

Download the software onto a USB stick (not provided)

Turn the Meter on , allow initialization to complete and verify the battery life is above 20% (no USB devices should be plugged in during initialization)

Insert the USB stick into the USB A port on the side of the ILT2500.

Click on Settings, and Scroll to the bottom of setting window. Click on the firmware update box.

Select the file using the drop down arrow selection box.

Click the Update button and wait for the process to complete.

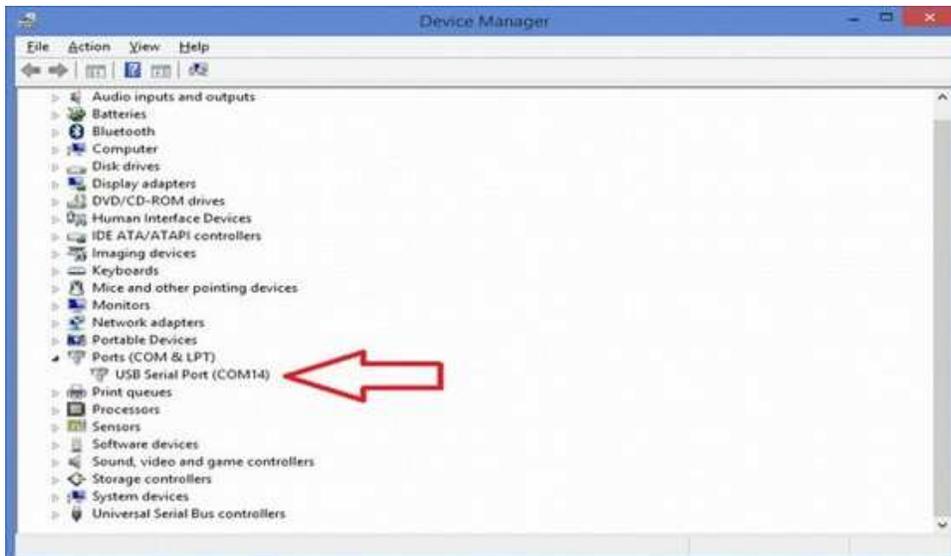


26. Datalight software for windows 7, 8 or 10 PC or MAC IOS:

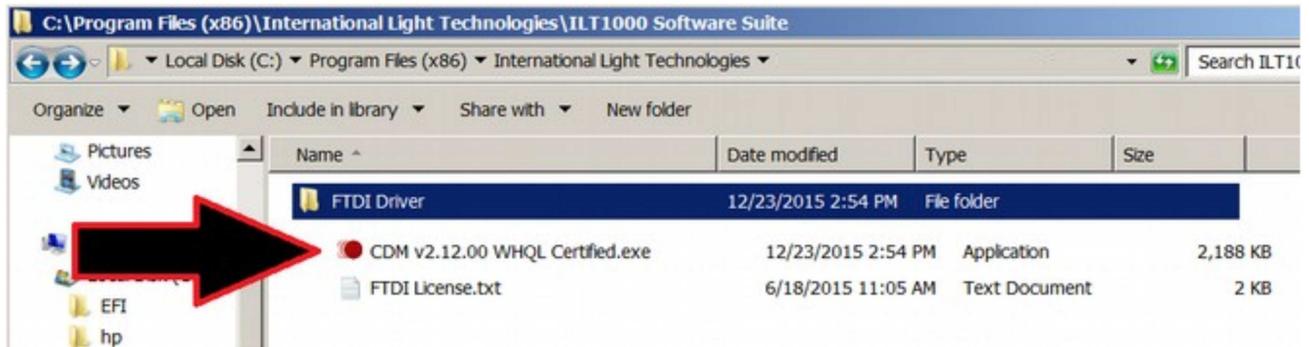
The ILT2500 can be connected to a computer via the USB mini port and be controlled by the external software as if you were using an ILT1000, ILT5000 or ILT6000 device. Datalight III software is available for download on the ILT website: <http://www.intl-lighttech.com/support/software>.

You will be brought through a simple set of “Next”, “Next”, “Finish” steps.

Once you have installed the Datalight III software, Turn on your ILT2500 and allow initialization to complete. After completion, Plug the ILT2500 into any available USB port or a hub connected to the computer. Wait up to 2 minutes for the drivers to install. You can verify a USB port has been assigned properly using device manager, under Ports (COM & LPT) as seen in the following image:



26A. Set Up Procedure: Allow the computer to assign a com port and install FTDI drivers, as needed. Device drivers are located in C, Program Files, International Light Technologies, Datalight III, FTDI folder. To install drivers double click driver CDM.....exe



Software manuals for Datalight III can be found on the ILT website: <http://www.intl-lighttech.com/support/manuals-documentation>

27. Care and Handling:

The ILT2500 internal board is a sensitive electronic device. Due to risk of board damage, only trained personnel should attempt opening the housing on the ILT2500. Opening the ILT2500 by non-ILT personnel voids all warranties and may adversely affect the calibration of the meter.

Always store the meter in the carrying case when not in use and always ship in the hard plastic carrying case with protective packing to prevent shock and damage. No items should be placed above or under the meter inside the carrying case. Do not expose meter to, strong levels of UV, direct sunlight or high heat sources as the internal temperature can rapidly increase and cause erroneous readings and damage. Do not apply any force to the display. Do not apply pressure to the meter when the stand is in use.

28A Operating Temperature: 0-40°C. ILT meters and sensors have a recommended operating range of 0 to 40°C to assure the accuracy of the calibrated measurements.

27B Humidity: 0-95% non-condensing.

27C ESD: Use basic ESD precautions and practices when handling the device. It is advisable to discharge any static buildup by touching a grounded conductive surface before making contact with devices or its connectors.

27D Cleaning: No chemicals or liquid solution should be used to clean the ILT2500 housing. The ILT2500 housing does not provide a sealed barrier to protect the internal components from moisture. The display should be cleaned with low moisture lens cleaning cloths to prevent scratching. Use care near the edges to assure moisture does not seep into the housing.

27E Submersion: The ILT2500 housing is not rated for submersion.

27F Calibration: ILT typically recommends an annual calibration for all equipment. Per ISO17025, the customer may, through their own QC process, create their own calibration cycle.

27G Service: Before returning any equipment to ILT for service (including warranty evaluations) customer should visit the ILT website and obtain an RMA:

<http://www.intl-lighttech.com/services/return-material-authorization/rma-form>

28. Warranty:

The equipment you have purchased from International Light, Inc. has been expertly designed and was carefully tested and inspected before being shipped. If properly operated in accordance with the instructions furnished, it will provide you with excellent service. The equipment is warranted for a period of twelve (12) months from date of purchase to be free of defects in material or workmanship. This warranty does not apply to damage resulting from improper set up, accident, alteration, abuse, loss of parts or repair by other than International Light Technologies. The equipment will be repaired or replaced, at our option, without charge to the owner for parts or labor incurred in such repair. This warranty shall not apply unless the equipment is returned for our examination with all transportation charges prepaid to International Light Technologies, 10 Technology Drive, Peabody, MA 01960, TEL: 978 818 6180, Email ilservice@intl-lighttech.com. International Light Technologies has no other obligation or liability in connection with said equipment.

The internal Datalight and external Datalight II & III Software and Firmware are supplied "as-Is" with no warranty.