NOTE: These Products Were Replaced by ILT400 and ILT490 Belt Radiometers

Operators Manual

IL390C Light Bug & IL290A Light Bug

Technical Support:

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This manual is also available in Adobe Acrobat (.pdf) format from:

http://www.intl-light.com/library/manual/Lightbug_manual_0306.pdf

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1. Introduction

All of the specifications contained in this manual apply to both the IL390C and IL290A UV Curing Light Bugs with the exception of spectral range. The IL290A spectral range is 205 to 345 nm for UVC and UVB measurement. The IL390C spectral range is 250 to 400 nm for UVB and UVA measurement. For convenience, the IL290A will only be mentioned where applicable.

The IL390C UV Curing "Light Bug" is a self contained UV dose measuring instrument. The IL390C's low profile, improved spatial response and range allow its use in the latest design high power UV curing apparatus, printed circuit (photoresist) and printing plate exposure systems.

The unit has been engineered to tolerate the harsh environments associated with UV curing applications. The polished aircraft aluminum housing reflects the high infrared and UV irradiance encountered to protect against overheating and materials degradation. The solid machined housing and internal high "G" force mounts on all critical components enable the unit to withstand rough handling in conveyor belt systems.

The IL390C's one button operation enables quick, easy and accurate measurements by non-technical personnel without disruption of production schedules. The instrument is run through the curing system and displays accumulated UV energy received. This allows the user to control the curing process by adjusting belt speed to maintain an optimum UV level for a particular formulation or to assist in troubleshooting a problem in the system, such as dirty lamp reflectors. Production process monitoring with the IL390C minimizes waste product and downtime.

2.0 Operation

2.1 On / Off

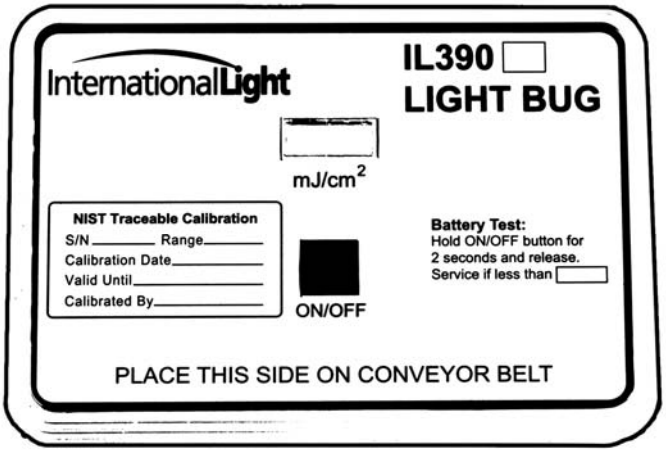
To turn the IL390C on, press the On/Off button quickly. The light bug will display "0" on the liquid crystal display. Press the On/Off button again to turn the unit off. To reset the display to zero after a measurement, simply turn the instrument off and back on again.

2.2 Automatic Shut-Off

The IL390C will automatically shut off after approximately 10 minutes, in order to prolong the life of its internal batteries.

2.3 Battery Test

Hold the On/Off button for two seconds and release. This action causes the IL390C to measure its battery voltage. Compare the reading with the minimum acceptable battery level indicated on the front label. Battery voltage is low if less than this number.



2.4 Measure

With the unit ON, place the IL390C in the exposure system with the polished aperture side facing the source of UV curing radiation. The IL390C integrates the total dose of ultraviolet radiation received during exposure. The integrated dose is displayed on the LCD display. Record this dose reading in millijoules per square centimeter (mJ/cm^2). For the most repeatable results, orient the IL390C in the same position each time it is sent through the exposure system. Alternatively, the IL390C can be used to measure uniformity by varying its position on the conveyor belt and profiling the system from several locations.

2.5 Measurement Units

Energy is measured in joules. Energy is what does work. Power is the rate at which work is done, expressed as energy per unit of time. A rate of one joule per second is defined as one watt. In light measurement, optical energy is measured per unit area, expressed in joules or millijoules (0.001 J) per square centimeter. A dose of 10 mW/cm^2 for 10 seconds delivers 100 mJ/cm^2 of optical energy to the receiving surface. Light spreads out the farther it gets from the source. Irradiance, or the density of light falling on a surface, decreases with distance. For this reason, it is important to measure ultraviolet radiation at the same distance from the source as the intended UV cured product. The low profile of the IL390C allows it to pass through most UV curing equipment in the same position as the target product. In a UV curing exposure system, it is most important to know the total dose products receive so that the process can be evaluated, adjusted, controlled, and repeated. The appropriate unit of measurement for exposure is energy per unit area, expressed in millijoules per square centimeter (mJ/cm^2). Typical curing systems deliver between 300 and 6,000 mJ/cm^2 in order to properly cure a product. Remember that dose is an accumulation of energy over time, so an irradiance of 500 mW/cm^2 for 1 second delivers the same dose as 50 mW/cm^2 for 10 seconds (= 500 mJ/cm^2).

2.6 Technical Support

For assistance using the IL390C Light Bug, call an International Light applications engineer between 8:00 AM and 6:00 PM Eastern Standard Time at: (978) 818-6180.

4. Specifications

4.1 General

Spectral range:
- IL390C: 250 to 415 nm (10% power).
- IL290A: 205 to 345 nm (10% power).

Spectral rejection:
- IL390C: 1,000 to 1 out of band rejection above 450 nm.
- IL290A: 10,000 to 1 out of band rejection above 365 nm.

Readout: 6 digit LCD, direct readout in mJ/cm^2.
Dose range: 1 to 20,000 mJ/cm^2.
Dynamic range: 0.001 to 20 W/cm^2.
Input power: 2 Lithium Fluoride batteries. Battery life: 150 hours.
Auto-shutoff: 10 minutes (± 2 min).
Dimensions:
- Length: 161 mm (6.3 in). Width: 111 mm (4.4 in).
- Height: 12.7 mm (0.5 in).

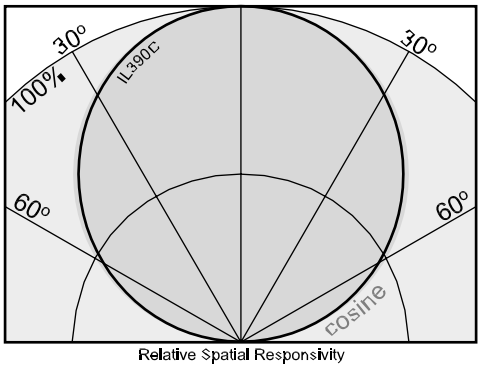
Weight: 341 g (0.75 lb).
Temperature: 10 to 75°C (case temperature).
Short term operation to 538°C, < 30 sec.
Accuracy: ± 10%
Linearity: ± 1%
Repeatability: ± 1%
Material: Polished 6061-T6 Aluminum.

4.2 Operating Temperature

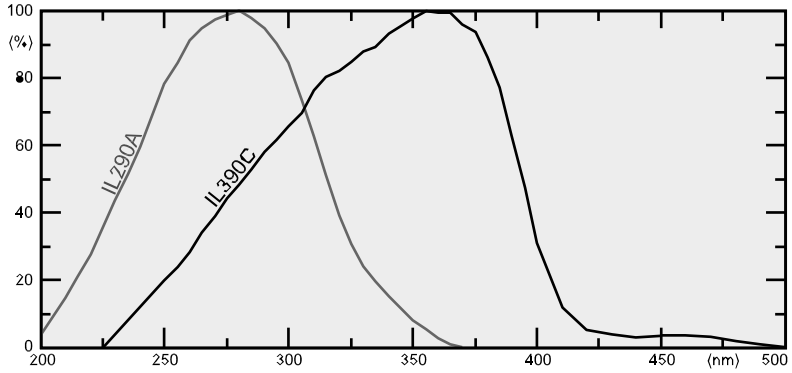
The absolute sensitivity of a detector changes with temperature. For the S-5 vacuum photodiode used in the IL390C, a change in sensitivity of -0.2% per degree Celsius has been measured. At a temperature that is 30°C higher than the temperature at which the device is calibrated, the measurement will be 6% low. The temperature referred to here is that of the photodiode, not the ambient temperature. With this in mind, the IL390C has been engineered to keep the photodiode temperature from increasing to a point where measurement accuracy is compromised. The polished solid aircraft aluminum housing reflects heat away, while also acting as a heat sink. The IL390C is capable of short term operation in ambient temperatures up to 538°C for up to 30 seconds with minimal measurement error. The specified operating temperature range of the IL390C is from 10 to 75°C (housing temperature). Above 62°C, the LCD display will temporarily darken, but should return to its normal state when allowed to cool.

4.3 Spatial and Spectral Response

The graphs below show typical spatial response (sensitivity at different angles) and spectral response (sensitivity to different wavelengths or "colors" of light).



Relative Spatial Responsivity



5. Calibration

A standard "IER" calibration of the IL390C includes battery replacement, electrical calibration, and optical calibration. Annual recalibrations are strongly recommended.

5.1 Electrical Calibration

The IL390C received a complete electrical test and calibration upon completion of assembly. Similarly, IL390C light bugs returned for recalibration receive new batteries and undergo the same electrical calibration procedures as part of the standard "IER" calibration. A green Electrical Instrumentation Report is issued with each IER calibration. Electrical calibration working voltage standard #N/A7 was compared to transfer voltage standard #4625008 which is referenced to the U.S. National Institute of Standards and Technology (NIST) standard #239658. Electrical calibration working resistance standard #N/A8 was compared to transfer resistance standard #846007 which is referenced to NIST reference standard #242008.

5.2 Optical Calibration

After electrical calibration, the IL390C is optically calibrated and certified. This is a two part procedure. Calibrations are performed to IEC Guide 25, ISO 10012-1:1992(E) and ANSI/NCSL Z540-1-1994 specifications. The unit is first calibrated to working standard #IL390 on a high pressure mercury vapor source, and then checked against the standard again on an extended source for spatial conformity. Primary standards used to calibrate IL390C light bugs are NIST Detector Response U1023 (Jan-1997), NIST test #844/257423-96/2 and NIST Detector Response D204 (Jan-1997), NIST test #844/257423-96/1. NIST uncertainty, 250 to 400 nm is ±1.0%. International Light Primary Transfer Standards are IL D.R.I.P #01, #02, #3275, #139, #1490, U522, and H627. IL transfer uncertainty is ±9.5% plus NIST uncertainty.

6. Battery Replacement

6.1 Battery Life

The IL390C is internally powered by two Lithium Fluoride batteries. Typical battery life is 150 hours. This figure is based on the manufacturer's specification of 750 mA*hr with the IL390C typically drawing 5 mA. The LiFl batteries have a shelf life of ten years, and a typical service life of between two to five years, depending on frequency of use.

6.2 Automatic Shut-Off

The IL390C has been designed to automatically shut off after approximately 10 minutes to conserve battery life. For applications where this auto shut-off is not desirable, we offer a custom modification to disable this feature, at additional cost. Contact an International Light applications engineer for details.

6.3 Battery Test

The batteries are not replaceable in the field. The unit must be returned to the factory for battery replacement since the integrity of the calibration is compromised when the unit is opened. If the Battery Test indicates a low battery condition, contact either your local IL representative or the factory to arrange for the unit's return. The battery test should be performed only after the IL390C has been on for at least two full auto shut-off cycles. The Lithium Fluoride batteries revert to a non-active state when the unit is not in use for an extended period of time. A battery test performed while the batteries are in this state will yield a false low indication. This is an inherent trait of LiFl type batteries which enables longer battery life. In most cases, due to the harshness of the environment, the IL390C will require recalibration before the batteries actually indicate a low condition. This is especially true when an accident occurs, such as when the instrument is dropped. As a matter of convenience, batteries are replaced whenever the IL390C is returned to the factory for recalibration. The cost of the new batteries is included as part of the standard IER calibration charge.

7. Repair / Service

The IL390C must be returned to the factory for repair work, battery replacement or recalibration. Do not open the IL390C housing. Opening the case will compromise the optical calibration and void the warranty.

7.1 Return Authorization Number

When returning equipment to International Light for repair or recalibration, please write the Return Authorization Number on the outside of the shipping box. This enables us to process your return order quickly, usually within 10 to 15 business days. Rush service is also available at additional cost. To obtain a Return Authorization Number, contact your local IL representative or the International Light Service Department at:

TEL: (978) 818-6180
FAX: (978) 818-6181
EMAIL: ilservice@intl-light.com

7.2 Shipping Address

Ship your IL390C to the address below:

RA#_____
International Light, Inc.
10 Technology Drive
Peabody, MA 01960
U.S.A.

8. One Year 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 enclosed instructions, it will provide years of excellent service. International Light equipment is warranted for a period of twelve (12) months from the date of purchase to be free of defects in material or workmanship. This warranty does not apply to damage resulting from accident, alteration, abuse, loss of parts or repair by other than International Light, Inc. 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, Inc.; 10 Technology Drive; Peabody, MA 01960; USA. International Light, Inc. has no other obligation or liability in connection with said equipment.