

UVICURE® Plus & UV Power Puck™

USER'S MANUAL



Electronic Instrumentation and Technology, Inc.
108 Carpenter Drive, Sterling, VA 20164
(703) 478-0700



Table of Contents

Introduction	3
The Process Values	3
Temperature Value	5
Overview of Data Acquired by UV Power Puck and UVICURE Plus	5
Components Shipped	6
Manual	6
Warranty	7
Other EIT Products	7
Hardware	8
Specifications	8
Physical Features	10
Operation	11
Doing an Exposure Run with UV Power Puck	11
Doing an Exposure Run with UVICURE Plus	11
Understanding How the Readings Are Stored and Displayed	12
Displaying Readings on UV Power Puck	13
Displaying Readings on UVICURE Plus	13
Converting Data Readings	15
Low Battery Indicator	15
Replacing the Batteries	16
Over-Temperature State	16
Diagnostics	17
Appendix	18
Spectral Response Curves	18
Theory of How Data Readings Are Accessed	19

List Of Figures

Figure Number	Figure Title	Page Number
1	The UV Power Puck and UVICURE Plus	4
2	Matrix Showing Data Collected by UV Power Puck and UVICURE Plus	5
3	UV Power Puck and UVICURE Plus Physical Features	10
4	LCD Display Showing Wavelength and Value Units	12
5	Order In Which Values Are Displayed	14
6	Converting Data Readings	15
7	Low Battery Display	15
8	Spectral Response Curves	18
9	Flowchart Showing the Pattern In Which UVICURE Plus Data Is Displayed	19
10	Flowchart Showing the Pattern In Which UV Power Puck Data is Displayed	20

Printed in U.S.A. - © Copyright 1994 by EIT
Revision 1 - June 1994

Introduction

The UV Power Puck™ and UVICURE® Plus are self-contained, electro-optic radiometers that measure and display total UV energy and UV intensity in a UV curing system. Their robust designs withstand the extremes of UV and thermal radiation that are part of UV curing environments.

The carefully designed optical sensing systems measure only certain wavelengths while rejecting others that are not relevant to the process. The output of the sensing system is converted to digital form and displayed in a liquid crystal readout.

The UV Power Puck measures four different ranges of ultraviolet wavelengths at the same time: With one pass through your UV process, you measure UVA (320-390nm), UVB (280-320nm), UVC (250-260nm) and UVV (395-445nm). This reading includes not only dosage (total energy), but peak intensity of each transmission band. The spectral response curve for each range is shown in Figure 8 in the Appendix.

The UVICURE Plus measures dosage (total energy) and peak intensity of one transmission band. The spectral response curve for the UVA range is shown in Figure 8 in the Appendix.

Both instruments are ideal for all types of UV curing processes, and because of their compact size are especially versatile.

The Process Values

The two process values read by the UV Power Puck and UVICURE Plus are peak intensity and dosage (total energy). Intensity is an instantaneous value, the highest intensity of UV energy that the unit sees during the exposure run. It is energy at one instant in time during the run. The instruments measure and display intensity in watts per square centimeter.

Dosage or total energy (the terms are interchangeable) is a factor of intensity and time. The units derive this value from the intensities during the exposure run and the length of time of the run. Dosage is measured in joules per square centimeter.

Reaching the intensity and dosage values specified by your process is necessary for achieving a complete UV cure.

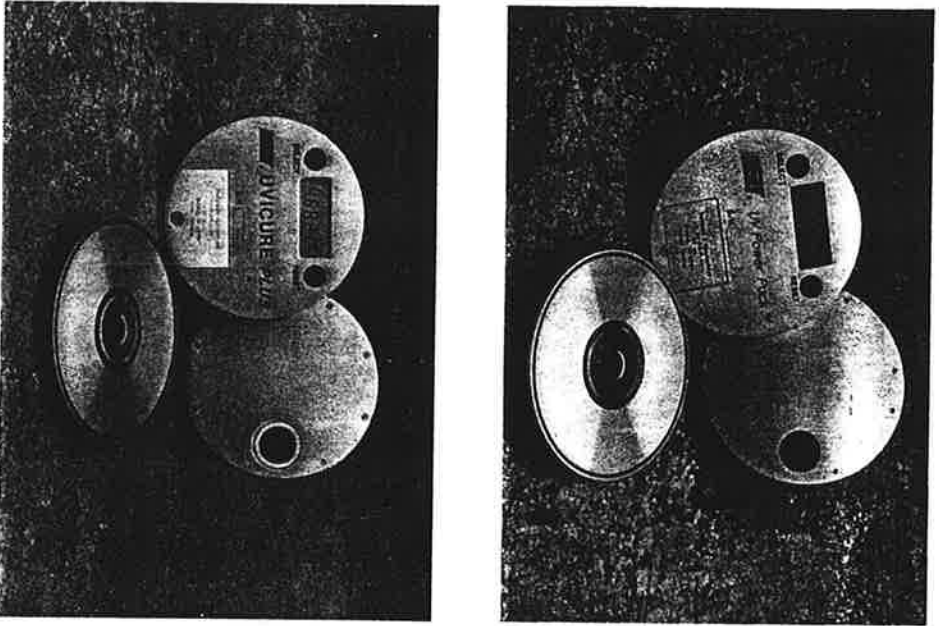


Figure 1 - The UV Power Puck and UVICURE Plus

Temperature Value

The UV Power Puck and UVICURE Plus also provide an internal temperature sensor that senses and displays the internal temperature of the devices. This reading is provided so you can keep the unit within safe operating parameters. It is not an indication of the temperature of the curing system. The temperature reading is displayed in degrees Centigrade for 3/4 second when the instrument enters the RUN mode.

Overview of Data Acquired by UV Power Puck and UVICURE Plus

During each exposure run, the UV Power Puck and the UVICURE Plus collect the data shown in the matrices in Figure 2. The matrices show the data in a format similar to the format in which the data is stored in the memory of the instruments.

Value	UV Power Puck Wavelength			
	UVA	UVB	UVC	UVV
Dosage	UVA J/cm ²	UVB J/cm ²	UVC J/cm ²	UVV J/cm ²
Intensity	UVA W/cm ²	UVB W/cm ²	UVC W/cm ²	UVV W/cm ²

Value	UVICURE Plus Wavelength
Dosage	UV J/cm ²
Intensity	UV W/cm ²

Figure 2 - Matrix Showing Data Collected by UV Power Puck and UVICURE Plus

Components Shipped

Each instrument is shipped along with this User's Manual in a protective foam-lined carrying case.

Manual

This manual contains all the information you need to use and maintain the UV Power Puck and UVICURE Plus. There is an introduction to the instruments and the process values they measure, a description of the hardware, specifications, and instructions for using the instruments in your application. Any maintenance problems that are not covered in this manual should be addressed to the EIT Return Department. See "Warranty" section that follows.

Warranty

Warranty period for the UV Power Puck and UVICURE Plus is six months from the date of purchase, abuse and neglect excepted. The only user-serviceable parts in the units are the batteries. If your unit does not operate properly call EIT at (703) 478-0700 or FAX at (703) 478-0291. We will arrange for its return to the factory for repair and recalibration. In addition, the unit should be returned every six months for certification.

Other EIT Products

UVIMAP ® : Measures UV intensity and temperature and plots the results as a function of time.

UVIRAD ® Low Energy UV Integrating Radiometer: Measures UV in $100 \mu\text{W}/\text{cm}^2$ to $100 \text{ mW}/\text{cm}^2$ range. Display in millijoules/cm². For use in platemaking, primary imaging, soldermask and silkscreen imaging.

SPOTCURE™ UV INTENSITY METER: Measures the peak intensity emitted by a UV spot curing system.

ONLINE UV INTENSITY DISPLAY MODULE™: Measures and displays output of a UV lamp on a continuous basis.

DIN RAIL-MOUNT UV INTENSITY MONITOR™: Measures the output of a UV lamp on a continuous basis and incorporates DIN-rail, snap-in convenience. Zero to 10V output proportional to UV intensity.

MULTIBRITE™: Measures up to four UV lamps simultaneously and sounds an alarm when any of the lamps fall below a user-selectable threshold.

THERMOMAP™: Measures three temperature channels and prints a profile on a printer or an IBM compatible PC.

Hardware

Specifications *

Display:
4-digit LCD.

Range:
5 mW/cm² to 5W/cm².

Accuracy:
± 5% typical; ± 10% guaranteed or 10mW, whichever is greater.

Spectral Response:

UV Power Puck: Four channels continuously monitored during operation.

UVA	320-390nm
UVB	280-320nm
UVC	250-260nm
UVV	395-445nm

UVICURE Plus: One channel continuously monitored during operation.
(Example: UVA 320-390nm)

Spatial Response:
Approximately cosine.

Operating Temperature Range:
0-75 ° C internal temperature; tolerates much higher external temperatures for short periods; audible alarm indicates when temperature is too high. **CAUTION:** The maximum internal temperature is 80° C. If internal temperature exceeds this, the warranty is voided.

Time-out Period:
4 minutes RUN mode (no energy observed); 2 minutes DISPLAY mode (no key activity).

Batteries:
Two user-replaceable lithium cells, Duracell DL2450, Sanyo CR2450 or equivalent.

Battery Life:
1500 readings with typical use.

Dimensions:
4.60 x .50 inches; 117 x 12.7 millimeters (D x H).

Weight:
11.75 ounces (333.1 grams).

Package Material:
Aluminum, stainless steel.

Carrying Case Material:
Cut polyurethane interior to accommodate radiometer. Scuff-resistant nylon exterior cover.

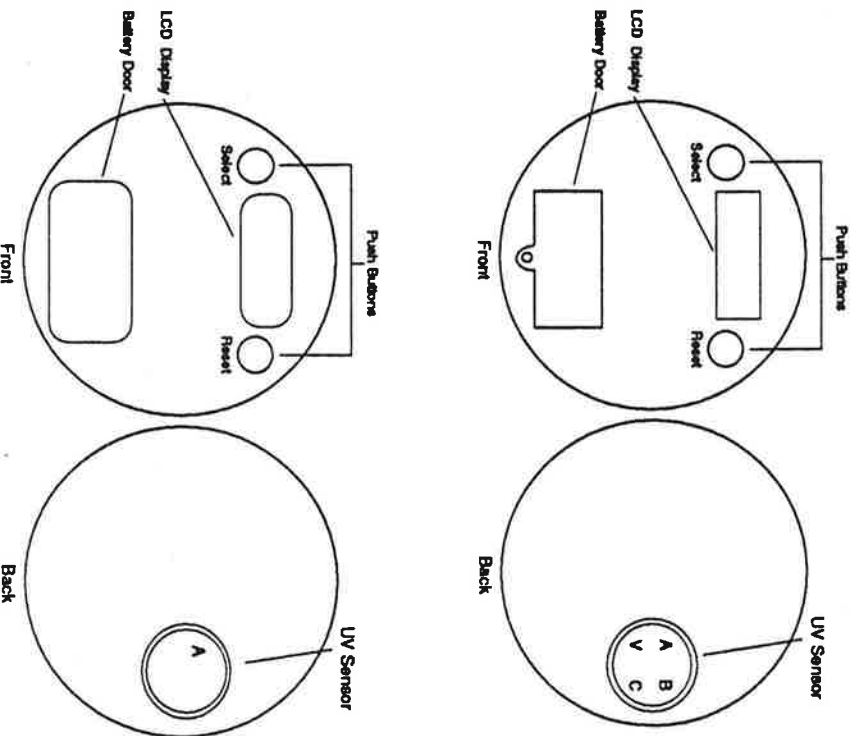
Carrying Case Weight:
1 pound (453.6 grams).

Carrying Case Dimensions:
12 x 4.7 x 8.25 inches ; 304.8 x 119.4 x 209.6 mm (WxHxD).

* Specifications subject to change without notice.

Physical Features

The main physical features of the UV Power Puck and UVICURE Plus are shown in Figure 3.



Operation

Doing An Exposure Run With UV Power Puck

1. Turn the unit on by pressing either the Select or the Reset button. The unit flashes the software version, PX.XX, for one half second. It then displays the wavelength last selected and the value last read before power-up.
2. Do a short press of the Reset button to clear memory and put the unit in the RUN mode. The display flashes "run" after momentarily displaying the internal temperature of the unit. Confirm that the unit flashes "run" before initiating a reading. A long press of the Reset will turn the unit off.
3. Put the device on the belt under the UV source with the LCD display down, directed away from the light source. Pass it through the system. When it comes out, the display will still be flashing "run."
CAUTION: Exposing the LCD display to high intensity UV radiation will damage the LCD.
4. Press Select to exit RUN mode and display the reading. It will be in the same display mode that it was in before the exposure run, but will display the new value.

Doing An Exposure Run With UVICURE Plus

1. Turn the unit on by pressing either the Select or the Reset button. The unit flashes the software version, PX.XX, for one half second.
2. Do a short press of the Reset button to clear memory and put the unit in the RUN mode. The display flashes "run" after momentarily displaying the internal temperature of the unit. Confirm that the unit flashes "run" before initiating a reading. A long press of the Reset will turn the unit off.

Figure 3 - UV Power Puck and UVICURE Plus Physical Features

- Put the device on the belt under the UV source with the LCD display down, directed away from the light source. **CAUTION:** Exposing the LCD display to high intensity UV radiation will damage the LCD. Pass it through the system. When it comes out, the display will still be flashing "run".
- Press Select to exit RUN mode and to display the reading. It will be in the same display mode that it was in before the exposure run, but will display the new value.

Understanding How the Readings Are Stored and Displayed

The UV Power Puck and UVICURE Plus write the data they sense into a section of non-destructible memory each time you do an exposure run. The internal temperature reading is the internal temperature of the unit when placed in the RUN mode. The intensity and dosage readings are based on what the unit senses optically during the exposure run. In the case of the UV Power Puck, the intensity and dosage are different for each transmission band.

The data readings are displayed in the LCD display. The wavelength of the displayed reading is shown at the top of the display and the units of the value of the reading are listed at the right of the display. See Figure 4. If the peak intensity exceeds threshold on a particular wavelength, the displayed number in that bandwidth (both J/cm² and W/cm²) will flash, indicating that the collected data cannot be considered valid.

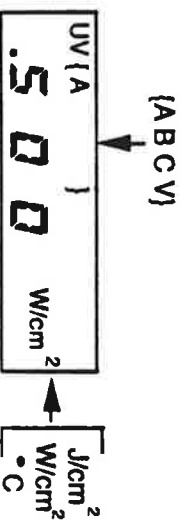


Figure 4 - LCD Display Showing Wavelength and Value Units

Displaying Readings on the UV Power Puck

The matrix in Figure 2 shows all the data readings taken and stored during an exposure run. You display the other data readings by doing long and short presses of the Select button. Each short press of the Select button shows the next value in the same wavelength. Short presses are identified by a short chirp after the press. Each long press of the Select key (approximately .75 seconds in duration) shows the same value in the next wavelength. Long presses are identified by the display moving to the next wavelength. **NOTE:** A long press of the Reset button will turn the unit off. The unit displays "off" momentarily and then turns off.

In summary, short presses loop through the values for one wavelength, from top to bottom, back to the top. Long presses loop through all the wavelengths showing the same value, moving from left to right, looping back to the left. See Figure 5.

Displaying Readings on the UVICURE Plus

The matrix in Figure 2 shows all the data readings taken and stored during an exposure run. You display the data readings by doing short presses of the Select button. Each short press of the Select button shows the next value in the wavelength. Short presses are identified by a short chirp after the press.

In summary, short presses loop through the values for the wavelength, from top to bottom, back to the top. See Figure 5. It is important to use a short press of the Select button to display the next value. A long press of the Select button is undefined for this unit, and the display appears not to change from the first value. **NOTE:** A long press of the Reset button turns the unit off. The unit displays "OFF" momentarily and then turns off.

Figure 5 - Order In Which Values Are Displayed

Value	Wavelength			
	UVA	UVB	UVC	UVV
Dosage	UVA ² J/cm ²	UVB ² J/cm ²	UVC ² J/cm ²	UVV ² J/cm ²
Intensity	UVA ² W/cm ²	UVB ² W/cm ²	UVC ² W/cm ²	UVV ² W/cm ²

Short press of Select key: the display moves to the reading below, then loops back to the top.

Long press of Select key: the display moves to the reading at the right and loops back to the left.

Value	Wavelength
Dosage	UVA ² J/cm ²
Intensity	UVA ² W/cm ²

Short press of Select key: the display moves to the reading below, then loops back to the top.

Converting Data Readings

If your specifications are in milliwatts or millijoules, you will need to convert your instrument readings from watts and joules to milliwatts and millijoules. Do this by moving the decimal point three places to the right of the display. See Figure 6.

UV{A	}		W/cm ²
.5	0	0	

= .500 watts or 500.0 milliwatts

Figure 6 - Converting Data Readings

Low Battery Indicator

When the batteries need to be changed, "LO BATT" is displayed in the upper right corner of the LCD display as shown in Figure 7. If this happens during an exposure run, the reading is still valid. The low battery indicator is designed to illuminate early enough so that your data remains valid. If battery capacity drops to the point where data integrity is affected, the unit automatically writes zero to all locations. Under severe low battery conditions, the unit does not enter RUN mode. Therefore, confirm that the unit flashes "run" before initiating a reading.

UV{A	}	LO BATT
.0	0	0
		W/cm ²

Figure 7 - Low Battery Display

Replacing the Batteries

Follow these procedures to replace the batteries.

1. Loosen the screw on the battery door and remove the door.
2. Remove the old batteries.
3. Install two new lithium cells (Duracell DL2450 or Sanyo CR2450), observing polarity. The unit is designed so it will not operate with reversed cells.
4. Replace the door and the screw.

Over-Temperature State

If the internal temperature of the UV Power Puck or UVICURE Plus exceeds 65° C during an exposure run, the unit will emit a steady beeping tone after the run. However, the data it has collected is accurate and can be read by pressing the Select key. When you do this, the beeping tone stops, and you can step through the data readings.

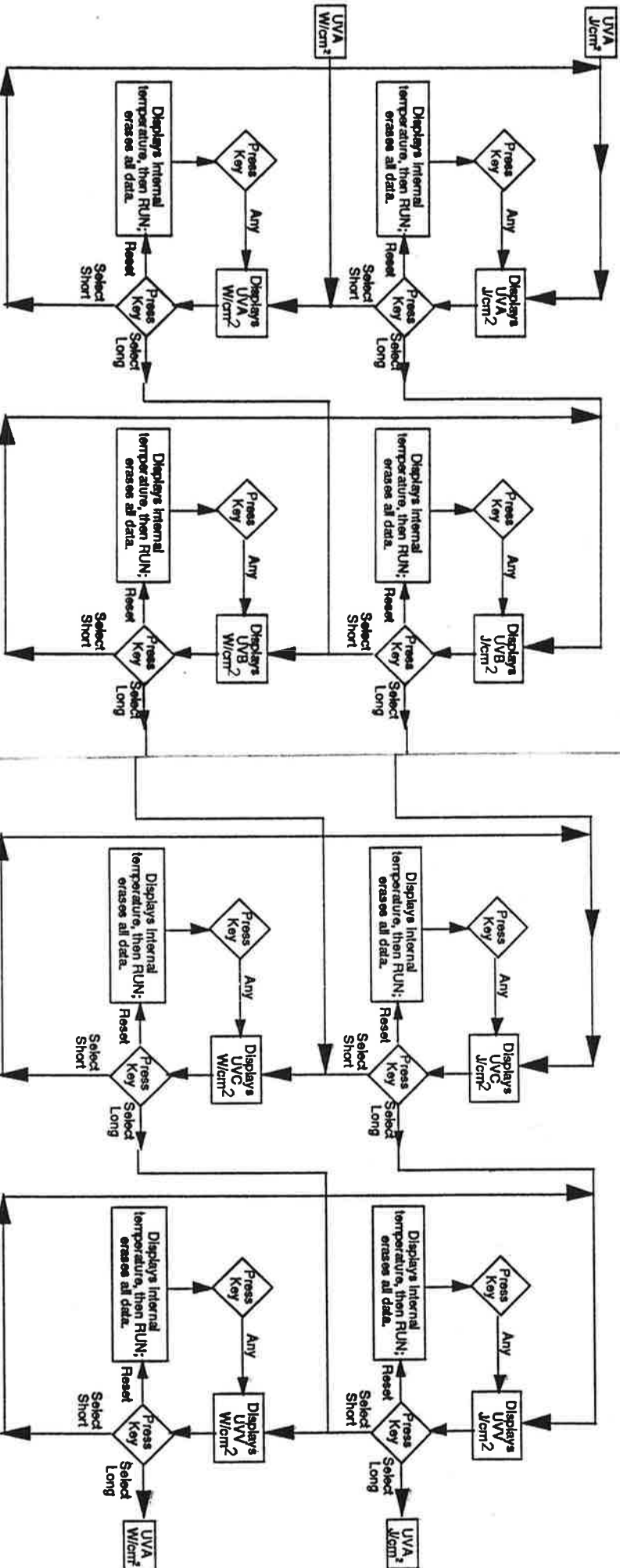
In addition, if the internal temperature of the unit exceeds 75° C the unit beeps once then displays the internal temperature continuously. It will not operate until the internal temperature drops below 75° C. You should confirm that the unit flashes "run" before initiating a reading.

CAUTION: If you press Reset to initiate the RUN mode, before the unit cools to below 75° C, all data from the previous exposure run is cleared from memory. The unit then beeps and again continuously displays the temperature.

Diagnostics

The Power Puck and UVICURE Plus are continuously doing internal self-tests. If the unit detects an internal problem, it will display one of the following error codes on the LCD display. Both error codes indicate unresolvable problems that require returning the unit to the factory for service.

E1 = EEPROM WRITE ERROR
E2 = EEPROM READ ERROR



UVA

UVB

UVC

UVV

Figure 10 - Flowchart Showing the Pattern In Which Power Puck Data Is Displayed