

OPERATION MANUAL

BLUEWAVE[®] LED CE

With Intensity Adjustment



Model 40161 – With 8mm Light Guide
Model 40160 – Without 8mm Light Guide
Visible Curing Spot Light Source



DYMAX[®]

318 Industrial Lane • Torrington, CT 06790

Phone: (860) 482-1010 Fax: (860) 496-0608
www.dymax.com

Operation Manual
Part #40038
03/07/08

TABLE OF CONTENTS

Unpacking and Inspection	4
Safety	6
General	10
Specifications	12
Installation and System Interconnect.....	13
Components Description	15
Operation	16
Maintenance	20
Troubleshooting	21
Frequently Asked Questions.....	22
Spare Parts List	23
Definition of Terms.....	24
Warranty	25

The enclosed BlueWave® LED Visible Curing Light Source was developed and manufactured by the DYMAX team, driven by a desire to best serve your needs. Before shipping, your BlueWave was thoroughly checked and tested for trouble-free performance.

The proper set up and operation of this Spot Lamp System will maximize safety and user-friendly performance, providing optimum yield of your technological process.

THEREFORE, WE ENCOURAGE YOU TO READ, UNDERSTAND, AND FOLLOW ALL SAFETY AND OPERATING INSTRUCTIONS AND RECOMMENDATIONS COMPILED IN THIS AND OTHER RELATED MANUALS prior to setting up and operating this new Spot Lamp System or its individual components.

Par conséquent, nous vous encouragez à lire, comprendre, et suivre toute sécurité et instructions d'opération et conseils rédigés dans cette et autres manuels établir un lien avant de mettre en place et de faire fonctionner ce nouveau système de lampe de tâche ou ces composants individuels.

If you encounter a problem, have any questions, or would like to help us with your suggestions or recommendations, please contact our Technical or Customer Service Departments at 860-482-1010. Trained DYMAX professionals are standing by to serve you.

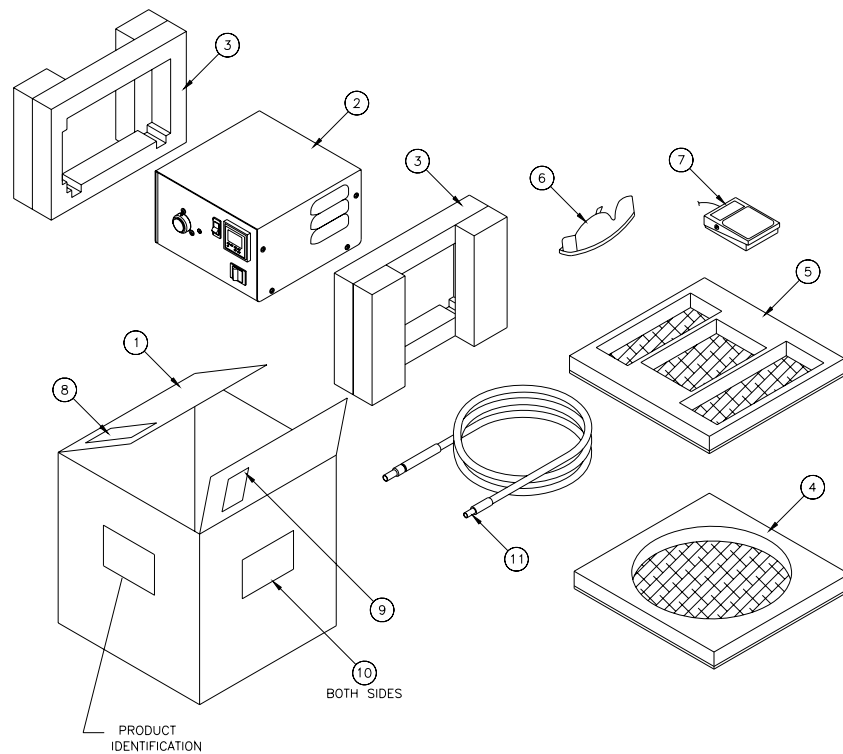
Par conséquent, nous vous encouragez à lire, comprendre, et suivre toute sécurité et instructions d'opération et conseils rédigés dans cette et autres manuels établir un lien avant de mettre en place et de faire fonctionner ce nouveau système de lampe de tâche ou ces composants individuels.

1. UNPACKING AND INSPECTION

Upon receipt of the unit, carefully remove the contents from the boxes and check for damage. **DYMAX® is not responsible for damage from shipping – all claims for shipping damage should be made with carrier.**

Check all boxes for contents and write down any serial numbers for further reference. You may wish to retain original shipping cartons in case you need to repackage any item for return.

If you observe or experience any problem with your equipment, notify DYMAX Customer Service, your authorized distributor, or your DYMAX Representative immediately.



BILL OF MATERIALS			
ITEM	QTY	DESCRIPTION	PART # DRWG. #
1	1	CONTAINER, SHIPPING, LED	40012 -
2	1	ASSY, BLUE WAVE LED	40069 40069
3	2	FOAM, SHIPPING, END CAP, LED	40011 40011
4	1	TRAY, SHIPPING, LOWER, LED	40010 40010
5	1	TRAY, SHIPPING, UPPER, LED	40009 40009
6	1	GOGGLES, GRAY	35285 -
7	1	SWITCH, FOOT, WIRED	5028 -
8	1	LABEL, DAMAGED	36203 -
9	1	LABEL, FRAGILE	36204 -
10	1	LABEL, SHIPPING ELECTRONICS	35766 -
11	1	LIGHTGUIDE, 8mm x 1000mm D	5722 -
*	12	WRENCH, HEX, 2 mm	38656 -
*	13	MANUAL, BLUE WAVE LED	40038 -
*	14	CARD WARRANTY	35901 -
*	15	SCREW DRIVER, LOGO, FLAT BLADE	39695 -
*	16	CLIP, SNAP-IN	39667 -
*	17	FILTER MEDIA 60mm 45PPI	40008 -
*	18	CORD, POWER 7'	35255 1270


ITEMS MARKED * ARE NOT SHOWN

Fig. 1 – Unpacking/Contents (model 40161 shown)

NOTE: REPORT ANY SHORTAGE TO DYMAX CORPORATION CUSTOMER SERVICE

Phone: 860-626-6326 or 860-482-1010, Fax: 860-626-7681

Before continuing with unpacking and installation, please read the following Chapters of this Manual for safety recommendations and installation, running, and troubleshooting instructions.

 **CAUTION!** Always wear protective goggles or face shield when working near the front of the unit, which emits high intensity visible light!

 **WARNING!** Always observe safety requirements!

 **CAUTION!** Risk of Electrical Shock if cover is removed!

 **PRÉ-CAUTION!** Toujours faire de l'usage des lunettes de protection ou protéger de visage marche près du devant d'élément!

 **AVERTISSEMENT!** Remmarquez toujours besoin de sécurité!

 **PRÉ-CAUTION!** Risque de décharge électrique quand le couvert est enlever!

2. SAFETY

Equipment is designed to be used properly set up, with components correctly connected, and operated in accordance with relevant instructions. Design was developed to maximize operator safety and minimize exposure to UV.

Safety Recommendations:

- Use goggles, provided, or a face shield approved for UV protection to protect your eyes.

NOTE: The BlueWave[®] LED emits high intensity visible light. Never look directly at the light source while the unit is on.

Sécurité

L'équipement être conçu pour être utilisé correctement constituer, avec composants brancher correctement, et marché en conformément avec instructions important. Le plan étai developper pour rendre au maxime opérateur sécurité et minimiser exposition à ultraviolette.

Recommander de sécurité:

- Emploi lunettes, ou un protéger de visage pour protection de ultraviolet pour protéger vous yeux.
- Chemises à manche long, ou manteau de labo, sont recommander pour protéger les bras, et utilisation de ultraviolette gants opaque vais protéger les mains.

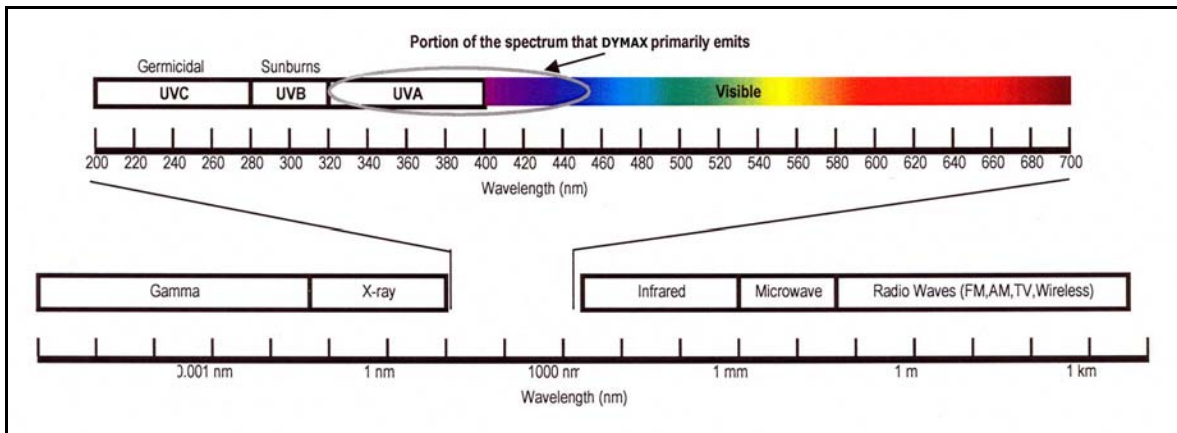
Remarque: avec le filtre intérieur installé, l'Onde Bleu émettre lumière visible. Ne jamais regardez directement à la source de lumière pendant que l'élément est en opération.

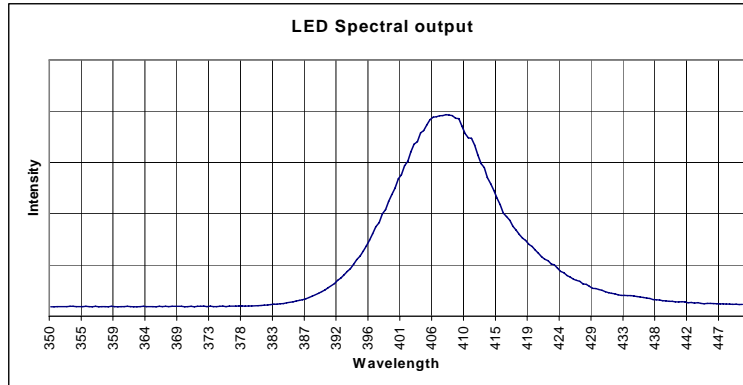
DYMAX UV CURING SYSTEM SAFETY CONSIDERATIONS

DYMAX curing technology has been used successfully for over 25 years. The fast cure, one component nature of our curing technology has made it the process of choice for many manufacturers requiring a Cure on Demand™ assembly process. The purpose of this document is to provide information relating to the use of DYMAX curing systems. There are four common questions/concerns related to UV curing systems: UV exposure, high temperature surfaces, ozone, and bright visible light.

UV EXPOSURE

Minimal UV light is emitted by this LED system. The wavelength is centered in the lower end of the visible spectrum. See the attached figure for the wavelength profile. Standard DYMAX UV curing systems and bulbs have been designed to primarily emit UVA light³ (as shown in Chart 1). UVA light is generally considered the safest of the three UV ranges: UVA, UVB, and UVC. Although OSHA does not currently regulate ultraviolet light exposure in the workplace, the American Conference of Governmental Industrial Hygienists (ACGIH) does recommend Threshold Limit Values (TLV's) for ultraviolet light. The strictest interpretation of the TLV (over the UVA range) for workers' eyes and skin is 1 mW/cm² (intensity), continuous exposure. Unless workers are placing bare hands into the curing area, it is unusual to exceed these limits. To put 1 mW/cm² limit into perspective, cloudless summer days in Connecticut regularly exceed 3 mW/cm² of UVA light and also include the more dangerous UVB light (primarily responsible for sun tans, sun burns and skin cancer) as well.





The human eye cannot detect “pure” UV light, only visible light. A radiometer should be used to measure stray UV light to confirm the safety of a UV curing process. A workstation that exposes an operator to more than 1 mW/cm² of UVA continuously should be redesigned.

UV adhesive curing can be a regulatory compliant, “worker-friendly” manufacturing process when the proper safety equipment and operator training is utilized. There are two ways to protect operators from UV exposure: shield the operator and/or shield the source.

SHIELD THE OPERATOR

- ❖ **UV-Blocking Eye Protection** – *UV-blocking eye protection is recommended when operating UV curing systems. Both clear and tinted UV-blocking eye protection is available from DYMAX (see Table 1).*
- ❖ **UV-Blocking Skin Protection** – *Where the potential exists for UV exposure upon skin, opaque, UV-blocking clothing, gloves, and full-face shields are recommended.*

SHIELD THE SOURCE OF UV

Any substrate that blocks UV light can be used as a shield to protect workers from stray UV light. The following materials can be used to create simple shielding structures or blind corners:

- ❖ **Sheet Metal** – *Aluminum, steel, stainless steel, etc. Sheet metal should be coated black or black anodized to minimize reflection of UV and visible light toward operators.*
- ❖ **Rigid Plastic Film** – *Transparent, UV-blocking plastics (typically polycarbonate or acrylic) are commonly used to create shielding where transparency is also desired. These rigid plastic films are available either water-clear or tinted.*
- ❖ **Flexible Film** – *UV blocking, flexible urethane films can be used to quickly create workstation shielding. This UV-blocking, flexible urethane film is available from DYMAX (see Table 1).*

HIGH TEMPERATURE SURFACES

Surfaces exposed to high intensity curing lights will rise in temperature. The intensity, distance, exposure time, cooling fans, and the type/color of the surface can all affect the actual surface temperature. In some cases, exposed surfaces can reach temperatures capable of producing a burn or causing damage to a substrate. In these cases, care must be taken to ensure either a more moderate surface temperature or appropriate protection/training for operators. No infrared radiation is produced by this LED system, so surface temperatures will be lower than with a standard lamp system. Empirical testing should be used to verify the exact temperature rise in each application.

OZONE




Standard DYMAX bulbs (UVA type) generate an insignificant amount of UVC and therefore essentially no ozone³. Some UV curing systems, like those used to cure UV inks, emit primarily “shortwave” (UVB and UVC) energy. Upon exposure to UVC light (specifically <240 nm), oxygen molecules (O₂) split into oxygen atoms (O) and recombine with O₂ to create ozone O₃. The current, long-term ozone concentration limit recommended by ACGIH, NIOSH, and OSHA is 0.1 ppm (0.2mg/m³).

BRIGHT, VISIBLE LIGHT

The bright visible light emitted by some curing systems can be objectionable to some workers and can cause eyestrain. Tinted eye protection and/or opaque/tinted shielding can be utilized to address this concern.

SUMMARY

UV light sources can be more “worker friendly” than many commonly accepted industrial processes, provided the potential concerns are addressed. Both the lower working temperature and lack of UV radiation this system produces make it even more user friendly. Contact your DYMAX representative for information regarding the proper use of DYMAX curing systems.

TABLE 1. UV Blocking Eye Protection and Shielding		
 <p>Clear Spectacles* No tint PN 35612</p>	 <p>Green Spectacles* Medium tint PN 35614</p>	 <p>Dark Green Spectacles* Maximum tint PN 38349</p>
 <p>Clear Goggles* No tint; for use over eye glasses PN 35284</p>	 <p>Grey Goggles* Medium tint; for use over eye glasses PN 35285</p>	 <p>Dark Green Goggles* Maximum tint; for use with eye glasses PN 35286</p>
 <p>Clear Face Shield** No tint PN 35186</p>	 <p>Dark Green Face Shield** Maximum tint PN 38407</p>	 <p>Flexible Urethane Shielding 8” wide, per linear foot PN 35531</p>

¹ Per manufacturer, 99.9+% UV blocking and meet ANSI Z87.1 and CSA Z94.3 requirements

² Meets ANSI X871.1

³ DYMAX also provides special order “shortwave” bulbs that emit primarily UVB and UVC light. Contact DYMAX directly for information regarding the use of “shortwave” bulbs.

3. GENERAL

The BlueWave® LED is a high intensity, visible light curing spot lamp used for the curing of adhesives, coatings, and potting materials. It emits mainly visible light from a lightguide. This guide can be hand-held for complete mobility, clamped into position for repetitive operations, or in automated equipment.

The unit consists of an anodized aluminum housing, containing an electronic power supply, circuit protection, LED assembly, cooling fans, lightguide mount, light guide safety interlock, and control PCB with connections for a remote operation system. A thermal shutdown sensor is provided for internal temperature control of the unit. The fan filter should be changed or cleaned frequently to prevent blockage and reduced ventilation airflow. The unit can run in either timed or manual operating modes. The lightguide is separate and plugs into the lightguide holder.

An intensity control feature allows operators to manually adjust output intensity during process validation and production. Users can now manually adjust intensity to compensate for any long-term system degradation that may occur.

Warning: Engage the Lightguide in the bezel before the light is turned on, and remove the Lightguide from the bezel ONLY AFTER the light is turned off. Lightly tighten the setscrew after the lightguide is inserted. If the lightguide is removed at any time while the LEDs are energized, the power is removed from the LEDs immediately. Timer operation will also be reset when the lightguide is removed. Replacing the lightguide will automatically reenergize the LEDs.

The power supply operates on line voltages of 100 to 240 VAC, 50/ 60 Hz.

A cooling fan is provided to keep the housing and internal components of the power supply at the optimum operating temperature. The fan must not be covered or otherwise blocked. The unit is rated for continuous operation.



Manual Intensity Control Feature

The equipment used to power all high intensity curing spot systems will degrade with use. Intensity, therefore, decreases as the system ages. Using the BlueWave LED's intensity control feature, users can eliminate this variation by manually increasing output intensity to offset this degradation. The intensity can be adjusted with a tool as shown in the photograph below. The intensity adjustment is a 10-turn potentiometer and allows fine control of output intensity. This feature is useful for both validation and control.



Validation

Prior to production, DYMAX advises customers to conduct testing to determine the time and intensity required to fully cure their resin in their specific application. Typically, users validate by one of the following methods...

Set Exposure Time, Determine Intensity

Users can specify a cure time and through empirical testing, determine the intensity required to achieve full cure. As with any manufacturing process, it is advisable to incorporate a safety factor.

Set Intensity, Determine Exposure Time

Users can specify intensity and through empirical testing, determine the exposure time required to achieve full cure. As with any manufacturing process, it is advisable to incorporate a safety factor.

Control

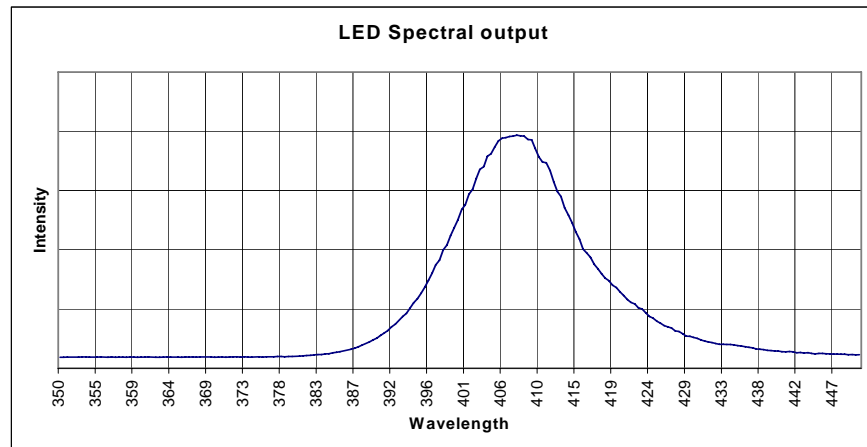
Process validation confirms a minimum acceptable intensity. Users can then choose to operate at full intensity (using the excess intensity as an additional safety factor) or maintain a constant intensity through periodic manual adjustments. BlueWave[®] LED units will typically vary less than 1% over 1000 hours of normal use and so weekly or monthly adjustments are adequate to maintain a tightly controlled process.

4. SPECIFICATIONS

Part Number	PN - 40161 – With Light Guide PN - 40160 – Without Light Guide
Intensities	Total (280-450) 3+ W/cm ² with 5mm light guide 2.5+ W/cm ² with 8mm light guide Visible (400-450nm) 3+ W/cm ² with 5mm light guide 2.5+ W/cm ² with 8 mm light guide UVA ¹ (320-395nm) 50 mW/cm ² with 5 mm light guide 25 mW/cm ² with 8 mm light guide UVB (280-320nm) 0 mW/cm ²
Power Requirements	100-240 VAC, 50/60 Hz, 1.6 Amp
Power Supply	Solid State, 100 Watt
Temperature / Humidity	40 Degrees C maximum / Non-condensing
Timer	Digital LCD timer up to 99.99 seconds; manual or timed shutter
Activation	Foot switch or PLC
I/O Port	9 pin D – sub-miniature connector
Signals (PLC Integration)	Inputs +24VDC, Activate, Safety Interlock, Output Adjust. Outputs LED Lit, Lightguide Inserted, Output Setpoint, Over Temperature.
Cooling	Filtered fan arrangement.
Housing Dimensions	5.38" x 8.5" X 8.75" (13.67cm X 21.59cm X 22.23cm)
Weight	4.90 lbs. (2.22 kg)
System Warranty	1 year from purchase

¹** Measured with ACCU-CAL™ 50 Visible and UV radiometers using 5mm and 8mm light guides.

Spectral Output Information



LED Spectral Chart

5. INSTALLATION AND SYSTEM INTERCONNECT

1. Connect power cord to rear of unit and plug into a grounded wall outlet.
2. Connect the foot switch to the connection in the rear of the unit.



Cable Connection

3. **Single Pole Lightguide Installation:** Insert lightguide into the lightguide mount by removing the cap and inserting and snapping the lightguide into place. Lightly tighten the setscrew on lightguide mount to secure lightguide.



Lightguide Connection

Multi-Pole Lightguide Installation:

4. Remove the protective cover from the BlueWave's lightguide mount.



5. Remove the protective end caps from the lightguide. Visually inspect the two ends of the lightguide to verify that no foreign material is present. The Dymax liquid filled lightguide ends can be cleaned with isopropyl alcohol to remove foreign material and deposition from Outgassing.
6. Insert the large end of the lightguide into the mount until it snaps into place.



7. If desired, the lightguide may be fastened into place by lightly tightening the securing setscrew installed in the lightguide mount. A hex wrench is provided with the BlueWave for this purpose. The setscrew should be tightened gently to prevent damaging the lightguide. Note: multi-leg lightguides should be checked for balance by rotating the lightguide to verify the desired intensity of each leg before tightening the setscrew.
8. The lightguide is now installed and is ready for use. The end of the lightguide should be periodically cleaned with isopropyl alcohol. Adhesive build-up may be removed from the end of the lightguide by gently scraping using a razor blade or razor knife.
9. Turn the power switch to ON.
10. There is no need to allow any warm up or cool down times with this LED system. The unit may be shut down and reactivated immediately with damaging any components.
11. Activate the LEDs by pressing foot switch. With the selector switch in the manual position, the unit operates directly from the foot switch. In the timed position, operation is determined by the setting on the electronic timer. Simply push the timer setting buttons to enter the desired number of seconds the LEDs need to be powered.
12. With the system active, adjust the intensity adjustment screw as required to achieve the desired output intensity on the visible radiometer. The intensity adjustment screw is a 10 turn potentiometer.



6. COMPONENTS DESCRIPTION

The BlueWave® LED is a special purpose visible light curing system used for small area curing of adhesives, coatings, and potting materials. It emits up to an 8mm diameter spot of visible light from a liquid lightguide. The guide is hand-held for complete mobility or clamped into position on assembly equipment or workstations for repetitive operations.

The unit consists of aluminum housing containing a 100-watt power supply, LED assembly, a control and communications PCB assembly, and an electronic timer. The system will operate in either timed or manual mode. The lightguide plugs into the bezel. If no lightguide is present, a new safety will prevent the powering up of the LEDs.

The power supply operates on universal line voltages of 100 – 240 V_{AC} 50/60Hz and is specially designed to provide proper rated voltage and current to the system.

Cooling fans are provided to keep the housing and internal components of the power supply at the optimum operating temperature. The fan must not be covered or otherwise blocked. The light source is an array of LEDs mounted on an air-cooled heat sink, positioned to provide optimum light output. The unit is rated for continuous operation.

The bulbs used to power all high intensity UV curing spot lamps degrade with use. Intensity, therefore, decreases as the bulb ages. The LEDs used in this system will also degrade, but to a much lesser degree. Aging, damage, or adhesive out-gassing will reduce transmission through the supplied lightguide. Using the Blue Wave LED's intensity control feature, users can eliminate any variation by manually increasing intensity to offset the system degradation. During operation a user can adjust the output intensity using the provided tool.



7. OPERATION

The BlueWave® LED will arrive almost fully assembled. Please refer to section 5 for installation of lightguide, power cord, and footswitch. The system should be positioned in a dry location that does not obstruct airflow around the unit.

IMPORTANT: To ensure that proper output of the system is obtained, be sure to completely insert the lightguide into the mount prior to tightening the setscrew. Be sure to lightly tighten the setscrew to ensure the lightguide remains in place during use.

To energize system, turn the power switch from the “O” position to the “I” position; the fans and timer should begin to function.



CAUTION: Always wear protective goggles or face shield when working near UV or bright Visible light. NEVER LOOK DIRECTLY AT LIGHT EXITING LIGHTGUIDE.

The **Timer** located on the front panel of the BlueWave® LED is factory set to the most common operating mode and recommended operation of the timer with the BlueWave. Some modes available on the timer may not operate correctly with the BlueWave unit.



The front panel of the timer contains a LCD display and keypad. The LCD display has a reset indicator, key protect indicator, output indicator, preset value, set value, and timing operation indicator. A brief description of each display and location:

- **Output Indicator** - Displays **OUT** in upper left corner of timer display. Displayed when relay is switched on; is not displayed when relay is switched to off.
- **Present Value** – Four digits segmented display in center of timer. Shows current status of time.
- **Set Value** – Four digit segmented display in lower right corner of timer. Shows set length of time.
- **Reset Indicator** – Display on the left of meter face. Active when the timer is reset by pressing the “RST” button on the lower left face of timer.
- **Key Protect** – Located on center left side of display, will always be lit as the function of timer is programmed at the factory and locked before shipment.

To operate the timer, select the “timed” option of the switch on the front panel. Program the time into the timer and depress the foot-pedal. Factory settings will power the LEDs and the preset value will begin to count backward. When the timer reaches 00.00, it will reset the value to the set value and remove power from the LEDs. The timer can be stopped once started by pressing the RESET button on the lower left face of the timer. If power is removed from unit, the timer will reset to set value.

To select the time, press the appropriate up key until the corresponding digit increments in the set value. By pressing the up key labeled (1), it will increment the left most digit on the set value. By pressing the up key (2), it will increment the second digit of the set value. The same will happen with the up key (3) and the third digit of the set display, and up key (4) and the fourth digit of the set display. The timer will increment from 9 back to 0. The timer comes programmed for a range of 00.01 seconds to 99.99 seconds. Consult factory for other time ranges and functions.

The system is designed so that the LEDs will last the life of the unit. No replacement of the light source will be required when operated within specifications. There is no automatic timed shutdown for the LED source. The only condition that may shut off the array would be an over temperature shutdown. If an over temperature shutdown occurs, check that the airflow is not restricted to the system and that the fan filter is clean. If the condition persists, consult the factory for further assistance. No user serviceable parts exist within the enclosure.

Position the lightguide end no closer than ¼” from material being cured. Locating the lightguide end too close can cause lightguide end to become cloudy from vapors coming off of curing material.

In a typical bulb based system, lamp life is reduced each time it is started. The new LED based systems have no such limitations. They can be shut off, and then immediately restarted with no cool down or warm up periods or loss of system lifetime. Powering off during breaks or lunch hour is not a problem. During a power failure, the LED system will only be down as long as the power is off. The only other interruption seen would be the termination of a timed exposure, if the power failure were longer than the hold up time of the internal power supply.

Intensity Adjustment

An intensity adjustment tool is included with each Blue Wave LED. Use the tool provided to make any changes in output intensity. The adjustment is a 10 turn potentiometer which allows accurate adjustment of output intensity. Each unit is shipped with the output set to maximum.

Since LEDs are temperature sensitive which causes a drop in output with an increase in temperature, the Blue Wave LED has a temperature compensation circuit. When the unit is operated at maximum output and the intensity adjustment is adjusted to a very low value, allow the LED array to cool for several minutes before completing the adjustment.



9-Pin Connector I/O Signals

The Blue Wave is equipped with a 9 pin D-subminiature connector that provides interface between the Blue Wave and PLC and similar factory control equipment. The pin configuration is not compatible with the present Blue Wave 200 system. The following discussion will describe inputs and outputs, their properties and how to use them.



Input signals:

Each input signal is optically isolated from the internal circuit of the Blue Wave LED. A positive 24 volts and 10 milliamp maximum is required to activate each signal input. All inputs are returned to the common terminal, and have built in current limiting resistors to protect the isolators.

Pin 1 – +24V:

Applying power to this pin enables the Interlock function (4). Interlock will not function unless +24V is applied to this pin.

Pin 2 – Common:

All signals, both inputs and outputs, are returned to this pin. Common may be used independently of +24V for all outputs and inputs, except for the Interlock (4) input.

Pin 3 – Shutter In:

This signal line may be used to remotely power up the Blue Wave LEDs. When it is being used, the local foot switch on the rear of the Blue Wave box is still capable of operating the unit. Similar to the footswitch, if the timer / manual switch is in timer mode, the unit will power the LEDs for the time set on the timer. In the manual mode, the unit will power the LEDs for the duration of the remote activate signal.

Pin 4 – Interlock In:

A safety interlock can be connected between pins 1 and 4. While +24 V is applied to pin 4, the system will allow activation of the LEDs. If the connection is broken, power is immediately removed from the LEDs. The Interlock relies on the 24V signal being present on pin 1.

Pin 5 – Intensity In:

This input is supplied as a means to actively control the output intensity of the Blue Wave LED unit. It can be used to Pulse Width Modulate (PWM) the power to the LEDs. This input cannot increase the intensity over the set point of the front panel Intensity adjustment, but can only reduce it. The front panel adjustment should be set fully clockwise to give pin 5 the greatest range.

A high level (+24V) on pin 5 will turn off the LEDs, and a low level (0V) will allow maximum LED intensity. A signal of 1.K Hz should be used, with a duty cycle of 0 to 60 %. Note: a 10% duty cycle will generate a greater intensity than a 50% duty cycle.

This input can be used with an external controller to create any number of customized step cure profiles, or with an additional sensor to regulate the output.

Output signals:

The output signals are all opto-isolated signals. Each signal has an NPN output transistor. The emitters of all output transistors are tied together and connected to the PLC common on DB9 pin 2. Each individual output signal line is connected to the collector of each transistor. When the transistor is turned on, this provides a ground to the PLC system that can be used to enable a relay coil or an enable signal to an opto-coupler. The conducting transistor can also function as a set of contacts that can initiate actions within the PLC. When the transistor is on, the signal is said to be enabled or asserted. When the transistor is off, the signal is said to be disabled or unasserted. The transistors have a max current rating of 30 mA, and a max power rating of 150mW. Only positive voltages with respect to the PLC common should be used to a maximum of 24 Volts DC. Series limiting resistors should be used to insure that the max conditions are not exceeded.

Pin 6 – Lightguide Out:

When a lightguide is fully inserted into the unit an internal switch will allow the LEDs to operate. The same switch will send a signal to turn on the transistor and connect pin 6 to pin 2. This output can be used to verify the condition of the system, should an error occur, or alert a user to the failure.

Pin 7 – Lamp Lit Out:

Pin 7 will be shorted to pin 2 when the LEDs are powered up, and the set point is above a predetermined level. Pin 7 will be open with respect to pin 2, if the LEDs are off for any reason. This output can be used as go/no go confirmation that the array is engaged.

Pin 8 – Intensity Out:

An internal circuit monitors the current sent to the LEDs, and generates a PWM signal whose frequency and duty cycle varies with the current. Adjusting the front panel Intensity, or using the Intensity Input on pin 5, will cause a change in the signal seen on pin 8. As the LEDs initially heat up, and before they reach a stable operating point, the system compensates for this change. The output on pin 8 will be slightly altered until stability is reached. This output can be used to verify step or ramped changes in the intensity for customized profiles, or to alert the remote controller when the system has reached maximum intensity in a closed loop system.

Pin 9 – Over Temperature Out:

A sensor constantly monitors the temperature of the LEDs in the system. If for any reason the reading rises above a predetermined limit, the control PCB will shut off current to the LEDs to prevent damage. When the measured temperature drops to a lower threshold, the PCB will re-enable current to the LEDs. If this fault occurs check for proper airflow into and out of the unit, and verify the air filter is clean.

8. MAINTENANCE

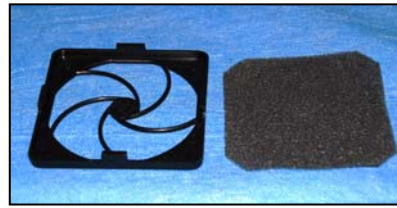
The BlueWave[®] LED was designed to operate with minimum maintenance. Follow the schedule below to assure top unit performance.

LIGHT GUIDE

Clean the lightguide ends monthly or as required. The ends of the guide should be kept clean to transmit as much light as possible. Cured adhesive can be removed from liquid filled light guides with a razor blade. Avoid sharp bends with the light guide since this reduces light output and damages guide.

FAN FILTERS

The external fan filter should be inspected and cleaned periodically to prevent dust buildup from affecting airflow through the unit. Spare filters are provided with each unit. The fan filters are washable and may be reused. Remove the fan filter by removing the snap-on cover from the rear of the fan.



FUSE REPLACEMENT

The unit is fused with two fuses that are installed in the power receptacle. To remove the fuses, unplug the unit and remove the fuse holder with a small screwdriver. Remove the fuses from the holder and install new fuses. Replace the fuse holder into the power receptacle. Replace fuses with 2.0 amp fast blow types Dymax PN 37236 or equivalent.



9. TROUBLESHOOTING

WARNING: ONLY QUALIFIED MAINTENANCE PERSONNEL SHOULD ATTEMPT THE FOLLOWING PROCEDURES:

AVERTISSEMENT: Seulement personnel d'entretien diplômé devrais essayer les procedures suivant.

Problem: LEDs Will Not Illuminate

Possible Cause	Testing	Corrective Action
Improper connections	Visually inspect all input/output connections (i.e. power cord, foot switch, lightguide).	Secure all connections.
Main line fuse blown (nothing in unit operates)	Remove fuse from power receptacle and check with an ohmmeter.	Replace fuse, if defective.
Lightguide not fully inserted	Try to pull lightguide out.	Reinsert lightguide into mount.

Problem: Low Output Intensity

Other Symptoms: Fails To Cure Adhesive In Allotted Time

Possible Cause	Testing	Corrective Action
Intensity adjustment screw set too low.	Use a radiometer (model DYMAX Accu-Cal 50 Visible or equivalent) to measure output intensity.	Adjust setpoint up to desired intensity.
Transmission loss in light guide too great	Compare lightguide output against new lightguide (or use the DYMAX Light Guide Simulator) to determine transmission loss.	Replace lightguide.
Contaminants on lightguide	Visually examine ends of light guide for contaminants.	Clean with isopropyl alcohol (or equivalent) Heavy deposits on liquid lightguides may be removed with a razor blade. Replace lightguide if it cannot be cleaned.
Inadequate system cooling	Check air filter for debris and blockages at exit vents.	Clean or replace filter and remove all air blockages from around unit.

1. FREQUENTLY ASKED QUESTIONS

Q.) My BlueWave LED will not turn on.

- A.) Check the power cord connection.
- B.) Check the fuses located where the power cord plugs into the unit.

Q.) The LEDs will not light, but the unit is powered up.

- A.) Check that the lightguide is fully seated in the mount.
- B.) Confirm the Intensity adjustment is not set to minimum.
- C.) Check the condition on the signals on the DB9 connector (+24V, Safety Interlock, and Intensity Input)

Q.) I have low intensity.

- A.) The end of the lightguide may have a build-up of adhesive. Carefully remove with isopropyl alcohol, or gently scraping with a razor blade for heavier deposits.
- B.) The condition of the light guide will also affect the intensity. All lightguides degrade with time, but intensity will also drop if the lightguide is bent or compressed. The intensity reading from the lightguide should be compared to the intensity reading from a lightguide simulator to determine the efficiency.
- C.) Incorrect setting of the Intensity adjustment. Turn fully clockwise for maximum intensity out.

Q.) My foot switch is not operating.

- A.) Check the connection of the foot switch into the unit.

Q.) Why does my BlueWave LED seem to run very hot?

- A.) Replace the fan filter media on the intake fan located in the back of the equipment. This is your first line of defense against airborne dust and debris. This filter media and several spares are supplied with new units, and should be changed regularly.
- B.) Idea operation of this equipment suggests at least 6" of clearance behind the unit for proper ventilation. Confirm intake fan is not feeding from the exhaust of other equipment.
- C.) Confirm the fan is operating.
- D.) Equipment may already be full of dust and debris, over heating the internal electronics.

11. SPARE PARTS

ITEM	PART#
Lightguide LED Assembly	40018
Fuses: F2.0 Amp	37236
Liquid-D Lightguide, 8mm X 1 Meter	5722
Fan Filter and Holder	5097
Fan Filter Media	40008
Footswitch	5028
Power Cord, US	35255
Digital Timer and Harness Assembly	40014
Intake Fan Assembly	40004
Feet, Rubber	5039
Switch, Manual Timer	35384
Switch, Power	36288
Control PCB Assembly	40016
Filter, Dual Fuse IEC Inlet	37178
Power Supply/Bracket Assembly	40007

OPTIONS/ACCESSORIES:

ITEM	PART#
BlueWave Case with Foam	1 - 40009
	1 - 40010
	2 - 40011
	1 - 40012
Liquid-D Lightguide, 5mm X 1 Meter	5720
Liquid-D Lightguide, 5mm X 1.5 Meter	5721
Liquid-D Lightguide, 8mm X 1 Meter	5722
UV Goggles – Green	35286
UV Goggles – Gray	35285
Face Shield	35186
DYMAX Accu-Cal 50 Visible Radiometer (Flood)	40044
DYMAX Accu-Cal 50 Visible Radiometer (Spot)	40043
5mm Lightguide Simulator	38408

12. DEFINITION OF TERMS

LED - Light Emitting Diode. A solid-state semi-conducting device that generates a specific, narrow band, wavelength of light.

Intensity - a measure of light energy over the unit of surface area (usually surface at the specified working distance from the bottom of reflector housing) in W/cm^2 or mW/cm^2 . For the UV portion of light, this measure is often called in literature "irradiance", i.e. radiant energy arriving at a point on a surface per unit area.

Brightness, also known as **Luminance** - description of energy in the visible region of the spectrum (approximately from 400 to 700 nm) and recorded in photometric units. "**Intensity**" (see below) of visible light energy is called Illuminance.

Illuminance - luminous flux (energy of visible light) incident per unit area, and measured in **Lx** (lux) or **Lumen/cm²**.

Ultraviolet (UV) - The invisible region of the spectrum just beyond the violet end of the visible region. Wavelength ranges in general from 1.0 to 400 nm. DYMAX[®] bulbs (burners) do not radiate energy in deep Ultraviolet; there are very minute amounts below 220 nm and practically nothing can be sensed below 200 nm. This is due to the use of an ozone blocking quartz bulb envelope (See Ozone).

1. **Ultraviolet A (UV-A)** - UV of long wavelength from within approximately 400 to 320nm of the spectral band (4000 to 3200 \oplus) - predominately produced by DYMAX Flood Lamps.
2. **Ultraviolet B (UV-B)** - UV of medium wavelength from within approximately 320 to 280nm - DYMAX Flood Lamps produce some amount of their energy within this bandwidth.
3. **Ultraviolet C (UV-C)** - UV of short wavelength below 280nm (we say from 280 to 200nm) – a large amount of this energy is present in the Sunlight.
4. **Visible** – Light that can be seen 400-700 nm.

Dose - is irradiance integrated over time, or Irradiance (W/cm^2) x Time (s) = Dose (Joules/cm²). Note: Watt is the power that gives rise to the production of energy at the rate of 1-joule (J) per second (s).

Ozone - oxidizing agent (O₃) produced by the action of Ultraviolet radiant energy (below 185 nm) or electrical corona discharge of oxygen on air.

OSHA 1910.145: "Regulation of Accident prevention Signs and Tags" defines the following headers as:

WARNING – is used when there is a hazardous situation that has some probability of severe injury.

CAUTION - is used to indicate a hazardous situation that may result in minor or moderate injury.

NOTICE - is used to convey a message related directly or indirectly to the safety of personnel, or protection of property.

OSHA 1910.145: "Regulation de la prevention d'accident Signes et Étiquettes" défin les têtes comme:

13. WARRANTY

CAUTION!

DYMAX® CORPORATION RESERVES THE RIGHT TO INVALIDATE ANY WARRANTIES, EXPRESSED OR IMPLIED, DUE TO ANY REPAIRS PERFORMED OR ATTEMPTED ON DYMAX EQUIPMENT WITHOUT WRITTEN AUTHORIZATION FROM DYMAX. THOSE CORRECTIVE ACTIONS LISTED BELOW ARE LIMITED TO THIS AUTHORIZATION.

WARRANTY CARD MUST BE RETURNED OR WARRANTY WILL BE VOID

DYMAX offers a one-year warranty against defects in material and workmanship on all system components *with proof of purchase date*. Unauthorized repair, modification, or improper use of equipment may void warranty. The use of aftermarket replacement parts not supplied or approved by DYMAX Corporation, will void any effective warranties and may result in damage to the equipment.

The data contained in this bulletin is furnished for information only and is believed to be reliable. We cannot assume responsibility for results obtained by others over whose methods we have no control. It is the user's responsibility to determine suitability for the user's purpose of any product or methods mentioned herein and to adopt such precautions as may be advisable for the protection of property and persons against any hazards that may be involved in the handling and use thereof. Nothing in this bulletin is to be interpreted as a representation of freedom from domination of patents owned by others or a license under a DYMAX® Corporation patent. We recommend that each prospective user test his proposed application before repetitive use, using the data as a guide.