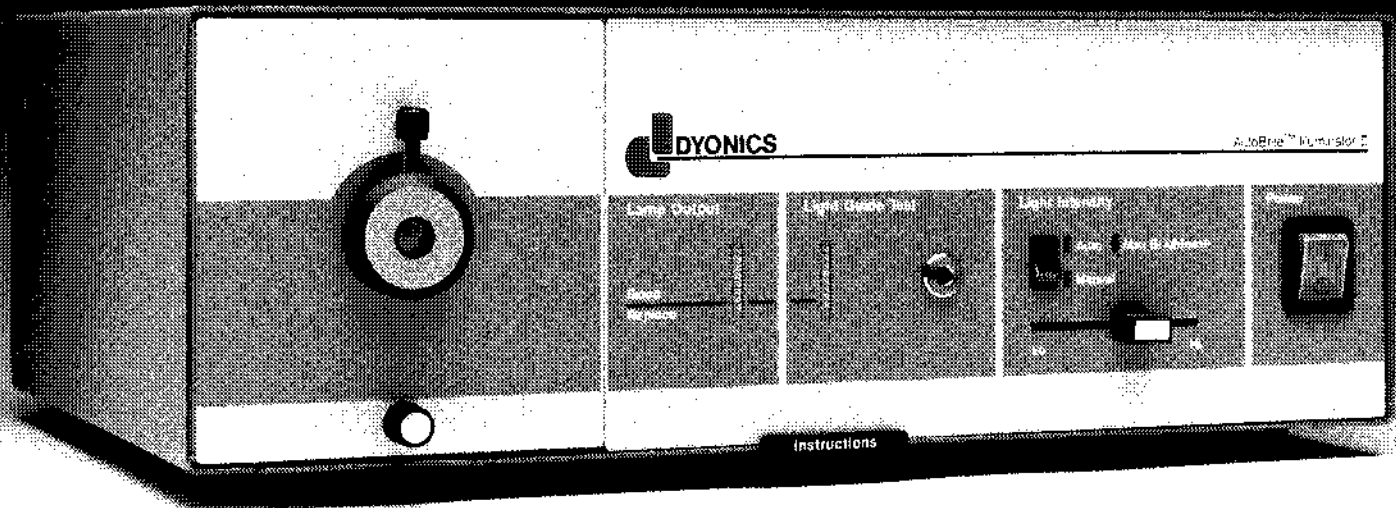


# THE DYONICS AUTOBRITE™ ILLUMINATOR II Manual

Smith+Nephew



## General Operating Instructions

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# The Dyonics AutoBrite™ Illuminator II

Your AutoBrite™ Illuminator II is a state-of-the-art fiber optic illuminator for use in endoscopic procedures. This light source provides a light intensity which, when set in the AUTO mode, adjusts automatically as needed for optimum illumination. When positioned in the MANUAL mode, the light intensity may be manually adjusted over a dynamic range of more than 30 to 1.

The Metal Halide Arc Lamp provides intense white light at over 5600°K color temperature and is suitable for the most exacting photographic or video recording requirements.

**Please be sure to read all the information in this manual carefully before use.** The manual will familiarize you with your AutoBrite™ Illuminator II and the steps which should be taken for its proper care and maintenance. Adherence to these steps will assure many hours of reliable operation.

In this manual data applicable to the 220V model are shown in brackets [ ].

## Specifications

### Lamp:

Metal Halide Arc Lamp, Model HTI 250, 45V 6A, 270W

Color Temperature: Over 5600°K  
Lamp Life: 250 hrs. (average) to half of acceptable initial light output.

### Illuminator:

Input Power Requirements: 120V 50-60Hz., 6A  
(220V 50-60Hz., 3A)  
Leakage Current to Ground: Less than 100 microamperes

**NOTE: AN ISOLATION TRANSFORMER IS NOT REQUIRED, BUT IF ONE IS USED, IT MUST BE RATED AT 1 KVA OR MORE.**

Light Guide Receptacle: Designed to accept Dyonics/Wolf-type light guide fittings.

Dimensions: 17½" W x 11" D x 5½" H  
(44cm W x 28cm D x 14cm H)

Weight: 16 lbs. (7.5kg)

Ambient Temperature (operating): 40°F-100°F  
(5°C-38°C)

**WARNING—POSSIBLE EXPLOSION  
HAZARD IF USED IN THE PRESENCE OF  
FLAMMABLE ANESTHETICS.**

## Front Panel Controls and Features

### Main Power On/Off Switch

Power for the AutoBrite™ Illuminator II is activated through the Rocker Switch that applies line voltage to the

instrument. Pressing this switch turns on the pilot light and cooling fan, and activates the arc lamp.

### Lamp Bargraph

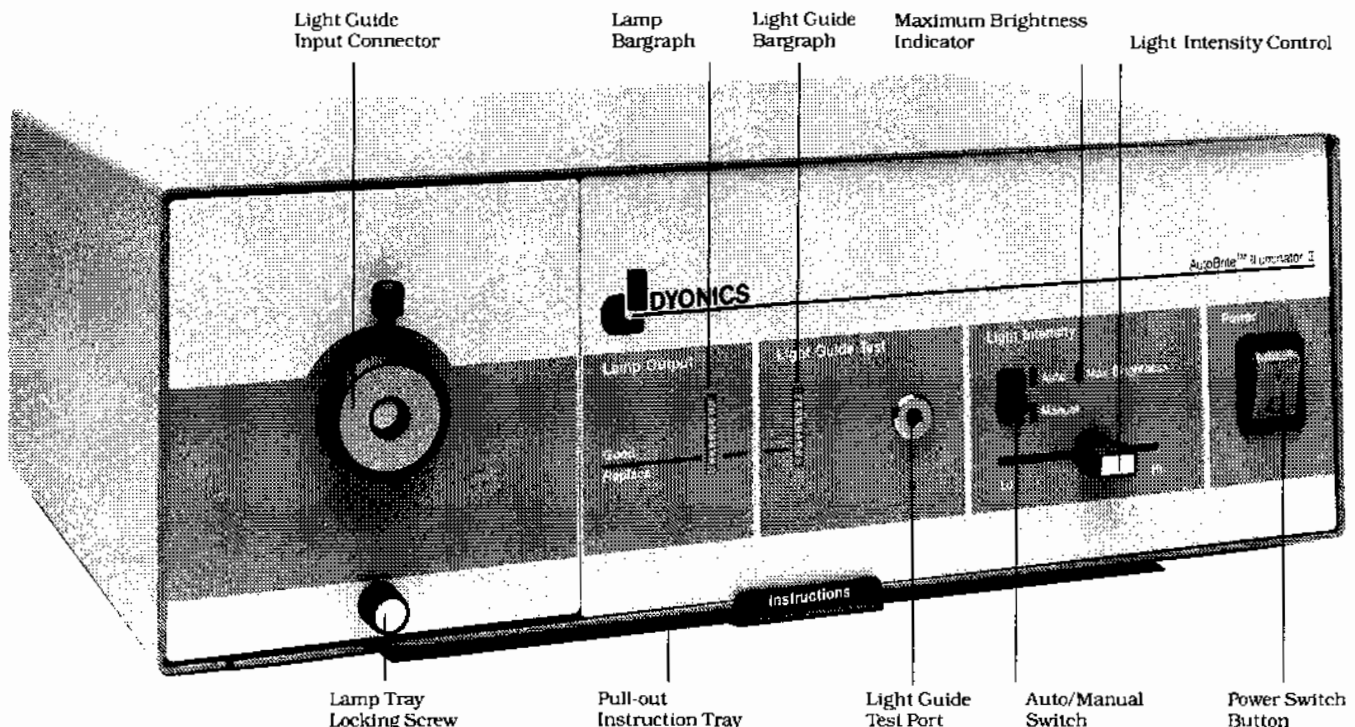
The Lamp Bargraph indicates the level of light from the lamp. As the lamp ages and becomes significantly less bright, the graph shows that the lamp should be replaced.

### Light Guide Test Port

The Light Guide Test Port accepts the distal end of the Dyonics Gemini Light Guide, with the arthroscope adaptor removed. To perform the light guide test, the proximal end of the light guide is plugged into the Light Guide Input Connector.

### Light Guide Bargraph

The Light Guide Bargraph indicates the level of light emitted from a light guide. One end of the light guide is inserted into the Light Guide Input Connector and the other into the Light Guide Test Port. The reading seen on the Light Guide Bargraph is the result of a light guide functional check/test.



## Light Guide Input Connector

This self-closing light port is designed to accept the Dyonics/Wolf-type light guide end fittings.

## Auto/Manual Switch

The Auto/Manual Switch selects the desired operating mode of the AutoBrite™ Illuminator II. When the upper side of the switch is depressed, the system is in Manual mode and the Light Guide Intensity Control directly determines the amount of light provided. When the lower side of the Auto/Manual switch is depressed, the system is in Automatic mode, and the Light Intensity Control determines the light level around which the illuminator automatically adjusts. In this mode, when the arthroscope or other endoscope is directed to darker or lighter areas, or when its distance from the tissue is varied, the light level will automatically be increased or decreased to maintain the brightness of the video picture. (For the Automatic mode to function, the illuminator must be connected to a video system from which an appropriate signal is received.) The green and yellow LEDs (Light Emitting Diodes) to either side of the Auto/Manual Switch indicate the operating mode of the system.

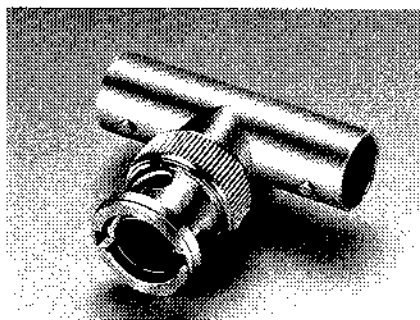
## Light Intensity Control

The function of the Light Intensity Control depends on the operating mode selected. In Manual mode,

moving the lever to the right increases the amount of light supplied, while moving the lever to the left decreases the light. In Automatic mode, the Light Intensity Control sets an illumination level about which the control circuitry operates to keep the video picture brightness constant.

## Maximum Brightness Indicator

The Maximum Brightness Indicator signals that maximum light output has been achieved. This indicator functions in both the Automatic and Manual modes.



"T" Connector

## Rear Panel Controls and Features

### Video Input Connector

The video signal cable from the camera controller connects to the illuminator at the Video (BNC) Input Connector.

## Termination Selector Switch

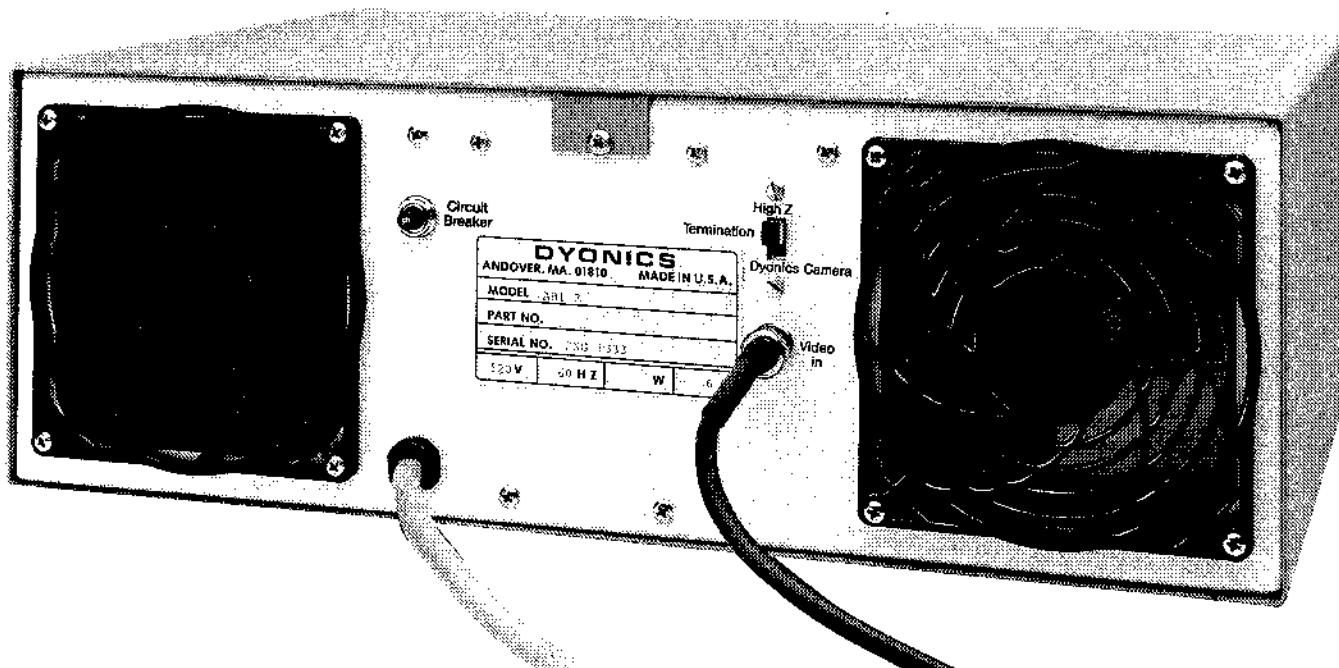
Dyonics Camera position: When the termination switch is in this position, the input is terminated through a 75 Ohm resistor. The DyoCam™ Video Cameras, which were designed with isolated outputs for the video monitor and the AutoBrite™ Illuminator II, function best in this position.

High-Z position: When the termination switch is in the High-Z position, there is no termination resistor in the circuit. This position functions best with video camera systems having only a single output and therefore requiring a "T" connector to operate both the video monitor and AutoBrite™ Illuminator II. The termination switch may need to be switched to the "High Z" position if a camera other than a Dyonics camera is being used, or if the signal is being looped through a videotape recorder or other accessory.

The instruments will not be harmed by trying the selector switch in either position to determine which is preferred.

## Circuit Breaker

The overcurrent circuit breaker protects the instrument circuitry and the arc lamp power supply. A tripped lamp breaker can be manually reset by pushing the black button.



# Operating Procedure

## Turning Instrument On

Before plugging the power connector into a power outlet be sure that the power corresponds to the data on the rear panel nameplate, and that the third pin on the plug is properly grounded to the outlet. The illuminator should be placed in a horizontal position with the back panel free from obstruction. Air must flow freely into the back of the unit. Pushing the power switch will start the cooling fan, illuminate the switch button and activate the circuitry to start the arc lamp within 4 seconds. As the lamp warms up, succeeding LEDs in the Lamp Bargraph will be lighted, thereby indicating lamp condition.

(Pull-out Tray contains abbreviated instructions.)

## Arc Lamp

If the arc lamp fails to light within 4 seconds, or if for any reason it goes out, push the power switch to turn off the unit. Wait at least 5 seconds. Then push the power switch to restart the unit. Repeat this procedure up to 3 times. If the lamp still does not start it should be replaced. Warm-up time is 2-3 minutes. The light will be bluish at first and will gradually become brighter and whiter.

**NOTE: ONCE THE HIGH INTENSITY LAMP HAS BEEN TURNED ON, IT SHOULD REMAIN ON FOR AT LEAST 3 MINUTES BEFORE IT IS TURNED OFF. (Failure to observe this precaution may seriously shorten lamp life.)**

## Selecting the Auto/Manual Mode and Light Intensity

Depress the switch to select either the Auto or Manual operating mode. The yellow light will glow when you are in the Manual mode and the green light will glow when you are in the Auto mode.

Manual Mode: The Manual operating mode allows the operator to

determine the amount of light delivered into the viewing area by moving the Light Intensity Control knob. (To the right increases the brightness; to the left decreases the brightness.) The amount of light emitted from the arthroscope changes only when the Light Intensity Control knob is moved. The Manual mode might be selected when a constant, unvaried light output is desired and when direct view, rather than video, is used.

Auto Mode: The Automatic Mode allows the illuminator to increase or decrease the light output according to the light level signal received from the video system. The maximum shutter response time is approximately 1-2 seconds. In this mode, the Light Intensity Control is used to set the preferred brightness on the monitor. The light source will then automatically adjust its output up or down to maintain this preferred brightness. The Automatic mode works only in conjunction with video systems such as the Dyonics DyoCam™ Arthroscopic Video Cameras.

With the video signal coupled into the AutoBrite™ Illuminator II through the rear panel Video Input Connector, obtain a picture of typical brightness on the monitor screen.

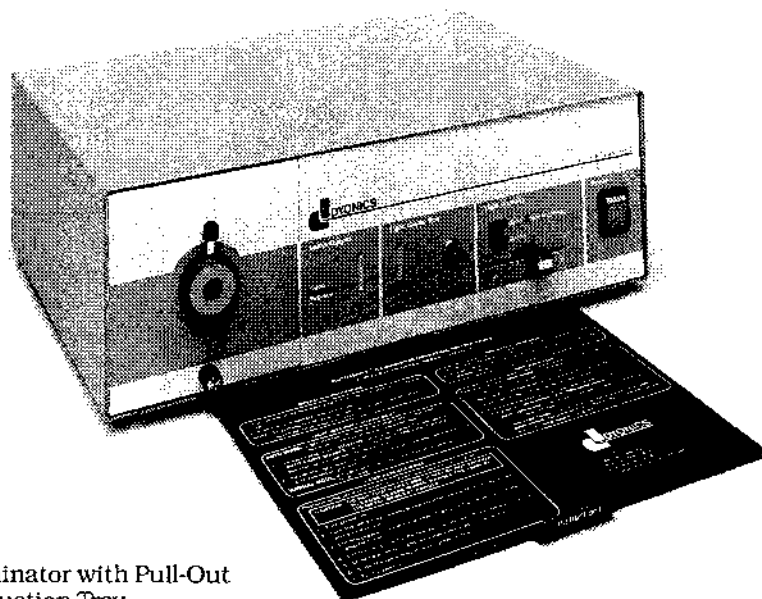
Then adjust the Light Intensity

Control until the monitor picture has the desired appearance: clear and bright but without blooming due to excessive light. When the arthroscope is directed to darker or lighter areas, or its distance from the tissue is varied, the light level will automatically be increased or decreased to maintain the selected brightness of the picture.

## Inserting and Removing Light Guides

**CAUTION: DO NOT HOLD THE SHUTTER OPEN WITHOUT A LIGHT GUIDE IN PLACE. FAILURE TO OBSERVE THIS PRECAUTION MAY RESULT IN BURNS TO SKIN, CLOTHING OR OTHER MATERIAL INADVERTENTLY PLACED IN FRONT OF THE LIGHT PORT.**

First check to be sure that the light guide has a Dyonics/Wolf end fitting. While depressing the shutter button, insert the tip into the port. The light guide will be locked in place when you release the button. To remove a light guide, depress the shutter button and withdraw the light guide by the black adaptor.



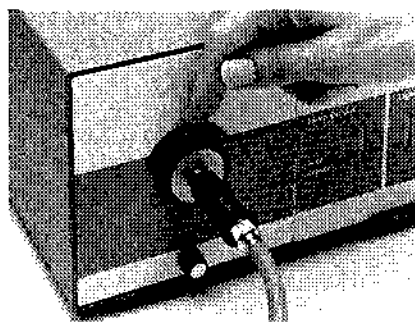
Illuminator with Pull-Out Instruction Tray

**CAUTION: THE METAL TIP MAY BE HOT. GRASP LIGHT GUIDE BY BLACK ADAPTOR OR USE CLOTH GLOVE TO PROTECT FINGERS FROM BEING BURNED. HIGH ENERGY LIGHT MAY CAUSE BURNS TO SKIN OR CLOTHING. KEEP EXPOSED TIP OF THE LIGHT GUIDE AWAY FROM CLOTH, PLASTIC OR OTHER COMBUSTIBLE MATERIAL.**

## Output Test Features

### Lamp Output

The Lamp Bargraph indicates the level of light from the lamp, irrespective of the setting of the Light Inten-



sity Control knob. Allow 2-3 minutes after start-up for the arc lamp to reach full brightness. When the arc lamp is new, either 9 or 10 Light Emitting Diodes (LED) will glow. As the lamp ages, the LED bars go out one at a time, beginning at the top, indicating that arc lamp brightness is gradually decreasing. When only the bottom LED bars are glowing, it is time to replace the arc lamp, as is indicated on the front panel.

### Light Guide Output

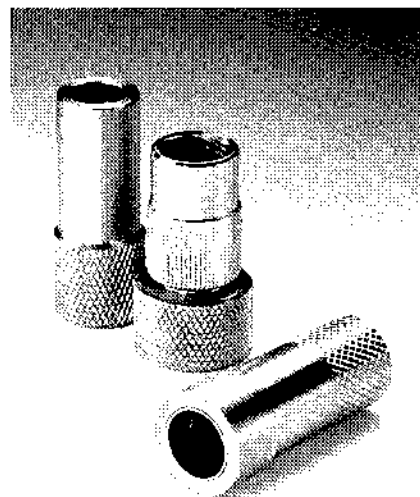
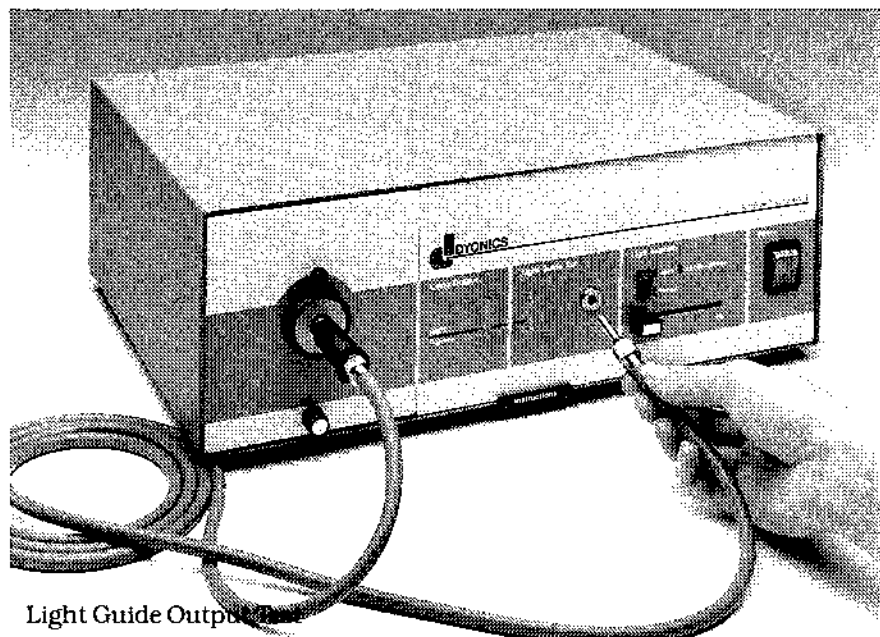
The Light Guide Bargraph is illuminated only during a light guide output test. To perform this test, first move the Light Intensity Control knob all the way to the left (to reduce glare), then attach the proximal end of the light guide to the Light Guide Input Connector, which is designed to accept the Dyonics/Wolf-type fitting. Hold the distal end of the light guide, with the arthroscope adaptor removed, insert it into the Light Guide Test Port (approximately 10mm). (Do not attach the light guide to the test port, as this places an unnecessary heat load on the electronic circuitry.) The setting of the Light Intensity Control does not affect this test. Internal circuitry

automatically overrides any set position of the Light Intensity Control in Auto or Manual mode, causing the shutter to move to the fully open position.

The Light Guide Bargraph indicates the level of light emitted from the light guide. The system is calibrated so that if a 4mm diameter, 8-foot-long Dyonics Gemini Light Guide in good condition is inserted into the test port, the two bargraphs, "Lamp Output" and "Light Guide Output," will indicate the same level (within one LED bar). If there is more than one bar difference between the two bargraphs, check the light guide for darkened ends, broken fibers, or other damage. If 2 or more bars are glowing in the Light Guide Bargraph, there should be sufficient light emerging from the light guide. If only 1 or 2 LED bars are glowing, either the light guide is damaged or the lamp is due for replacement, as will be indicated by the lamp bargraph.

If other than a 4mm light guide (to which the system has been calibrated) is tested, the bargraph correlation will be different. If a 5mm light guide is tested, the Light Guide Bargraph should be 3 bars ( $\pm 1$  bar) higher than the Lamp Bargraph to be considered in good condition.

Note: The length of the light guide does not appreciably affect the light output.



Light Guide Instrument End Adaptors

# Maintenance and Service

## General

Your Dyonics AutoBrite™ Illuminator II was thoroughly tested and calibrated before shipment. If you should encounter difficulties that cannot be eliminated by the use of these instructions, please feel free to write or phone our Service Department. We will need a full description of the problem and the serial number of your instrument.

## Cleaning

### **CAUTION: UNPLUG LINE CORD BEFORE CLEANING**

Your AutoBrite™ Illuminator II should be cleaned often enough to prevent the accumulation of dust and dirt especially around the air intake and outlet openings. Use a soft, dry brush and vacuum or low pressure blower. Painted areas of panel and cabinet should be cleaned with a soft, damp cloth and a mild detergent.

## Replacement of High Intensity Lamp

The lamp should be replaced promptly when only two bars remain lighted on the lamp brightness bar-graph, as unexpected failure of the lamp is possible after this time.

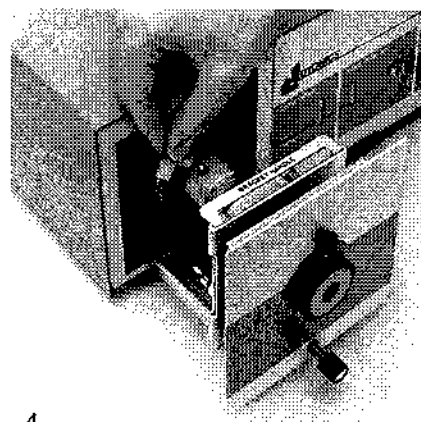
### **CAUTION: LAMP MAY BE HOT**

To replace the lamp:

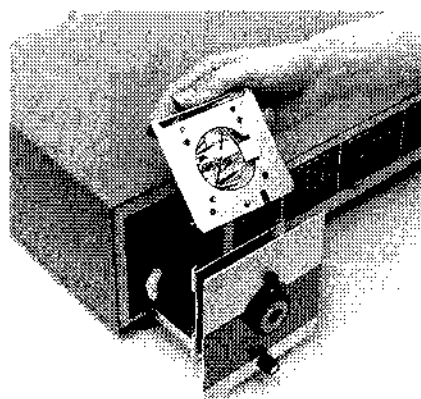
1. Turn the power off by depressing the Power Switch Button.
2. Turn the Lamp Tray Locking Screw counterclockwise until the lamp tray is free.
3. Slide the lamp tray out as far as possible.
4. Lift the plastic connector at rear of lamp to disconnect it from the lamp terminal.
5. Lift the lamp out by the bracket handle which may be warm to touch.

### **CAUTION: TOUCH ONLY THE MOUNTING HANDLE; OTHER PARTS MAY BE HOT**

6. Slide the new lamp with bracket into the vertical slots.
7. Connect the plastic connector to rear of lamp by pressing it onto the new lamp terminal.
8. Slide the lamp tray in as far as it will go.
9. Turn the lamp tray locking screw clockwise as far as it will go without forcing it.
10. Depress Power Switch Button to begin operation.



4.



5.

# Troubleshooting

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## WARNING

DO NOT LOOK AT THE ARC LAMP WITHOUT PROTECTIVE GOGGLES. THE LAMP PRODUCES HIGH INTENSITY VISUAL AND ULTRAVIOLET RADIATION WHICH MAY CAUSE BURNS TO THE SKIN OR EYES.

## WARNING

HAZARDOUS HIGH VOLTAGE AND ENERGY (15 kV STARTING PULSE, AND 70 VOLTS AT 7.7 AMPS D.C. OPERATING POWER) ARE PRESENT AT THE OUTPUT AND IN THE INTERNAL CIRCUITRY OF THIS UNIT. ONLY QUALIFIED SERVICE PERSONNEL SHOULD OPERATE OR TROUBLESHOOT THE "UNCASED" POWER SUPPLY.

# Table of Replaceable Parts

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Description	Part No.
1. Arc Lamp Assembly	2974
2. Arc Lamp Power Supply	8001003
3. Arc Lamp H.V. Cable Assembly	8001156
4. Arc Lamp Drawer Assembly (Does not include Arc Lamp Assembly)	8001140
5. Ceramic Spacer	8001224
6. Shutter Motor/Gearbox	471-0024
7. Circuit Breaker 6 amp (For 120V System only)	440-0064
8. Fan (For 120V System only)	694-0025
9. P.C. Board Assembly, 6 Volt P.S./TV Interface	8001114
10. Voltage Regulator 7806UC	453-0007
11. Transformer, 6 Volt P.S./TV Interface	527-0016
12. Rectifier Bridge	431-0125
13. Relay	490-0287
14. IC, LF 353N	453-0009
15. P.C. Board Assembly, Front Panel Control	8001113
16. Rocker Switch	500-0203
17. IC, LM 324N	453-0013
18. IC, LM 3914N	453-0012
19. IC, TL 081CP	453-0015
20. Bargraph Display	453-0011
21. Slide Pot, 10K	309-0238
22. Slide Pot Knob	750-0113
23. Plate, Diffusion	8001076
Copper Tape for Diffusion Plate	8001112
24. PC Board Interconnection Cable	8001161
25. Power Switch (120V Systems only)	500-0202
26. Lamp Drawer Connector Plug	480-0093
27. Lamp Drawer Connector Socket	505-0087
28. Sensor Tube Assembly (Part of and included with Lamp Drawer Assembly)	8001230
29. Nosepiece Shutter Assembly (Part of and included with Lamp Drawer Assembly)	802-0047
30. Thermostat	8001231



# Circuit Description

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The circuitry comprises the following subsystems, as shown in the Functional Block Diagram: 1) Input AC, 2) Logic Power Supply, 3) Lamp Start Control circuit, 4) Lamp Ignition/Switching Power, 5) Video Signal Processor, 6) Lamp Brightness Indicator circuit, 7) Light Guide Output Indicator circuit, 8) Automatic Intensity Control circuit, 9) Manual Intensity Control circuit, and 10) Motor Controller.

## 1. INPUT AC

Line power (120 VAC, 60 Hz.) is provided through the rear panel via a cable and hospital grade plug. All functions are energized when the power switch is depressed. The fan provides air flow to cool the electronics and lamp.

## 2. LOGIC POWER SUPPLY

The Logic Power Supply (LPS) provides regulated  $\pm 6$  VDC to operate the electronics, and 6 VAC used in Manual mode to modulate the signal to the Motor Controller.

## 3. LAMP START CONTROL

The Lamp Start Control (LSC) circuit is energized when the power is turned on. As a capacitor is charged, current flows through the coil of a relay, causing the relay to close, allowing high ignition voltage to be delivered to the arc lamp thereby starting it. Once the capacitor has charged, current ceases to flow through the winding, the relay opens, and ignition voltage is no longer delivered. When the power is turned off, the capacitor discharges within 5 seconds, after which the lamp will restart when power is turned back on.

## 4. LAMP IGNITION/SWITCHING POWER SUPPLY

The Lamp Ignition/Switching Power Supply (LISPS) circuit provides high voltage to the lamp, producing the arc which permits ignition. Once the lamp is on, current is supplied to maintain a lamp input power of 270W.

## 5. VIDEO SIGNAL PROCESSOR

The Video Signal Processor (VSP) accepts the video signal through the BNC connector on the back panel. A switch allows 75 $\Omega$  termination to be selected for systems, like the Dyonics DyoCam™ Video Cameras, which have a separate video output and therefore do not have to be operated in parallel with a terminated monitor. The signal is then amplified, rectified, and integrated to provide an input signal to the motor controller when the system is operated in Automatic mode.

## 6. LAMP BRIGHTNESS INDICATOR

The Lamp Brightness Indicator (LBI) circuit uses a photoresistor to sense the light intensity directly from the lamp. This value is displayed on the Light Guide Bargraph, scaled by a bargraph driver. The signal is also used for scaling in the Manual mode.

## 7. LIGHT GUIDE OUTPUT INDICATOR

The Light Guide Output Indicator (LGOI) circuit uses a photoresistor to sense light intensity from a light guide inserted into the test port on the front panel. The value is scaled by a bargraph driver and displayed on the Light Guide Bargraph. When light is sensed by this circuit, the signal also causes the motor driver to move the shutter to the full open position. When the light guide is removed, the shutter returns to its previous position.

## 8. AUTOMATIC INTENSITY CONTROL

The Automatic Intensity Control (AIC) circuit uses the output from the VSP as the signal (+) input to the Motor Controller, in Automatic mode. The reference (–) input to the Motor Controller is determined by the setting of the intensity control. This circuit allows the shutter position, and thereby the light output, to vary automatically in response to changes in the video signal. Average video signal is maintained at a level set by the Light Intensity Control.

## 9. MANUAL INTENSITY CONTROL

The Manual Intensity Control (MIC) circuit permits the shutter position to be determined directly by means of the Light Intensity Control, thus setting the output light level without automatic control. In Manual mode, the light output photoresistor is used to sense the shutter position by measuring the light which has been passed by the shutter. After scaling, this signal becomes the signal (+) input to the Motor Controller. The signal from the photoresistor in the LBI circuit is scaled and used to control the current through the slide potentiometer intensity control. The setting of this control sets the voltage of the reference (–) input to the Motor Controller. The scaling of this voltage through the LBI circuit compensates for decreasing light output due to aging of the lamp, allowing Manual mode control to function effectively independent of lamp output.

## 10. MOTOR CONTROLLER (MC)

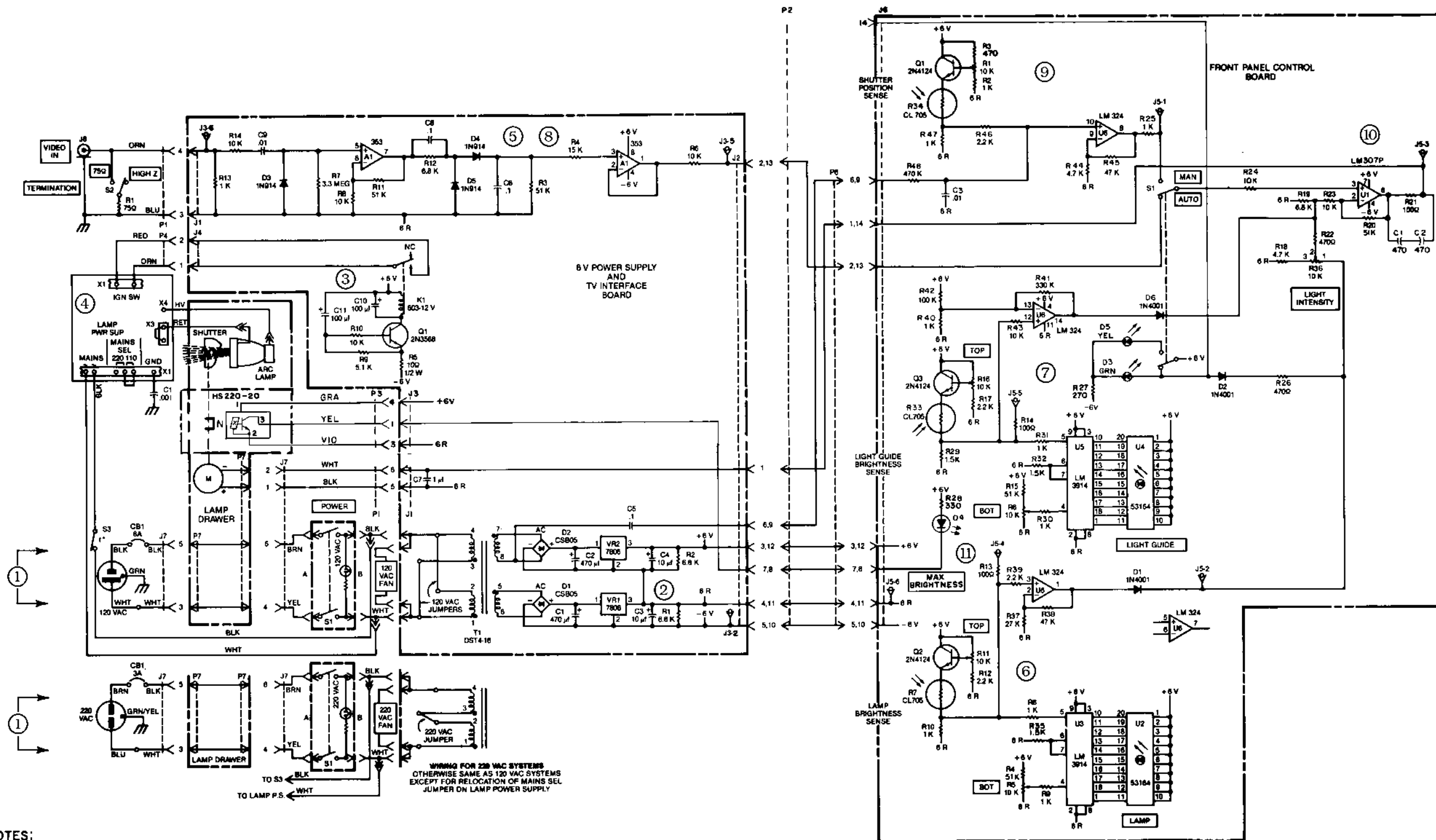
The Motor Controller (MC) compares the signals from its two inputs and generates a DC or square wave output. The reference (–) input has a DC voltage. When the voltage on the signal (+) input is greater than the reference, the MC output is positive. When the voltage on the signal (+) input becomes smaller than the reference (–), the MC output swings negative. Because the amplifier is operated at high gain, the output is a positive or negative DC level during these times. The motor moves in a direction to open the shutter when the MC output is negative, and moves in a direction to close the shutter when the output is positive. If the signal oscillates about a level close to the reference level, the Motor Controller produces a nearly symmetrical output. Since the gain is set quite high, this output is a square wave. The effect would be to move the

motor back and forth so as to open, then close, the shutter. Since the frequency is actually too high for the motor to follow, the motor does not move and is actively braked.

The effect of this circuit is to move the shutter until the signal oscillates about a level equal to the reference, then to brake the motor and stop the shutter very quickly to maintain this condition.

# 11. MAXIMUM BRIGHTNESS INDICATOR

The Maximum Brightness Indicator circuit uses a Hall Effect IC and a moving magnet on the shutter drive assembly. In the shutter fully open position, the magnet moves close to the Hall Effect IC causing the device to be switched on. The signal is used to light the Maximum Brightness LED indicating shutter open maximum light output condition.



## NOTES:

1. ALL RESISTORS ARE EXPRESSED IN OHMS & ARE  $\pm 5\%$ , 1/4 WATT, UNLESS OTHERWISE SPECIFIED.
2. ALL CAPACITORS ARE IN MICROFARADS.