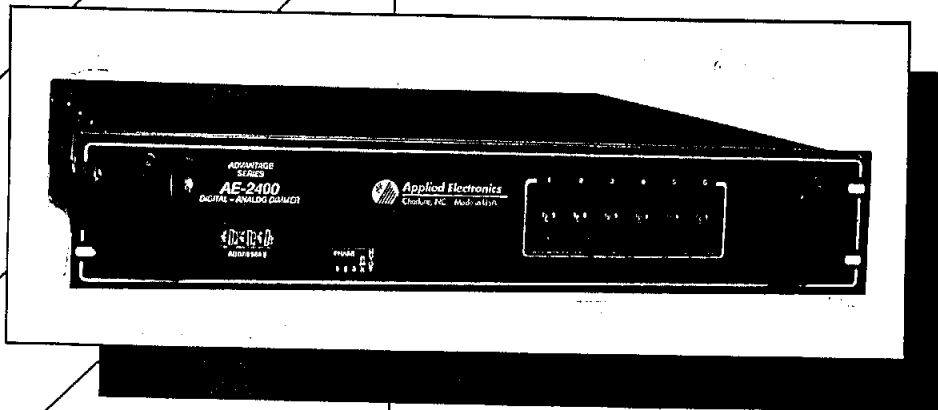


AE-2400UL
Digital
Dimmer



UL Listed

Operational
Manual

 **Applied** Electronics
TRUSSING LIFTS ROOFING

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INTRODUCTION

Congratulations, you are the owner of a state of the art digital lighting dimmer. The AE-2400UL has six 2400 watt dimmer channels and uses either DMX512 or analog 0-10 vdc. control protocols. This unit is 3 EIA rack spaces and has been designed to operate continuously under full load.

MECHANICAL INSTALLATION

For temporary or portable operation, the AE-2400UL may be placed on a flat surface with clearance of at least three inches on each side. Side clearances are required for proper integral fan forced air cooling. Ambient air temperature should not exceed 105 degrees Fahrenheit (40 degrees Celsius). Areas exposed to rain or heavy dust should be avoided.

Rack Mounting

AE-2400UL dimmers are designed to be rack mounted in EIA 19" equipment rails and can be supplied premounted as a rack system. If the user wishes to construct his own rack system, the following conditions should be observed.

1. Each unit must be supported in addition to the front rack ears. Side support rails or rear rack ears attached to rear rails are required to securely support the dimmer.
2. Sufficient ventilation openings must be provided on each side of the dimmer rack as air flow is from side to side. With proper side ventilation, fans within each dimmer provide adequate cooling requiring no additional rack fans.
3. Preferably, incoming power and load wiring would use properly rated quick disconnect type connectors for easy dimmer installation and removal. Alternately, enough slack should be left in the wiring to allow servicing.

ELECTRICAL INSTALLATION

Power Hook-up

The top cover must be removed to install AC power wiring. Wiring is then fed through the power cable clamp on the back of the dimmer and secured to the incoming power connection pressure lug terminals. **See Figure 1.** Copper wiring is recommended. Always meter line side supply voltages and check the integrity of both neutral and ground lines before connecting power to the dimmer. Within the dimmer, all Phase 1 wiring is Black, Phase 2 wiring is Red, and Phase 3 wiring is Blue. Neutral, the return path for all loads is White. Safety ground wiring is Green.

NOTE: INSTALLATION WIRE SIZE, TYPE, AND ROUTING USED IN A PARTICULAR LOCATION SHOULD BE BASED ON THE CURRENT NATIONAL ELECTRICAL CODE AND APPLICABLE STATE AND LOCAL CODES. BECAUSE OF THE COMPLEXITY AND CONTINUAL REVISION OF THESE CODES, IT IS RECOMMENDED THAT INPUT POWER BE INSTALLED BY A LICENSED ELECTRICAL CONTRACTOR. APPLIED ELECTRONICS ASSUMES NO RESPONSIBILITY FOR THE SAFETY OR APPROPRIATENESS OF CUSTOMER INSTALLED WIRING.

ELECTRICAL INSTALLATION

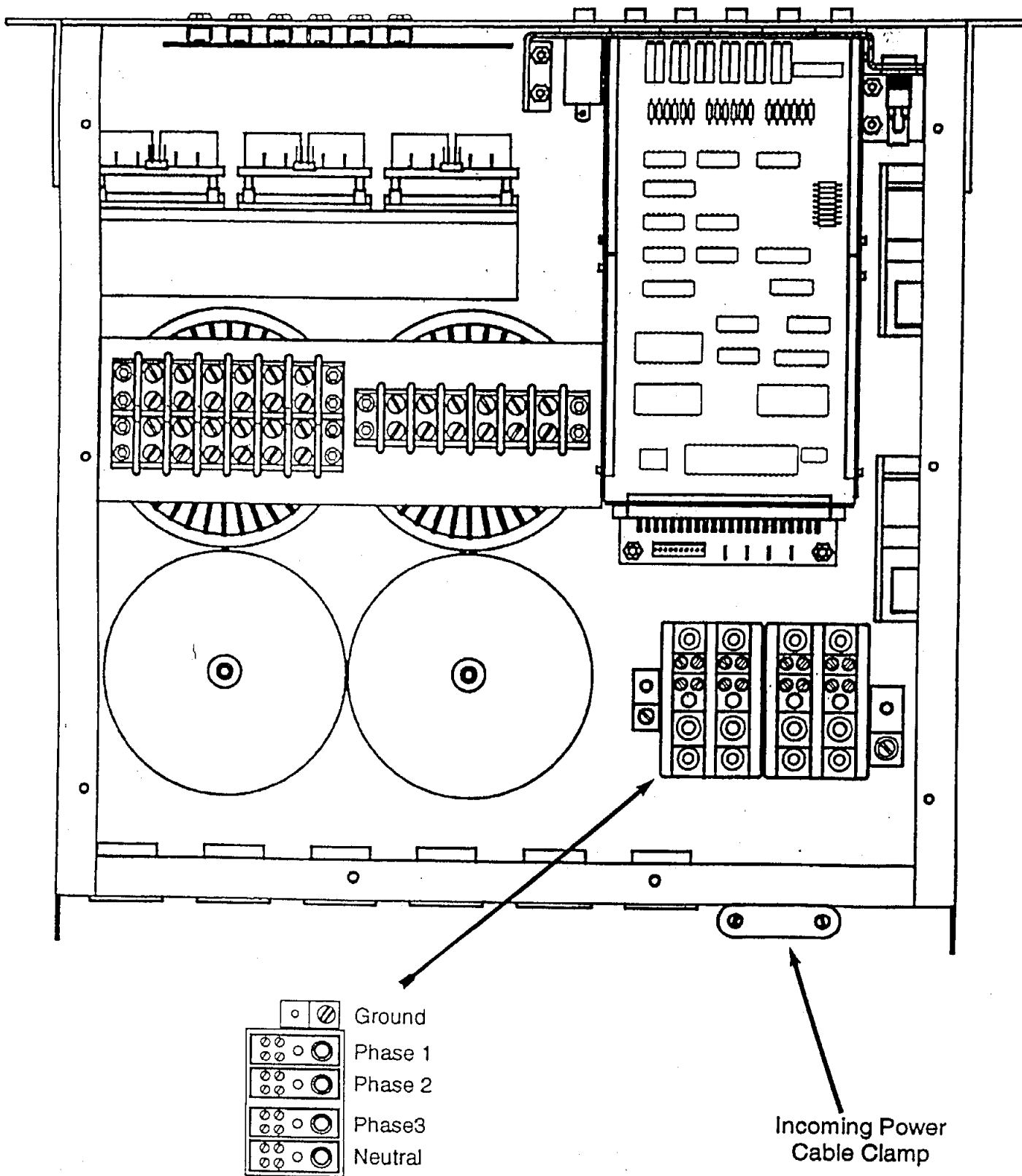


Figure 1

120/208 VAC, 3 phase, 4 wire (plus ground) is the preferred power input for each dimmer. Phase 1, Phase 2, and Phase 3 are the "hot" supply leads and are 120 VAC referenced to neutral. Each phase will draw 40 amps when the dimmer is fully loaded. With this type of power input, Neutral is a current carrying conductor. Five wires must be installed to the dimmer power terminals; Phase 1, Phase 2, Phase 3, Neutral, and Ground. Terminals are marked for easy identification. **See Figure 2.**

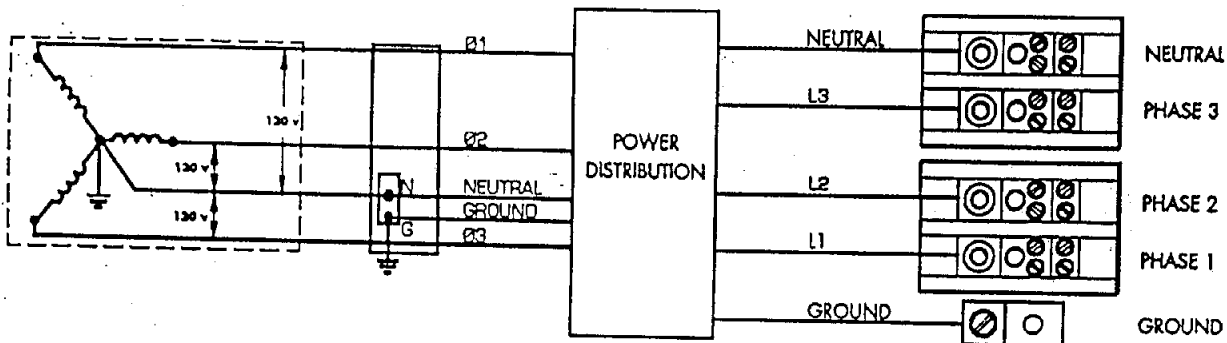


Figure 2

120/240 VAC, single phase, 3 wire (plus ground) may also be used. When more than 1 dimmer is to be installed, alternate wiring between **Figure 3a** and **Figure 3b** for optimal line loading. Neutral is a current carrying conductor. Each dimmer phase terminal will draw 40 amps when fully loaded.

Figure 3a

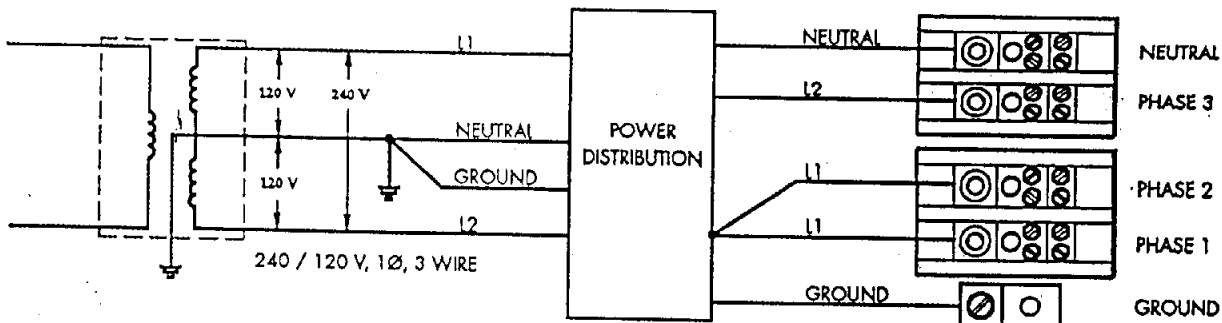
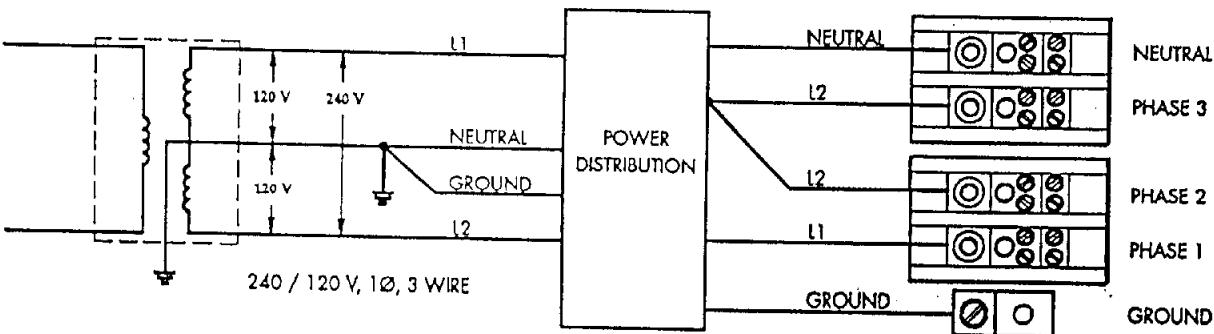


Figure 3b



DIMMER OPERATION OVERVIEW

Some DMX512 dimmers utilize a DMX decoder inside the unit to produce analog signals to control ramp comparison circuits (basically an analog dimmer with a DMX decoder inside). Other DMX dimmers may output only 64 different lighting levels. Analog dimmers may fluctuate from dimmer to dimmer in response time, trim, and output voltage curve, especially with change in ambient temperature.

The AE-2400UL is a true digital microprocessor controlled dimmer. Digital operation insures matched dimmer to dimmer and channel to channel performance. All 255 levels in the DMX512 protocol are supported in the AE-2400UL.

Analog 0-10 vdc signals are received via a 10 pin Cinch Jones connector and DMX512 data is received from a 5 pin XLR connector. The microprocessor then selects the higher light level setting and uses this data to calculate SCR firing times for each channel. This allows use of either a DMX512 controller or a 0-10 vdc analog controller which provides a useful back-up function. If DMX512 reception is lost, and a 0-10 vdc analog control signal is not present, the last received levels will be held indefinitely. If this occurs and a 0-10 vdc analog control voltage is received, stores DMX levels will be set to zero giving the analog controller total control.

OPERATION

1. **DMX Input Connector:** Male and female 5 pin XLR type connectors are provided as per the DMX512 specification. See Figure 4.

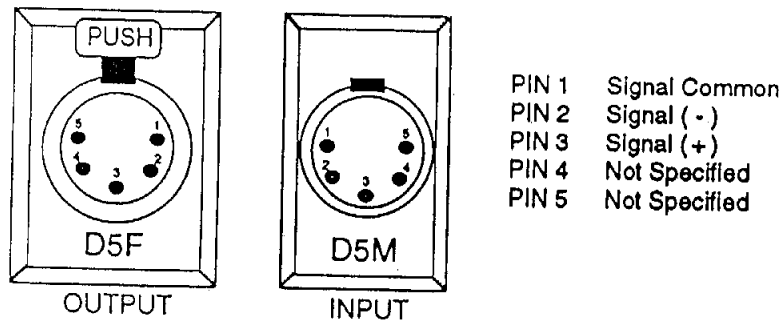


Figure 4

2. **Analog Input Connector:** Analog input is via a rear panel 10 pin Cinch Jones type connector. See Figure 5.

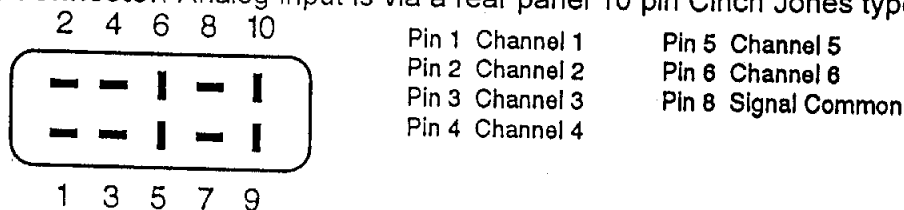


Figure 5

3. **Phase Indicators:** The presence of incoming voltage on each of the three phases is indicated by Phase 1, Phase 2, Phase 3 Green LED's. These are after the technical power fuses and show voltage present from the three respective internal dimmer power supplies. If power is lost on one or two phases, lighting on the remaining powered phases will continue to operate.

OPERATION CONTINUED

4. Analog Hi & Low Trim Adjustments: Trim adjustments are located on the microprocessor board are grouped (left to right) Channel 1 low trim, Channel 1 high trim, Channel 2 low trim, Channel 2 high trim, etc. The low trim, when rotated clockwise, increases the preheat voltage from 0-35 vac rms. Low trim is used to preheat the filaments and extend bulb life. The high trim adjustment allows various control voltages to be trimmed to cause a full up condition. When rotated clockwise the dimmer output voltage increases. Full clockwise adjustment causes a 7 vdc control signal to set the dimmer to maximum output voltage. Trim adjustments may be monitored via the test jacks.

Factory settings are zero preheat voltage and a 10 vdc control signal sets the dimmer to a maximum output.

5. Test Switches: A test switch is provided for each dimmer channel and may be used to aim lighting instruments without a controller. Pressing the test switch causes a microprocessor controlled soft change from the present controller level to full up. Pressing again turns the test switch off and causes a soft change back to the controller setting. This soft change feature is intended to reduce lamp failure from cold filament thermal shock. When in the test position and LED in the switch is lit.

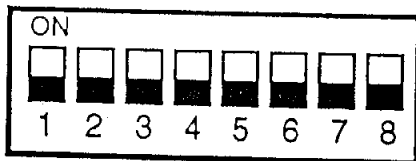
6. DMX512 Address Switches: The DMX512 address switch which is found behind the front panel access door is used to set the channel starting address number. Channel assignments for this dimmer are in groups of six. See Figure 6.

Figure 6

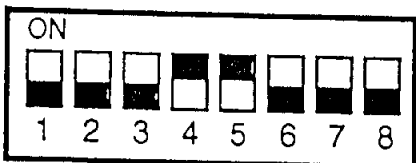
Dimmer Channel Address	EXAMPLE SWITCH SETTINGS							
	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8
1	256	128	64	32	16	8	4	2
49	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
507	ON	ON	ON	ON	ON	ON	OFF	ON

SET SWITCHES SO THAT THEY ADD UP TO 1 LESS THAN THE DESIRED DMX START ADDRESS.

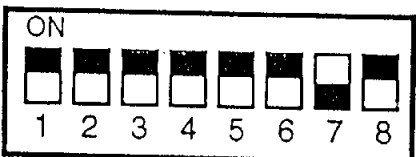
SWITCH 1 ON = 256 SWITCH 5 ON = 16 OFF = 0
 SWITCH 2 ON = 128 SWITCH 6 ON = 8
 SWITCH 3 ON = 64 SWITCH 7 ON = 4
 SWITCH 4 ON = 32 SWITCH 8 ON = 2



DMX address = 1



DMX address = 49



DMX address = 507

OPERATION CONTINUED

7. **Valid DMX512 Indicator:** This indicator illuminates only if valid data for the address selected is being received. Example: if the switch address is 258 and the console only outputs channels up to 256, the indicator will not illuminate, data is not being received for that address. If DMX512 data is lost, the indicator will flash for ten seconds. If this indicator is on but flickering, you may be receiving bad data or the console update rate is too slow for clean set-less operation.

When incoming DMX512 data is lost, the last received data will be held (the lights will stay at the same brightness) until DMX data reception is restored or an analog control signal is received.

8. **Overvoltage Indicator:** This red LED indicator is illuminated if the incoming ac voltage exceeds 140 vac. If this condition occurs the microprocessor will cut off drive to the SCR's thus protecting loads. Drive will return as soon as incoming voltage returns to a normal level.

9. **Load Indicators:** Presence of a load connected to a channel is indicated by a yellow LED.

10. **Drive Indicator:** A green LED on each channel lights in proportion to the drive signal being sent to the SCR's for that channel.

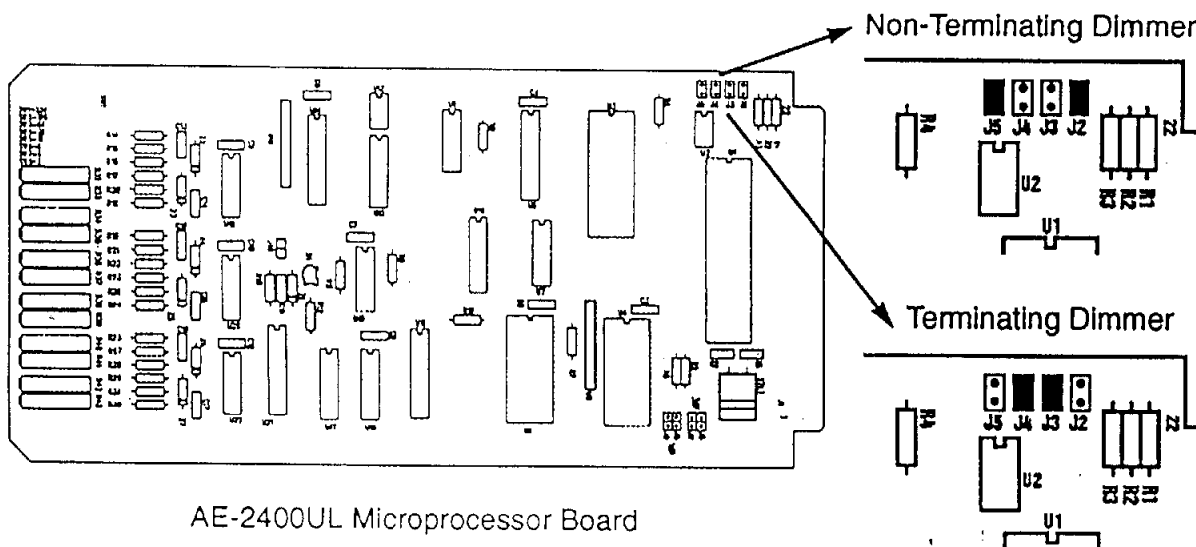
11. **Channel Breakers:** Fully magnetic 20 amp circuit breakers protect against overloads and also serve as channel disconnect switches. This type of breaker is not affected by ambient temperature or cabling temperature rise.

12. **Test Jacks:** Test jacks are located behind a removable access door and allow metering output voltages.

DMX512 LINE TERMINATION

Proper termination of the DMX512 data line is important to prevent data errors. The technical explanation for proper line termination is beyond the scope of the document. Fortunately, the hands on implementation is fairly simple. A DMX connector with an internal termination resistor should be plugged into the most distant dimmer from the console. Generally, the termination resistor is 120 ohms and is connected across the two data lines. If the DMX512 lighting console is not connected to a dimmer or system, the termination resistor shorts the inputs to the DMX receivers in each dimmer. Since the receivers are differential comparators, their outputs will not be specifically defined. To force receivers to have proper and known outputs in this situation, one dimmer in each rack should be jumpered (as shown below in **Figure 7**) to provide a bias voltage to the receivers.

Figure 7



Engineers and Architects Specifications: AE-2400UL Digital Dimmer

Acceptable dimensions for the dimmer enclosure shall be 17" wide (19" with rack ears), 5.25" high (3 EIA rack spaces), and 17" deep. Weight for the dimmer pack shall not exceed 50 pounds.

Each dimmer pack shall be housed in a rack mountable aluminum and steel enclosure. The finish shall be industrial grade mar and scratch resistant textured polyurethane enamel. All graphics shall be silk-screened to the front and rear panels. The front panel must be hinged so that it can be opened while rack mounted.

Internal components must be modular for easy replacement and repair. Control electronics and power output devices must be replaceable from the front while rack mounted via a hinged front panel.

The dimmer pack shall operate on 120 vac three phase, four wire or single phase three wire supplies with a common neutral. Presence of power supply voltage on each phase shall be indicated by three front panel LEDs. Access to line terminations shall be via a removable top access cover.

Load connections shall be rear accessible. The back panel shall be replaceable to allow selection of various power output options including Terminal Block, Edison, and Stage Pin.

Power output circuitry shall be protected by a UL Listed front accessible fully magnetic circuit breaker for each dimmer channel which may also be used as an individual channel disconnect. The dimmer shall be resistant to short circuit and overload conditions. Under overload conditions, the breaker will disconnect power from the load before the power devices can be damaged.

Low voltage technical power shall be protected by front accessible fuses. A self-resetting circuit shall protect lamps controlled by the dimmer by shutting down output power when overvoltage conditions are detected. Should this condition occur, a front panel indicator LED shall light.

The dimmer pack shall be designed to operate safely with all channels fully loaded with ambient temperature not exceeding 40 degrees Celsius (104 degrees Fahrenheit). Cooling shall be provided by a quiet self contained forced air system. When mounted in a properly designed rack or other enclosure, no additional forced air cooling of the enclosure shall be required.

Each dimmer pack shall consist of six 2400 watt solid state dimmer channels. Output power shall be handled by two Silicon Controlled Rectifiers (SCR's) for each channel. Power device on state current shall be rated at five or more times the RMS current carried by the device at full rated load.

Use of TRIAC's as output power devices will not be acceptable.

Each dimmer shall be capable of hot patching cold incandescent loads at full capacity without malfunction.

Toroidal filtering with a rise time of not less than 500 microseconds shall be utilized on each dimmer channel to limit objectionable audible load noise (lamp filament sing), transmitted radio frequency interference (RFI), and RFI conducted onto the AC power lines.

The dimmer shall accept USITT DMX512/1986, DMX512/1990, and 0-10 VDC control protocols directly without external hardware. When both DMX512 and 0-10 VDC controls are used simultaneously, the higher dimmer level setting shall take precedence. A front panel LED shall indicate reception of valid DMX512 information addressed to the dimmer pack.

Front panel LED's shall indicate the relative setting of each dimmer channel. No greater than 1 milliampere per dimmer channel shall be drawn from the 0-10 VDC analog control source. Isolation between control signals and the AC power line shall be a minimum of 2500 volts.

Internally, the dimmer shall be a fully digital design. Analog control signals shall be immediately converted to digital values and used to calculate power device turn on times. DMX512 digital information shall not be converted to analog values and fed to an analog dimmer. All 255 dimming levels supported by the DMX512 protocol shall be implemented.

Dimmer output RMS voltage as determined by the control protocol shall follow the Square Law dimming curve. Curve stability shall be maintained without the need for adjustment. Output RMS voltage shall remain within $\pm 2\%$ with changes in the load from 10 watts to full rated load. Channel to channel variation shall be less than 2%.

The dimmer output shall operate from full off to full on and vice versa within one half cycle of the AC line following reception of control information. Response time shall be independent of load.

Each dimmer channel shall have an associated push on, push off latching test switch that allows control of attached lamps without a controller. Turning on a test switch forces a soft change to full on for that dimmer channel. Turning off the test switch forces a soft change back to the level set by the controller or to full off. Test switches shall contain integral LED indicators that when lit, shall indicate that the switches are on.

A front panel LED load indicator shall be incorporated on each dimmer channel.

Power efficiency shall be greater than 96% at full rated load. Output voltage under full load shall be within 4 volts RMS of the incoming AC line voltage.

The dimmer shall be covered by a 12 month factory warranty.



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Made in USA

**Warranty on all
electronic dimmers and
controllers is 1 year on
parts and service**

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