

INSTRUCTION MANUAL

S.A. SERIES

(Type SD-2E)

DUAL AUDITORIUM LIGHT DIMMER



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INTRODUCTION

The STRONG INTERNATIONAL line of auditorium light dimmers is capable of being interfaced to almost any theatre automation. The new line of STRONG Stand Alone dimmers, the S.A. 2000, S.A. 4000, S.A. 6000 and S.A. 8000 light dimmers will satisfy the industry's need for a rugged and dependable dimmer. The dimmer control board and the triac power supply module were designed to be a retrofit for the STRONG "SD" light dimmer cabinet, completely replacing the current dimmer/triac light circuit.

PRODUCT OVERVIEW

The STRONG Stand Alone dimmer consists of two parts: the dimmer control board and the power supply module. The dimmer control board consists of two completely independent control circuits; one controlling the house lights and the other controlling the stage lights. Each has four (4) independent level adjustments. They are FULL UP, HALF UP, HALF DOWN and FULL DOWN. Each level adjustment allows complete variability between 0 and 100 percent output. Each has separate rate adjustments allowing you to set the rate of speed at which the lights come up and go down. Each has a programmable *wake-up* state. This feature allows you to determine the daily *power-up state* your lights will be in.

The power supply module comes as a separate unit and is capable of delivering up to 2000 watts of power. Up to 4000 watts can be obtained by paralleling modules for both house and stage light circuits.

The unit as a whole can house up to four triac power supply modules that can be paralleled for extra power requirements and a dimmer control board that contains two separate light control units.

THEORY OF OPERATION

Dimmer Control Board

The dimmer control board consists of two identical and independent circuits labeled HOUSE and STAGE. Since both circuits are identical we will refer only to the house circuit schematic.

The REF signal is full wave rectified AC from the transformer on the triac board. It provides a power line zero crossing timing reference, and a source of power to the dimmer control board. The sine wave is squared up with comparator U4 pin 1. This signal goes high when the reference signal is nearly ground, which corresponds to zero crossing of the power line. It is used to reset the gate flip-flop (U6 pin 9 and pin 10), and is used to reset the integrator made up of U3 pin 7, R16, R20 and C10.

The time constant of the integrator is adjustable with R20 to accommodate variations in the capacitance of C10. The output of the integrator is a negative going ramp from about 7 volts to 1 volt, which corresponds to triac firing angles from near 0 degrees to near 180 degrees.

Dimmer Control Board, Theory of Operation (continued)

The quad flip-flop U3 is used to store the light state. U3 pin 3, 6, 11 and 14 are used for UP, HALF UP, HALF DOWN and DOWN respectively, and are also used to establish the "direction" either increasing (up) or decreasing (down).

Potentiometers R1-R4 are used to set the UP, HALF UP, HALF DOWN and DOWN levels. Each level is adjustable from 0 to 100 percent output.

When power is applied, R10 and C5 are used to generate an initialize pulse through one section of SW1, to one of the four latches (U3). The initialize pulse is also used to establish an initial voltage across C11 and C12. If the selected wake-up state is UP or DOWN, then a high level is established at either pin 3 or pin 14 of U3 respectively. If the select state is HALF UP or HALF DOWN then a high level is established at pin 6 or pin 11 of U3 respectively.

The ramping from level to level is generated by an integrator with two time constants, consisting of U3 pin 1, C11 and C12, and D7 and R5, or D8 and R6. R5 establishes the DOWN rate and R6 establishes the UP rate. The output of this integrator is compared with the line voltage ramp signal generated by U5 pin 7. When the voltage on U5 pin 1 is below the voltage on comparator U4 pin 7 generates a pulse which sets the triac gate voltage flip-flop U6 pin 9 and U6 pin 10. At the next power line zero-crossing, the pulse from U4 pin 1 resets the triac gate voltage flip-flop. The output of this flip-flop is buffered by a voltage follower Q1.

Power to the dimmer control circuitry is obtained from the reference signal. Diode D11 and Q3 form a voltage regulator which limits the supply voltage to about 9 volts.

Triac Board

The Triac board contains an optically isolated triac, a high power triac and a small isolation transformer. The transformer is connected to the same power line as the lighting load, to obtain a line reference and power for the control board. The triac firing pulse from the control board is connected to OC1, an optically isolated triac. OC1 is used to apply gate current to the power triac through current limiting resistor R2. Choke L1 and capacitor C1 are a filter which reduces the electrical noise generated by the phase angle firing of the power triac.

Manual Override Switches

In the event of an emergency, or in case of an automation failure, the HOUSE and STAGE lights can be operated manually by means of the rocker switches on the face of the dimmer cabinet.

INSTALLATION

First determine the appropriate location for the light dimmer unit. We recommend mounting it as close to the incoming power for the lights as possible. Since power and signal/control lines may provide excellent conduction paths for RFI (electrical noise), long, unshielded wire runs may serve as undesirable antennas. By minimizing the distance you run larger feed cables, you reduce the chance of erratic behavior. You may also want to consider keeping cable runs at least six feet (2 meters) away from any audio cables and equipment since thyristor power and control lines may cause electrical noise to be induced into these cables.

The AC input must conform to the requirements (voltage, phase, current) imprinted on the Equipment Data Plate. Supply lines should be installed by a licensed electrician in conformance to local codes.

Dismount the lower front panel of the dimmer cabinet by removing the (3) mounting screws. Two access openings for conduit are located on the sides of the cabinet. Wires entering the cabinet should be of a size or gauge appropriate to current requirements (*observe local codes*). The AC supply line(s) should be connected to the input terminals identified as INPUT LINE (black) and NEUTRAL wire (white). A ground wire (green) must be terminated at the copper ground block mounted below the input terminal board.

The *load* line for the lighting circuit is connected to the terminal board positions identified as OUTPUT LINE (black) and NEUTRAL (white).

Each triac board contains a transformer connected to the same power line as the lights, which is used as a line reference for the dimmer control circuit. This would allow the installer to balance the lighting loads between the A, B and C phases of a three phase power site.

When more than 2000 watts of power are required for the light circuit, the triac modules must be paralleled. This is accomplished by connecting the COMMON and GATE terminals between supply 1 and supply 2. **DO NOT CONNECT A WIRE BETWEEN THE REFERENCE TERMINALS.**

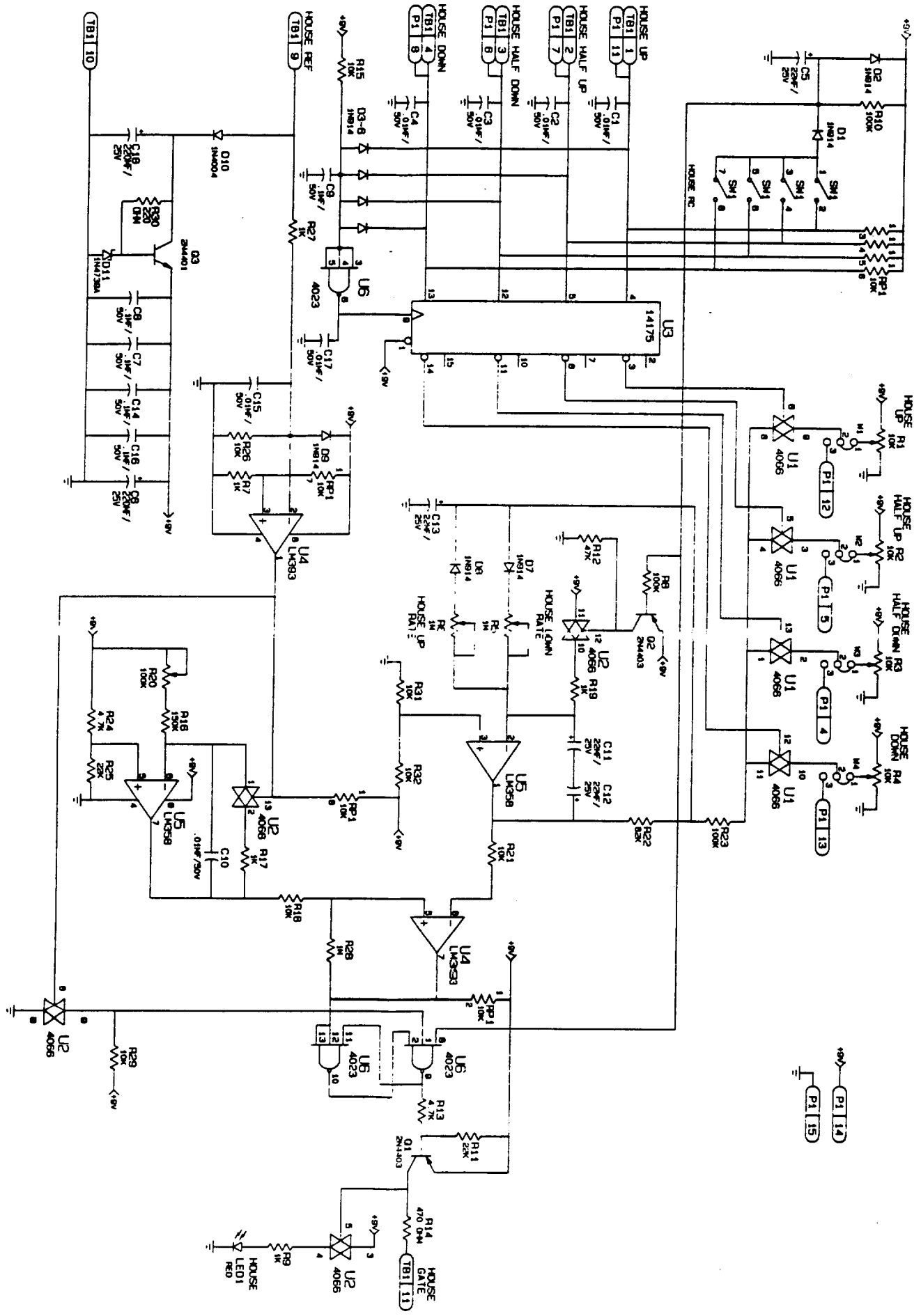
Connections to the dimmer control board are made to terminals TB1 - TB8. These terminals are for the automation inputs. Each circuit has four separate inputs: UP, HALF UP, HALF DOWN and DOWN. Each via the appropriate level pot are fully adjustable from 0 to 100 percent output. Use of 16 to 20 gauge shielded wire is recommended.

To select the desired state (UP, HALF UP, HALF DOWN or DOWN), the dimmer control board automation inputs (TB1 - TB8) have to be momentarily pulled to a low state by closure of a dry switch contact.

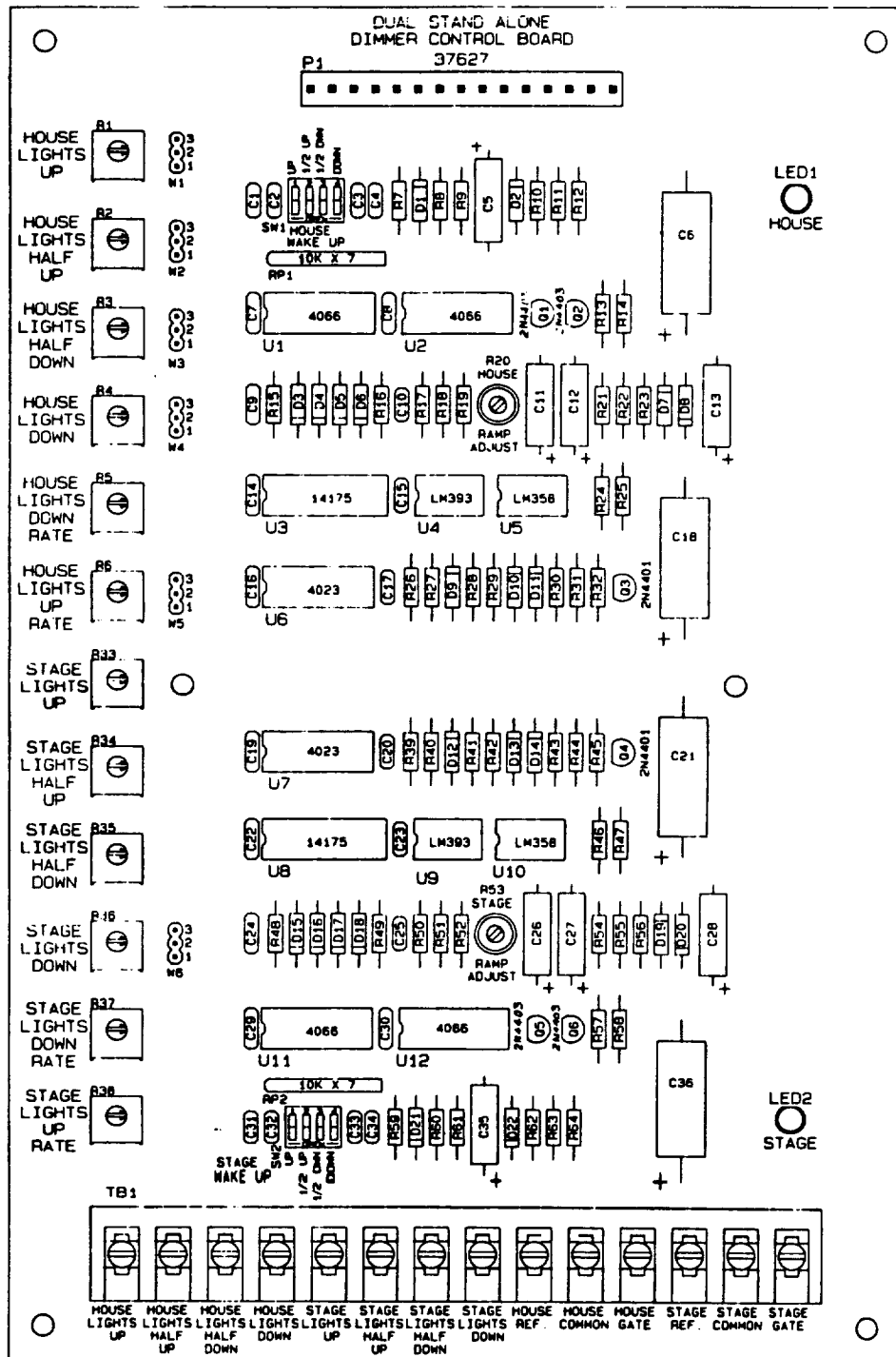
SET-UP

DIP switches SW1 and SW2 are used to program the *wake-up* state. The positions are clearly identified on the control board. Simply close the appropriate switch for the desired wake-up state. All other switches must remain open for proper operation.

The *rate* and *level* adjustment potentiometers for the HOUSE and STAGE lights are clearly identified on the board. To set the level pots, you must be in the state you want to work on. Do this by grounding the desired input at the terminal block TB1 or by programming the wake-up state and cycling power; or by using the manual input switches on the front panel. Each level (UP, HALF UP, HALF DOWN and DOWN) is adjustable from 0 to 100 percent output. Increase the light level by turning the pot clockwise (decrease the light level by turning the pot counterclockwise). Each circuit has *up* and *down* rate pots. Turning the pots fully clockwise yields the slowest level change speed. It will take the lights about (1) minute to go from minimum to maximum (or opposite) at this setting.



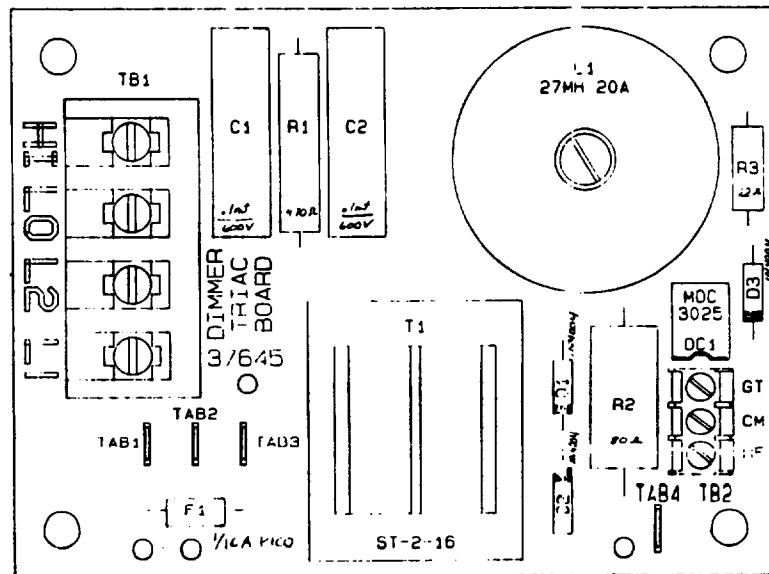
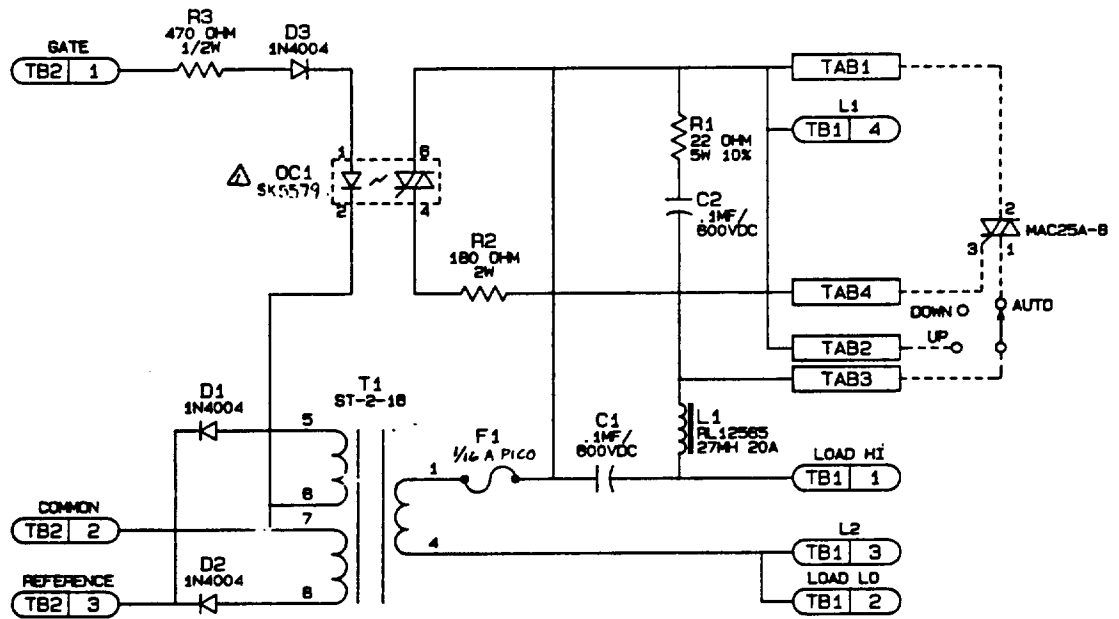
DIMMER CONTROL BOARD (1 of 2)



DIMMER CONTROL BOARD

DIMMER CONTROL BOARD
Parts List

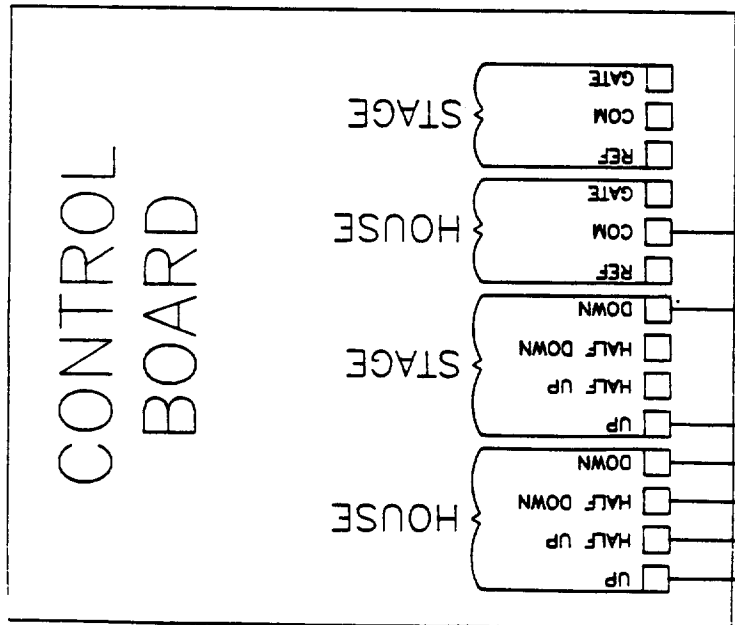
<u>Ref.</u> <u>Desig.</u>	<u>Description</u>
U1,2,11,12	I.C. 4066, SPST Switch with Driver
U3,8	I.C. 14175, Quad Type "D", Flip-Flop
U4,9	I.C. LM393, Dual Comparator
U5,10	I.C. LM358, Dual Diff. Input Op. Amp.
U6,7	I.C. 4023, Triple (3) Input Nand Gate
Q1,2,5,6	Transistor, 2N4403, PNP
Q3,4	Transistor, 2N4401, NPN
R1-4;33-36	Potentiometer, 10k Ohm, (1) Turn
R5,6,37,38	Potentiometer, 10k Ohm, (1) Turn
R7,9,17,19,27,40,50, 52,59,61	Resistor, 1k Ohm, 1/4 W. 5%
R8,10,23,56,60,62	Resistor, 100k Ohm, 1/4 W. 5%
R11,25,47,63	Resistor, 22k Ohm, 1/4 W. 5%
R12,64	Resistor, 47k Ohm, 1/4 W. 5%
R13,24,46,57	Resistor, 4.7k Ohm, 1/4 W. 5%
R14,58	Resistor, 470 Ohm, 1/4 W. 5%
R15,18,21,26,29,31, 32,39,42,44,45, 48,51,54	Resistor, 10k Ohm, 1/4 W. 5%
R16,49	Resistor, 150k Ohm, 1/4 W. 5%
R20,53	Potentiometer, 100k Ohm, (4) Turn
R22,55	Resistor, 82k Ohm, 1/4 W. 5%
R28,41	Resistor, 1k Ohm, 1/4 W. 5%
R30,43	Resistor, 220 Ohm, 1/4 W. 5%
RP1,2	Resistor Array, 10k Ohm x 7
C1-4; 10,15,17,20, 23,25,31,34	Capacitor, Ceramic, .01 MFD, 50 V.
C5,11-13,26-28,35	Capacitor, Electrolytic, 22 MFD, 25 V.
C6,18,21,36	Capacitor, Electrolytic, 220 MFD, 25 V.
C7-9,14,16,19,22,24, 29,30	Capacitor, Ceramic, .1 MFD, 50 V.
D1-9,12,15-22	Diode, IN914, 10 MA, 100 V. 20%
D10,13	Rectifier, IN4004, 400 VRM
D11,14	Diode, IN4739A, 9.1 V.
SW1,2	DIP Switch, (4) Pole, Grayhill 76SB04
LED1,2	Light Emitting Diode, Red, RL4403



DIMMER TRIAC BOARD

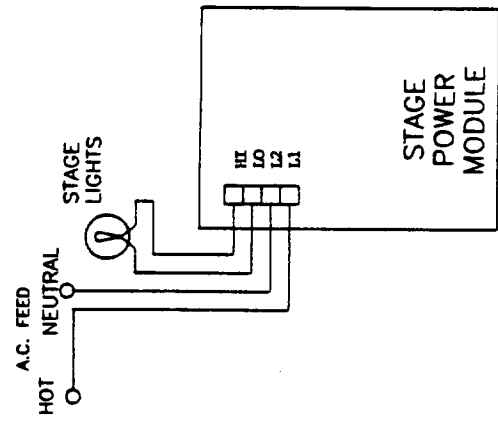
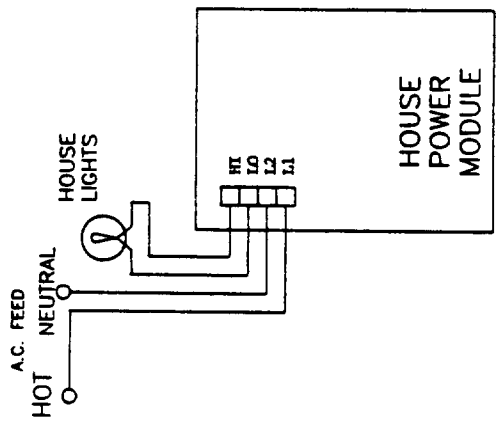
DIMMER TRIAC BOARD
Parts List

<u>Ref.</u> <u>Desig.</u>	<u>Description</u>
T1	Transformer, ST-2-16
L1	Choke, 27 MHZ. 20 A.
D1,2,3	Rectifier, IN4004
OC1	I.C. MO3021, Triac Optocoupler
C1,2	Capacitor, Polyester Film, .1 MFD, 600 V.DC
R1	Resistor, 470 Ohm, 1/2 W. 5%
R2	Resistor, 180 Ohm, 2 W. 5%
R3	Resistor, 22 Ohm, 5 W. 5%
TB1	Terminal Block, RDI 6PCV-04
TB2	Terminal Block, RDI 2MV-03
F1	Fuse, 1/16 A. 125 V.
TAB1-4	Faston Tab, AMP 62409-1



AUTOMATION CONNECTIONS

- 1 = HOUSE UP
- 2 = HOUSE DOWN
- 3 = STAGE UP
- 4 = STAGE DOWN
- 5 = COM



NOTE: REMOVE JUMPER BETWEEN L1 & L2 OF HOUSE AND STAGE MODULES IF USING SEPARATE AC FEEDS (AS ILLUSTRATED)

AUTO

DIMMER

- STAGE DOWN----->STAGE DOWN, HOUSE HALF DOWN
- HOUSE DOWN----->HOUSE DOWN
- HOUSE UP----->HOUSE HALF
- STAGE UP----->STAGE UP, HOUSE UP